Integration of Forestry Research and Extension in an Online Graduate Course

Martha C. Monroe, Jessica Ireland, and Timothy A. Martin

Despite calls for integrated education from the literature and federal granting agencies, some forestry faculty and students prefer to cultivate specific disciplinary expertise. A regional grant-funded project fostering integrated research, however, enabled a climate of experimentation among the participating faculty who created an interdisciplinary distance graduate course focused on climate change, research supporting forest management, and stakeholder communication in the southeastern United States. The two-credit seminar-style course was offered for 2 years and was required of the masters and doctoral students from nine universities that were funded by the project. Student evaluations and faculty reflection from the 1st year were used to improve the course for a second offering, including reducing the amount of readings, requiring levels of participation for a grade, and further developing assignment instructions. Evaluations from both years suggested that the course format was valuable and the assignments engaged students in better understanding disciplines outside their own and applying research to meet stakeholder needs. The course successfully introduced the project and launched students toward integrated research. Useful aspects of the course can be duplicated by the forestry faculty from one institution who wish to create an interdisciplinary issue-focused course or by a regional team from several institutions through an online platform. A variety of strategies can be used to help prepare students to contribute to resolving complex, interdisciplinary societal issues.

Keywords: graduate education, distance education, interdisciplinary, integration

Undergraduate forestry programs are among the most interdisciplinary in a university, largely because the Society of American Foresters (SAF) general accreditation standards for education programs that lead to a bachelor’s degree in forestry involve many disciplines. Forestry courses are expected to teach students about plant taxonomy, soil properties, forest ecology, land measurement, silviculture, economic analysis, management planning, professional ethics, and forest policy (SAF 2014). At the graduate level, however, students in forestry units tend to specialize in a specific discipline, e.g., genetics, ecophysiology, or modeling, with coursework and research activities designed to create depth, focus, and expertise. There are benefits to having a specialization—it may be easier to find committee members and classes, to publish in respected journals, and to obtain academic employment. Moreover, current graduate education tends to reflect the way faculty were trained, maintaining a tradition of disciplinary rigor.

If we expect graduate students to enter the workforce able to address complex current and future problems, however, they may benefit from a graduate program that offers opportunities to gain a more interdisciplinary perspective. This is the challenge presented by the National Research Council (NRC)’s report, A New Biology for the 21st Century:

The essence of the New Biology, as defined by the committee, is integration—re-integration of the many subdisciplines of biology, and the integration into biology of physicists, chemists, engineers, and mathematicians to create a research community with the capacity to tackle a broad range of scientific and societal problems. (NRC 2009, p. 3)

In other words, the research community is moving to embrace the importance of the integrated perspectives that forest managers and forest scientists have long appreciated; practical problems that necessitate multiple perspectives will also generate research opportunities.

 Whereas the word “integration” has many definitions (Huutoniemi et al. 2010), three important aspects are captured in or implied by the NRC statement: (1) future endeavors will be tackled by teams of researchers from different perspectives (interdisciplinarity), (2) blending their ideas to create new approaches and strategies (inte-
1. Building an awareness of the many perspectives held by those in different disciplines is often the first step in integration. It involves learning the language, paradigms, and culture of other fields well enough to have conversations about shared goals (Golde and Gallagher 1999, Miller et al. 2008). Doing so usually involves learning about the foundation and assumptions of other disciplines, as well as how each approaches the process of knowing. It could be a challenge for students to find a course in a field tangential to their own that provides both a basic foundation and graduate credit, however. Accordingly, special seminars or short courses that engage students and faculty from many disciplines may be a more feasible approach (Metz 2001, Thompson et al. 2009). It is relatively straightforward to bridge among natural resource disciplines such as wildlife, silviculture, or soils, because they share a common biophysical foundation. On the other hand, fostering effective communication and collaboration among the natural and social sciences, although more difficult, builds a framework for collaborations that are central to creating useful solutions to today’s sociocological challenges (Bradshaw and Bekoff 2001, Morse et al. 2007).

2. Integrated research engages a variety of disciplinary perspectives to identify, collaborate on, and answer research questions, exploring common problems that lie between disciplines or that use discipline-based tools in new ways. A similar term, transdisciplinary research, stresses the creation of new knowledge as a result of seeing novel connections (Klein 2004, Eigenbrode et al. 2007, Mässe et al. 2008, Miller et al. 2008). Although it is clear that society’s problems require new thinking, it is challenging to structure a process to achieve it, although some groups have simply begun and are tracking their progress (Metz 2001, Morse et al. 2007); insights from these efforts may help those who follow.

3. Some versions of integration stress the importance of work with stakeholders and end users to define researchable questions, pilot test tools, engage in data collection, and/or critique findings. These activities may focus on using local knowledge (Ballard et al. 2008), using community-based natural resource management (Pretty and Smith 2004, Child 2009), or developing partnerships with agencies or stakeholders (Hall et al. 2008). Land-grant universities have an advantage over others in the United States, because their Cooperative Extension Service faculty have a mission to engage the community in a variety of ways (Franz 2014). Such partnerships help researchers focus on the applied nature of their work and use knowledge that stakeholders bring from their work in the field (Peters et al. 2003).

Graduate education can introduce or prepare students to engage in all three types of integration. Many of the large funding opportunities recently available through the National Science Foundation and the US Department of Agriculture (USDA) National Institute of Food and Agriculture (NIFA) grant programs require that integrated graduate education programs be incorporated into proposed projects. This is one response to the NRC report (NRC 2009) that called for resources to support interdisciplinary integration. Working with faculty mentors on integrated research is one avenue for grant-funded projects to meet this goal. Coursework is another platform that may be helpful in meeting this requirement.

This article describes a graduate course that was developed by a group of forestry faculty in the southeastern United States as part of the Pine Integrated Network: Education, Mitigation, and Adaptation Project (PINEMAP). The project was funded through NIFA and involves more than 100 faculty, students, and staff at 11 land-grant universities who focus on loblolly pine (Pinus taeda) management to mitigate climate change and adapt to future climate variability. Here, we explain how the course was designed and what we have learned over 2 cycles with a total of 41 students. This example may provide a useful model for other faculty who might consider using integrated graduate education to meet proposal requirements or enhance regional research projects.

Course Goals

The impetus for this course was NIFA’s request for proposals, which stated that a priority of the project should be increasing the “number of professionals with cross-disciplinary training in agriculture and climate science.” The proposal authors discussed ways to creatively address integrated graduate education given two parameters: students would be building expertise in one of five broad disciplinary areas (ecophysiology, genetics, modeling, economics, and education) and would be enrolled at nine different universities across two time zones in the southeastern United States. Several successful experiences with Integrated Graduate Education and Research Traineeship (IGERT) projects that engaged students in a common course to build familiarity led us to an integrated graduate course for PINEMAP students. We proposed to use web-based technology to link students synchronously and asynchronously (Thompