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Outreach and Engagement Education for Graduate Students in Natural Resources: Developing a Course to Enrich a Graduate Outreach Requirement

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Abstract

Scientists need to engage stakeholders in natural resource management; however, few graduate programs prepare students to conduct outreach and engagement. Given this need, the authors' goals were to (1) create a one-credit course that introduced outreach and engagement practices and participatory approaches, (2) improve the quality of graduate students' Outreach Experiences (OEs) within the framework of a university departmental requirement, and (3) share lessons learned in addressing the training gap. Students in the course met learning objectives to improve OE plans, evaluate the effectiveness of outreach and engagement, and improve engagement with varied audiences. OE plans from students in the course scored significantly higher than precourse plans, indicating increased likelihood of effective engagement with their chosen audiences. Formal training in best practices and detailed guidance for students and faculty advisors are likely to improve student professional development and the outcomes of outreach and engagement activities.

Introduction

Scientists from multiple disciplines have called for increased engagement with stakeholders and the public to address shared concerns *(Leshner, 2007)*. As Friedman *(2008)* noted,

> One reason for the failure of science to play a more dominant role in public discourse is that scientists have not engaged the general public so that they understand who we are, what we do, and why the way we look at the world matters. *(p. 11743)*

The need for engagement is particularly critical in natural resource management, where scientists and stakeholders are commonly tackling complex (or wicked) environmental problems *(Allen & Gould, 1986; Batie, 2008; Haubold, 2012; Rittel & Webber, 1973)*. Finding strategies to address most natural resource problems often requires

understanding stakeholder values and balancing those values with the best available science because these complex problems are not exclusively technical or scientific issues, but rather conflicts over differing values influenced by multiple social and political factors *(Duda, Bissell, & Young, 1998; Haubold, 2012)*.

The approach to scientific outreach, particularly among academic research institutions, has been shifting from one-way, researcher-to-public communication ("traditional outreach") to two-way, reciprocal engagement with community partners *(Sandmann, 2008; Weerts & Sandmann, 2008).* Traditional outreach in natural resource and environmental fields, as in many other disciplines, follows an expert model of passing on knowledge and skills to those outside one's own discipline *(Roper & Hirth, 2005; Weerts & Sandmann, 2008)*. This one-way approach is often a result of deficit model thinking *(Bauer, Allum, & Miller, 2007; Nisbet & Scheufele, 2009)*, in which scientists assume stakeholders do not know about or understand environmental problems and therefore fail to act *(Groffman et al., 2010)*. Thus, traditional outreach communication with stakeholders focuses on increasing scientific literacy. An alternative and more recent approach is the engagement model. For example, the "public engagement" model described by Groffman et al. *(2010)* acknowledges that technical or scientific understanding is just one component of stakeholder characteristics and environmental problems. Engagement builds connections between researchers and stakeholders by focusing on two-way communication in which questions, approaches, values, and possible solutions are created and discussed, and mutually beneficial relationships among partners are established *(Decker & Chase, 1997; Roper & Hirth, 2005)*. As explained by Sandmann *(2008)*, engagement within institutions of higher education "incorporates principles of bidirectional reciprocity expressed through campus–community partnerships. This two-way dimension differentiates engagement from outreach, in which resources are extended in one direction only: from the university to the community" *(p. 95).*

Engagement with stakeholders offers unique opportunities for natural resources researchers and graduate students to gain a deeper understanding of complicated issues, work cooperatively with community partners to develop relevant questions, carry out research collaboratively, and apply results toward real-world solutions. O'Meara and Jaeger *(2006)* posit that this reciprocal interaction "betters both the discipline and the public or set of stakeholders for whom the work is most relevant" *(p. 3)*. Because it adheres to the standards of academic scholarship even as it aligns with the

principles of engagement *(Michigan State University, 1996; Sandmann, 2006),* engaged research has a clear place in academia *(Sandmann, 2008; UCLA Center for Community Partnerships, 2007)*.

Despite the importance and benefits of scientist–stakeholder engagement to natural resources research and management, most graduate degree programs in natural resources focus on developing students' technical knowledge and skills and on communicating to other academics rather than requiring training in outreach and engagement *(Leshner, 2007; Merenstein, Bowdy, & Woolley, 2001)*. Muir and Schwartz *(2009)* conclude that "graduate education does not currently provide students with the skills they need to solve conservation problems in a nonacademic workplace" *(p. 1358).*

Communication is one fundamental skill necessary for effective outreach and engagement. Historically, scientific education has done a poor job of training students to communicate with those outside their discipline *(Whitmer et al., 2010)*. In a recent survey of graduate students and employers from multiple sectors, students indicated they believed communication skills were among their greatest strengths, whereas employers indicated communication was one of the areas in need of greatest improvement (*Sundberg et al., 2011)*. Government and nongovernmental organizations who participated in the same survey stressed that future natural resource scientists need to communicate across disciplines and with multiple audiences and must be "collaborators, policy facilitators and negotiators across a spectrum of stakeholders" *(Sundberg et al., 2011, p. 137)* in order to effectively address environmental problems. These additional skills are necessary to move from traditional outreach to engagement.

The importance of outreach and engagement skills cannot be overestimated, especially when working on the front line between the state fish and wildlife management agency and the public. State fish and wildlife agencies consistently emphasize the need for their employees to be skillful communicators *(Sundberg et al., 2011*), an essential trait for effective outreach and engagement. According to the Michigan Department of Natural Resources (Michigan DNR) wildlife chief, "In order to be truly effective, wildlife managers must hone communication skills so that they convincingly explain the overarching importance of healthy wildlife populations and their habitats" (*R. Mason, personal communication, January 11, 2013).* Fish and wildlife managers often struggle to interact meaningfully with the public (or a specific set of stakeholders) to address problems and develop mutually acceptable solutions. The Michigan DNR fisheries chief pointed out that

> if resource professionals are going to be successful for managing both a resource and its users, they must be able to tell a story that will resonate with the users and that is easily understood. Managing natural resources is fairly simple. Managing resource users is mostly difficult, and much of that difficulty is a direct outcome of our inability to communicate with users. *(J. Dexter, personal communication, January 7, 2013)*

Further, Teague *(1979)* states that "most wildlife management problems start out as biological problems but eventually become people problems" *(p. 59)*.

Given the need for engagement to achieve effective natural resource decision-making and management and the lack of training, there have been repeated calls for educational programs to address the gap *(Dann & Payne, 2002; Groffman et al., 2010; Jacobson & McDuff, 1998; Leshner, 2007; Moslemi et al., 2009; Whitmer et al., 2010)*. Michigan State University implemented a graduate requirement in 2005 called the Outreach Experience (OE) to provide a "flexible, experiential learning opportunity for students based on their research or long-term professional interests, while meeting the missions of the department and institution, a Land Grant University" *(Michigan State University Department of Fisheries and Wildlife, 2008, p. 1)*. The title "Outreach Experience" reflects the commonly used definition of outreach in Michigan State University documents, wherein "a given for university outreach is mutuality of purpose or two-way exchange" *(Michigan State University, 1996)*, which evokes the current definition of engagement. In practice, the OE can fall anywhere along a gradient from traditional one-way outreach to two-way engagement.

There is no prescribed OE; the requirement is designed to be flexible so graduate students can best match their OE to their research program or professional interests. The guidance for both graduate students and their faculty advisors for designing and implementing the OE is minimal. Prior to conducting the OE, each graduate student develops an OE plan. Departmental requirements for the OE plan consist of an abstract, not to exceed one page, which describes "who will participate in the experience, the learning objectives of the experience, and where and when the experience will occur" *(Michigan State University Department of Fisheries and Wildlife, 2012, p. 18)*. Plans are reviewed and approved by each student's faculty advisor and then submitted to the faculty chair of the departmental graduate committee for final review and

acceptance. Since the requirement was introduced, faculty advisors have approved a wide range of graduate OEs, and many have focused on communicating research results to scientific audiences, rather than two-way engagement with nonscientific audiences or stakeholder groups. Once the OE is complete, each student writes a one-page outcome report that describes the audience, what was done, and the results. The report is submitted to the faculty advisor, who determines acceptability.

An online search of fisheries and wildlife graduate programs suggests that very few programs include an outreach or engagement requirement. Only three programs reviewed currently have such a requirement: the Department of Fish and Wildlife Conservation at Virginia Polytechnic Institute and State University (Virginia Tech); the Department of Forestry and Natural Resources at Purdue University; and the Department of Fisheries and Wildlife at Michigan State University, the authors' institution. The program at Virginia Tech requires that graduate students fulfill three outreach requirements to be eligible to defend their thesis or dissertation: (1) prepare a poster or presentation for a technical audience and a manuscript for a peer-reviewed journal; (2) prepare a poster, presentation, or manuscript for a nontechnical audience; and (3) prepare a one-page research summary for the department website (*Virginia Tech Department of Fish and Wildlife Conservation, 2008*). The program at Purdue is modeled on the program at Michigan State University; both programs require all graduate students to complete an OE *(Michigan State University Department of Fisheries and Wildlife, 2012; Purdue Forestry and Natural Resources, 2013)*. In addition, the students at Purdue must complete a required course, Theory & Application of Natural Resource Extension Programming (FNR 598).

To improve the outreach and engagement training provided to future natural resource scientists and managers at Michigan State University, the authors designed, taught, and evaluated a new graduate course. The goals in creating the course were to (1) introduce graduate students to outreach and engagement practices and the participatory approaches commonly used in managing natural resources and (2) improve the quality of Michigan State University Fisheries and Wildlife graduate students' OEs so that the process fosters learning and beneficial experiences for students and stakeholders within the framework of the departmental requirement. Throughout the course, the authors aimed to build understanding of the spectrum of stakeholder outreach and engagement and encouraged greater emphasis on engagement for meaningful

and effective OEs. In this article, we evaluate the effectiveness of the course and share lessons learned from this experience to help others interested in addressing the training gap in natural resources outreach and engagement.

Methods

Course Design

The authors, three Department of Fisheries and Wildlife faculty members with substantial appointments in outreach, cotaught the one-credit, pass/fail course Effective Outreach and Engagement in Fisheries and Wildlife. The course was taught in 80-minute sessions once per week for 12 weeks during the 2012 spring semester. Teaching techniques included PowerPoint presentations, lectures, small group discussions, large group discussions, guest presentations, peer reviews, and written and oral program critiques. Students were expected to read supporting materials in preparation for in-class discussions and to actively contribute their experiences, opinions, and questions to these discussions. The course learning objectives were intended to enable students to achieve three goals:

1. Design an effective Outreach Experience (OE) plan with an emphasis on two-way, reciprocal engagement with a specific audience.
2. Evaluate outreach programs by asking appropriate questions, collecting data, analyzing relevant observations, making interpretations, and offering recommendations.
3. Communicate research via multiple formats to a variety of audiences.

The development of OE plans was an overarching theme of the course. Course topics included public perceptions of science, advocacy and politics, program evaluation, meeting management, and stakeholder engagement (see Appendix). Students were required to participate in an outreach activity or program of their choice (the course "field trip") and provide a written and oral critique of the activity or program. The field trip allowed students to conduct a real-world assessment of outreach, in contrast to learning about outreach third-hand via course readings and lectures. A semistructured guide based on course topics was provided to assist students in evaluating the program and recording their observations during their field trip. The purpose of the observation guide was to provide

a consistent evaluation framework among outreach activities to facilitate comparisons during the oral critique of each individual's field trip.

Development of Outreach Experience Plans

Students were expected to adhere to the departmental requirements when developing their one-page OE plan (i.e., identifying their audience, learning objectives, location, and timing) to ensure "acceptance" by the departmental graduate committee chairperson. One critical component possibly overlooked when developing the departmental OE requirements was evaluation. Therefore course instructors requested that students describe possible evaluation strategies within their outreach plan. Within OE plans meeting departmental requirements, the extent of the OE could fall anywhere along a gradient from one-way outreach to two-way engagement. It was the intention of the course instructors to encourage students to focus on the engagement side of the spectrum. To incorporate generally accepted best practices for effective outreach and engagement, students in the course were asked to address the following questions in their outreach plans *(Jacobson, 2009; Lauber, Decker, Leong, Chase, & Schusler, 2012; Shanahan, Gore, & Decker, 2012)*:

1. What is the need that your proposed OE is aimed to address?
2. What are the desired outcomes or goals? This can include what you are seeking to learn by conducting the outreach.
3. Who is your priority audience?
4. What is your strategy/approach? That is, what are you going to do?
5. What resources do you need to create your outreach product or activity?
6. How will you evaluate the effectiveness of your outreach? What indicators will be used to evaluate impact?

The authors believe the integration of these questions into the students' plans extends beyond the departmental requirements to enhance students' overall experience. To comply with the one-page length constraint, course instructors encouraged students to

1. Stay focused on the outreach project itself. Limit background information to needs addressed by the outreach project. Omit citations.

2. Write in a direct, concise style to an audience that includes nonscientists. Avoid jargon and lengthy research descriptions.
3. Write in first person, active voice.

During the semester, students were required to submit first and second drafts of their OE plans for written peer review, discussion, and instructor feedback.

Course Evaluation

Students were provided with three formal opportunities to provide anonymous assessment of the course. The instructors solicited feedback via instructor-designed questionnaires at midsemester and again at the end of the course in addition to the standard university end-of-semester evaluation. The mid-semester evaluation sought student opinions on course content and structure, depth of topic coverage, and utility of the course in developing their OE plans. The timing of the survey allowed for adjustments to the teaching approach, if warranted, for the remainder of the course. The in-class questionnaire administered 1 week prior to the end of the course gave students an opportunity to suggest topics for further discussion before the course concluded and to provide anonymous feedback about the course. Students also were encouraged to complete a standard Student Instructional Rating System (SIRS) end-of-course online evaluation provided by the university. All data used in this research were anonymized (names on past OE plans were redacted by the department graduate secretary, and surveys administered to current students were anonymous), and the University Social Science/Behavioral/Education Institutional Review Board (IRB) confirmed that the study did not meet the definition of human subjects research [45 CFR 46.102(f)]. Therefore, IRB approval was not required.

Evaluation of Outreach Experience Plans

One intended outcome of the course was to improve the students' OE plans. To evaluate whether this outcome was achieved, a rubric was developed to compare the quality of the proposals by students in the course to a random sample of approved OE plans written prior to this course ("precourse" plans). The precourse plans were randomly selected by the graduate secretary, with approval of the department chair, and all identifying information was redacted. The authors also evaluated the quality of first- and second-draft

plans developed by students in the course to document improvement over the semester. Seventeen plans for each of the three types (i.e., precourse, first draft, second draft) were evaluated to maintain equal sample sizes across groups. The rubric examined whether the plan (1) identified need, (2) defined the desired outcomes/goals, (3) identified priority audience, (4) described strategy/approach, (5) discussed resources needed, and (6) evaluated the effectiveness of the outreach activity. These criteria were identified by the authors as essential for high-quality plans. Each plan was also examined to determine whether the proposed OE consisted solely of one-way communication (giving a presentation or producing a written product, i.e., traditional "outreach") or included two-way interaction (i.e., engagement) with the audience beyond a question and answer session. These additional criteria were used to assess movement from one-way to two-way communication with stakeholders; the authors considered one-way communication unsatisfactory for this course. If a plan addressed a component satisfactorily, it was scored a 1 in that category; if the plan did not address the component satisfactorily, it was scored a 0 for that category.

Differences between total scores (sum of all category scores) for precourse plans and plans written by students in the course were analyzed using t-tests. A paired t-test was used to analyze differences between in-course first and second drafts. McNemar's test was used to examine differences between each category in the first and second drafts. All statistical analyses were performed using SYSTAT 12 software (SYSTAT Software, Inc.).

Results

The course filled up quickly once announced, reaching the enrollment limit within a few days. Nineteen graduate students (10 female, 9 male) completed the course, all in master's (58%) or doctoral (42%) degree programs in the Department of Fisheries and Wildlife.

Student Feedback

On the midsemester evaluation, all respondents agreed that the course had been helpful in designing or evaluating their Outreach Experiences (OEs), and on average, students felt that the depth of coverage of topics through Week 6 was "*Just right*." In an open-ended question asking what aspects of the course they felt were most beneficial, the most common response (6 out of 19) was evaluation—students commented specifically that they were thinking and

learning about evaluating outreach and engagement efforts more than they would have without taking this course. Additional topics noted as beneficial included setting objectives, understanding and working with public perceptions, and strategies for working with various stakeholder groups. Several students also commented on particular in-class teaching and learning approaches as being beneficial: feedback from and discussion with peers, readings from the literature, and reflection on one's own perspectives and values on science outreach. Six students recommended less lecture time and more discussion.

This midpoint evaluation also gauged student interest in a three-credit version of the course in the future. Students were asked, "If this seminar were offered as a 3-credit graduate course, would you enroll? Why or why not?" Responses were mixed, with as many students interested in a three-credit version as not. Those who stated that they probably would take a three-credit course tended to indicate that the content warranted more in-depth coverage. Those who were unlikely to enroll in a three-credit course tended to state that they were interested in other course offerings more closely related to their scientific research given limits on credit hours. Overall, students were likely to recommend a three-credit course to a friend, especially if that friend had an interest in outreach.

At the conclusion of the course, students had the option of completing two course evaluations. The instructor-designed questionnaire was completed by 17 of the 19 students during class. Because this questionnaire was given 1 week before the last class, students were offered the opportunity to request additional information on outreach topics not covered during the course. Responses varied widely, from general requests for additional readings on the broad topic of outreach and engagement to specific topics, including the following:

- Outreach activities and environmental education for youth
- How to change people's perceptions (both those of scientists and "the public")
- Science education and scientific advocacy
- How to "sell" outreach and engagement as important
- How to find graduate student or faculty positions in outreach and engagement

- Why do research scientists do outreach? How does it affect decisions?
- Citizen science
- How to publish outreach work
- How to deal with a difficult public without losing your cool
- How to become a more confident public communicator

A list of additional references and resources addressing these topics was provided in response to student feedback and is available from the authors.

This questionnaire also offered students an open-ended opportunity to share anonymous feedback with the instructors. Most comments expressed students' enjoyment of the course and their appreciation for how the course helped to improve their understanding of engagement and execution of their OE. Specific feedback included finding student presentations valuable, especially the two-way interactions, as well as a desire to hear more "stories from the field" from scientists who have faced challenging outreach and engagement situations. One student responded that the value of the field trip could have been improved by an observation guide with more specific questions that prompted more critical thinking as opposed to the general guide provided.

The university's standard online course evaluation focused on student satisfaction with the instructors and course. Seventeen (17) of the 19 students in the course completed the university survey by rating various factors on a scale of 1 (*highest*) to 5 (*lowest*). Students responded particularly favorably to "The instructor's use of examples or personal experiences to help get points across in class" (M = 1.29, SD = 0.57). Overall, respondents recognized an "improvement in [their] competence in this area due to this course" (M = 2.17, SD = 0.85) but did not see the course as a particular intellectual challenge (M = 3.23, SD = 0.87). Respondents gave the course an overall mean rating ("grade") of 1.41 (SD = 0.59) and the instructors an overall mean rating of 1.05 (SD = 0.23).

Evaluation of Outreach Experience Plans

Students developed a broad variety of OE plans, reflecting the diversity of their graduate research areas. In one example, a student proposed creation of a land management guide for promoting habitat for sharp-tailed grouse, a species of interest to hunters

and birdwatchers alike. The student planned to collaborate with the state natural resource agency and an advisory committee of stakeholders to determine the content and design of this guide and to evaluate its usefulness. Another student proposed engaging youth and their teachers and parents in understanding the roles of native and invasive species of lamprey in local aquatic ecosystems where economic impacts have been felt by taking them out in the field and giving them hands-on experience with live organisms. Yet another planned in-depth involvement in a science program for refugee and minority high school students with a focus on inspiring interest in science as a career with an evaluation strategy including student surveys and consultation with teachers regarding behavioral changes (e.g., interest in science classes, participation, and performance).

Precourse plans versus in-course plans. Total scores between precourse plans and in-course first drafts were significantly different ($t = 3.189$, $p = 0.003$), as were total scores between precourse plans and in-course second drafts ($t = 5.287$, $p < 0.001$; see Figure 1). In-course first and second drafts scored higher than precourse plans in identifying needs, defining goals, discussing resources needed, and evaluating effectiveness (see Figure 2). There was no difference in identifying a priority audience because all students included it in their plans. Measures of two-way communication increased from first to second drafts (see Figure 3). Fewer students in the course proposed OEs that were solely a written product or presentation, without interaction with audiences, as compared to precourse plans.

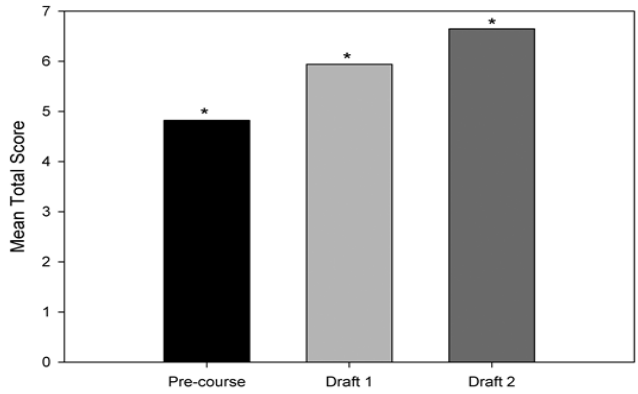

Figure 1. Total mean scores for precourse plans and in-course first and second drafts. Significant differences are shown with an asterisk (*).

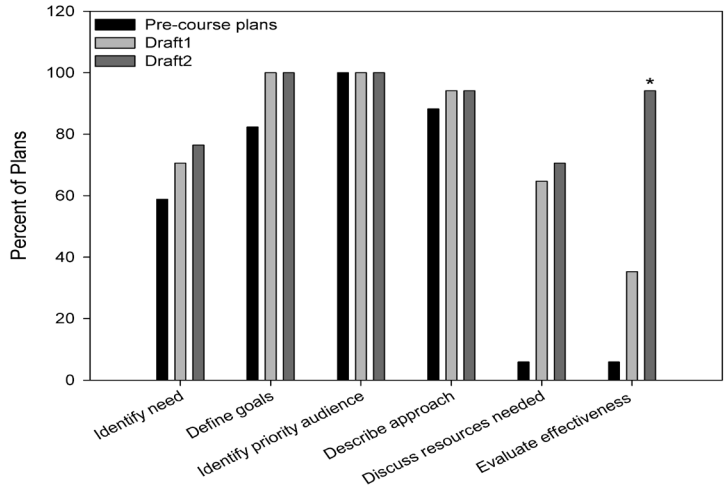

Figure 2. Percentage of precourse, first draft, and second draft plans that included key components of satisfactory Outreach Experience (OE) plans. Significant differences are shown with an asterisk (*).

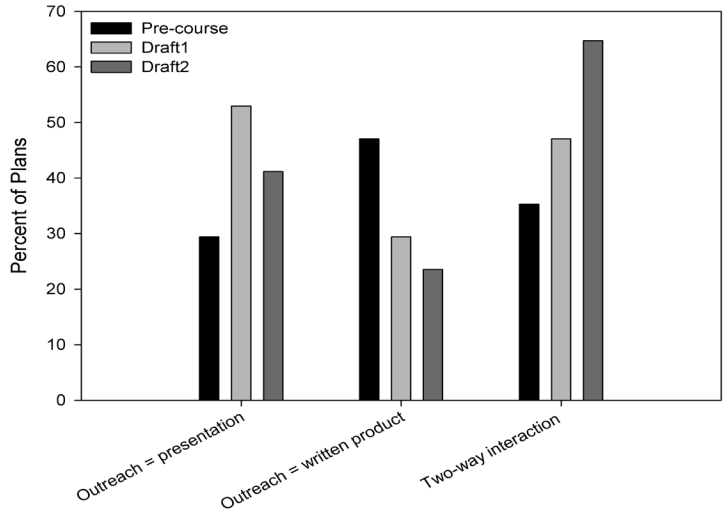

Figure 3. Percentage of precourse, first draft, and second draft plans demonstrating two-way communication as assessed by products and activities described in Outreach Experience (OE) plans.

In-course student plans: first versus second drafts. Total scores for first and second drafts were significantly different (t = 3.429, p = 0.003; see Figure 1). Scores increased between first and second drafts for four categories: identify need, discuss resources, evaluate effectiveness, and two-way interaction (see Figures 2 and 3). However, upon examining each category individually, only evaluation differed significantly between the first and second drafts (McNemar's χ^2 = 10, p = 0.002; see Figure 3). Two categories, outreach = presentation and outreach = written product, decreased from first to second draft, but the difference was not significant. There was no change between first and second drafts for the "identify priority audience" category because all students included this component in their proposals. There was also no change in the "define goals" and "describe approach" categories.

Discussion

Overall, we believe that the learning objectives of this course were achieved. First, all students developed clear plans for graduate Outreach Experiences (OEs) that, in our opinion, were likely to result in effective engagement with their chosen audiences. In their final one-page plans, nearly every student clearly identified a need, desired outcome(s), priority audience, and required resources and explicitly described his or her intended approach and evaluation plan. Providing the students the opportunity to submit two drafts improved the plans. The greatest improvement between first and second drafts was made in the evaluation category. In the first drafts, students often proposed to evaluate effectiveness by whether their priority audience asked questions. In the second drafts, which were submitted after evaluation was covered in class, most students incorporated pre- and post-surveys or short questionnaires to evaluate the effectiveness of their OE. Although not statistically significant, improvement was noted in other categories as well. All plans identified a primary audience, which was not surprising given that it is an explicit requirement in the graduate handbook, but second drafts often identified a more specific audience rather than "general public" or revised the audience to align better with the student's goals. An increase in two-way interaction, or movement from traditional outreach toward engagement, was evident between the first and second draft. This was reflected by a decrease in the number of plans in which students were solely giving a presentation or producing a written document as their OE. Although these components were required on both drafts, the improvements

in the second drafts demonstrated a deeper understanding of the outreach and engagement spectrum.

The level of detail in the in-course plans was not common in precourse plans, but the authors believe that the components listed above are critical for preparing graduates to conduct successful OEs. Providing students with training and guidance about best practices in outreach and engagement increased the quality of the proposals, as demonstrated by the differences found not only between first and second drafts but between students who had completed the course and those who had not. Shortly after the course, the departmental associate chairperson commented that the plans submitted by his students who participated in the course were "clearly superior to those submitted by those students who did not. Proposals submitted by the seminar participants are better focused, more appropriate for graduate students and contain evaluation procedures and metrics" *(S. Winterstein, personal communication, April 18, 2013)*. One of the students also contacted the instructors regarding the value of the course, saying,

> I just wanted to send out an e-mail to thank you all for the wonderful seminar last semester! I successfully completed my outreach presentation this summer and it went very well! I did the pre- and post-evaluation and found out all my participants met my objectives and effectively learned what I wanted them to. It was a very rewarding experience! Thank you for all your input in helping me prepare for it!

The second course objective focused on evaluation. The intentional emphasis on the importance of evaluating outreach efforts seemed to resonate with the students as both a novel idea and an important one. Several course lectures, readings, and discussions focused on evaluation. A key take-home message for students was that evaluation is extremely important and should be conducted throughout the process—during planning, formative and developmental stages, and for summative outcome purposes *(Michigan State University, 1996)*. The students included evaluation strategies in their OE plans and gained experience in conducting evaluation by providing peer feedback, evaluating outreach products (such as brochures and websites) as a group in class, and individually evaluating a variety of local outreach programs (the field trip) and presenting their findings to the class. During the field trip critique, students acknowledged that most program organizers failed to

identify objectives or evaluate their programs. In some cases, students recognized a mismatch between program content and audience. Students appeared to gain more insight by evaluating what did not happen during their field trips and had many suggestions for program improvements.

The third major course objective was to enable students to communicate research effectively to various audiences. Although the design and time constraints of this one-credit course did not allow students to actually implement their OEs, the authors feel that the students' abilities to identify effective and ineffective practices and products and to incorporate best practices into their own OE plans improved during the course. Critique and discussion of example outreach materials and their field trip generated some of the most lively class discussions, much of which focused on characteristics that made the outreach material or program successful. For many students, this course may have been their first exposure to the literature and knowledge base surrounding effective natural resource outreach and engagement.

Course instructors demonstrated outreach and engagement techniques throughout the semester to reinforce course material from an applied perspective. The students grasped the material exceedingly well and, during the midcourse evaluation, identified areas in need of improvement in teaching methods (e.g., lengthy PowerPoint presentations, text-heavy slides, shortage of two-way interactions, guest lecturers' presentations misaligned with student needs).

Student feedback and instructor observations allowed for some midcourse adjustments and recognition of areas for improvement in future versions of this course. A key design change made midcourse was to increase time for discussion. The authors initially had succumbed to the temptation to cover more material than was suitable for a one-credit course, an inclination exacerbated by involving three instructors with somewhat different areas of outreach expertise. As a result, several early course sessions were heavy on lecture and left little time for group discussion. Group discussion frequently needed to be cut off just as the students were really engaging with the topic because the class period was over. The students were eager to point this out on the midcourse evaluation survey, and adjustments were made. As a result, discussions in the second half of the course were richer and, the authors believe, more valuable to all participants. In the future, the authors would consider changing to a 2-hour course period, rather than the 80-minute period used in this course, to ensure plenty of time

for lecture and discussion. An intensive, workshop-style model (perhaps two or three full days for the entire course) could also be considered.

It was clear that in the future more time must be devoted to discussing the fundamental topic of why it is important for research scientists to conduct outreach and how to justify its importance to others in academia. Several students highlighted this need on the end-of-class questionnaire (e.g., Why do researchers do outreach? How does one "sell" the idea of outreach and engagement?). Within the scientific research community, there remains plenty of resistance to conducting outreach *(Ecklund, James, & Lincoln, 2012)*. These barriers to outreach and engagement include the focus on disciplinary expertise at research universities, reward systems that do not value outreach and engagement as highly as research or teaching, lack of funding and resources, and the misperception that outreach and engagement is not scholarship (*O'Meara & Jaeger, 2006*). Graduate students are likely to hear mixed messages about the value of outreach and engagement from the professionals they interact with and may have mixed or negative feelings themselves about outreach and engagement and the departmental outreach requirement. Perhaps because the authors were all trained as research scientists and now spend a majority of their professional time in the outreach and engagement arena, they unintentionally minimized the importance of what is a critical and foundational issue that deserves more exploration. Feedback from the class suggested that even though students understood the importance of outreach and engagement, they were uncertain about how to justify and communicate its importance to others in academia. In the future, the course could be improved by including readings or lectures from established academic scientists who actively conduct outreach and engagement work, open dialogue about the value of that work to advancing natural resource science and management, and information on how to discuss the value of outreach scholarship and scholarly activities with academic colleagues and administrators.

To further assess the effectiveness of the course, a longitudinal study could be undertaken to evaluate student application of the new outreach and engagement education gained from this course to community projects. Currently, the department does not assess the effectiveness of the OEs as described in the outcome reports written by each graduate student or by any other measures. The authors recommend that the department adopt the project evaluation guidelines presented by Michigan State University *(1996)* to

assess the "four fundamental characteristics of any outreach project in higher education" *(p. 18)*: significance, context, scholarship, and impact. This would ensure alignment of departmental and university outreach and engagement goals.

In addressing the outreach and engagement training gap, the authors identified several areas where current department practices could be improved. The authors recommend that the department provide more detailed guidance to faculty and students on how to develop an OE plan that will be effective and relevant to students' research and professional interests. The fact that course enrollment reached maximum capacity within a few days of being announced suggests that students feel the need for more guidance and are interested in outreach training. Student responses to the course evaluations also demonstrated that students believed outreach and engagement training was valuable and likely to increase the effectiveness of their OEs.

A clear tension exists within the departmental culture between the desire to remain flexible and responsive to the broad range of student research areas and interests and the need to provide students with the necessary engagement knowledge and skills for becoming effective natural resource professionals. The authors suggest that flexibility can be maintained while a core set of minimum requirements be adopted in order for the OE requirement to be valuable and effective and to make clear that engagement is valued within the department and the university (*Michigan State University, 1996*). For example, some level of departmental evaluation of the OE must be incorporated. What does "accepted" by the graduate committee chairperson mean? Are there departmental metrics by which OEs are deemed acceptable? Where along the spectrum from one-way outreach communication to true two-way engagement does an individual student's OE plan lie? Is the student's proposed OE appropriate for his or her career goals, or is the student (and faculty advisor) merely looking to check off the OE requirement? Departments need open dialogue regarding outreach and engagement to develop a common vision for how to best integrate appropriate training opportunities into their curriculum *(O'Meara & Jaeger, 2006)*.

Students should be provided opportunities to learn effective communication and engagement strategies through coursework and experiences that are integrated into their degree programs. Training in outreach and engagement would address the skills gap identified by stakeholders and management agencies. The OE, and engagement in general, enhances the educational experience and

creates opportunities for graduate students to develop critical skills required not only for connecting with stakeholders but for developing a deeper understanding of their own discipline *(O'Meara & Jaeger, 2006)*. Michigan State University, like many land-grant institutions, is at the forefront of engagement with its Extension programs and Office of Outreach and Engagement; however, graduate education and faculty reward structures focus on research skills. This course and others like it present the opportunity to harness the expertise on campus and better align the missions of the land-grant institution to both conduct top-level research and engage society.

Through the development and implementation of this graduate course, the authors have identified areas where the departmental OE requirement could be improved, particularly by providing more guidance to faculty advisors and students about the essential components of an effective outreach and engagement plan. The course also provided the guidance needed to develop more effective and meaningful OEs for the students enrolled in the course. Improving training in communication, outreach, and engagement will better prepare students to be natural resource scientists and professionals who can engage a broad group of scientists, stakeholders, and decision makers to tackle more effectively the complex problems related to natural resource management.

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Appendix

Course Syllabus for "Effective Outreach and Engagement in Fisheries and Wildlife"

Week	**Topics**	**Readings**
1	**Course Overview** What is the definition of outreach? How is engagement defined? What are some examples of outreach and engagement in academia and practice?	List of definitions of outreach and engagement compiled from various sources by instructors
2	**Public Perceptions** How does the public view science? How do scientists view the public? What are the implications for outreach?	**Required:** Miller 2004. Public understanding of, and attitudes toward, scientific research: What we know and what we need to know. Public *Understanding of Science 13:* 273–294. Besley & Nisbet 2011. How scientists view the public, the media and the political process. *Public Understanding of Science,* 1-16. **Optional:** Science and Engineering Indicators 2010. Chapter 7: Public Attitudes & Understanding Pew Research Center Science Literacy Quiz
3	**Science and Advocacy** (Guest Speaker—Executive Director Michigan Trout Unlimited)What are the differences between policy and politics? Should scientists advocate on policy-related matters? Does advocacy conflict with science?	Nelson & Vucetich 2009. On advocacy by environmental scientists: What, whether, why, and how. *Conservation Biology 23*: 1090–1101. Pielke, R. A., Jr. 2007. Chapters 1–3 in T*he honest broker: Making sense of science in policy and politics*. Cambridge University Press, New York. **Optional:** Lackey, R. T. 2007. Science, scientists, and policy advocacy. *Conservation Biology 21:* 12–17.

4	***Outreach Experience*** *(Guest Speaker—Associate Provost for University Outreach and Engagement)* How does the University view outreach? What does it mean to be an engaged university? How can outreach be incorporated into your career?	**Optional:** University Outreach and Engagement—Michigan State University website Engagement Scholarship Consortium website: http://www.engagementscholarship.org/ An Example Engagement Dossier
5	***Outreach Strategies*** *(Guest Speaker—Michigan State University FW Graduate Committee Chair)* How do you define your audience? What are your outreach goals, objectives, and expected outcomes? What are the requirements of the Outreach Experience?	**Required:** US Fish and Wildlife Service. *A field guide to outreach.* Pacific Region U.S. Fish and Wildlife Service, 911 N.E. 11th Avenue, Portland, Oregon 97232-4181. Duda, M., S. J. Bissell, & K. C. Young. (1998). *Wildlife and the American mind: Public opinion on and attitudes toward fish and wildlife management.* Harrisonburg, Virginia: Responsive Management.
6	**Program Evaluation** Why do we evaluate? What are the types of evaluations and methods used to assess program outcomes?	**Required:** Lok, C. 2010. Science for the masses. *Nature 465:* 416–418. A look at NSF's Broader Impacts review criteria *Designing evaluation for education projects*. NOAA Office of Education and Sustainable Development. Available online at http://wateroutreach.uwex.edu/use/documents/NOAAEvalmanualFINAL.pdf My Environmental Education Evaluation Resource Assistant (MEERA) website: http://meera.snre.umich.edu/ Online resource for evaluation
7	**Critique Outreach Examples** What are some real life examples of outreach products? What makes your outreach example effective or ineffective?	
8	**Design Effective Outreach** What words can be used to resonate better with the public? What terms and phrases inspire conservation action?	

9	**Engagement: Partnerships, Stakeholders, and Collaborative Processes** How is stakeholder engagement defined? What are some considerations when planning partnerships? How is engaged scholarship different from traditional scholarship?	**Required:** International Association for Public Participation. 2007. *IAP2 Spectrum of Public Participation*. http://www.iap2.org/associations/4748/files/IAP2%20Spectrum_vertical.pdf International Association for Public Participation. 2006. *IAP2 Public Participation Toolbox*. http://iap2.affiniscape.com/associations/4748/files/06Dec_Toolbox.pdf Reed, M. S. 2008. Stakeholder participation for environmental management: A literature review. *Biological Conservation* 141: 2417–2431.
10	**Effective Meetings** How do you design an effective meeting? What are the most effective ways to communicate with meeting participants?	Required: University of Nebraska Extension. *How to organize and run effective meetings.* http://www.unce.unr.edu/publications/files/cd/other/fs9729.pdf AAAS Communicating Science website: http://communicatingscience.aaas.org/ Website from AAAS on communicating science to nonscience audiences How to Lead Effective Meetings website: https://www.ohrd.wisc.edu/AcademicLeadershipSupport/LeadMeetings/tabid/74/Default.aspx This site from the University of Wisconsin was designed for academic committees and units, but the principles apply to any meeting University of Wisconsin Facilitator Tool Kit. http://oqi.wisc.edu/resourcelibrary/uploads/resources/Facilitator%20Tool%20Kit.pdf. Background info (not required reading); chapter 4 is on meetings Planning and Conducting Effective Public Meetings. Ohio State University Extension Fact Sheet. http://ohioline.osu.edu/cd-fact/1555.html

11	**Field Trip Critique** What were the strengths and weaknesses of the meeting/activity? What improvements would you suggest? Did the organizers evaluate participants or collect any data to assess effectiveness of their program? If so, what method(s) did they use?	
12	**Course Wrap-Up** What were the main messages you learned from the course? What questions about outreach and engagement do you still have?	**Required:** Sandmann, L. R. 2006. Scholarship as architecture: Framing and enhancing community engagement. J Physical Therapy Ed 20(3): 80–84. UCLA Center for Community Partnerships. (2007). New times demand new scholarship II: Research universities and civic engagement: Opportunities and challenges. http://www.compact.org/initiatives/research_universities/Civic_Engagement.pdf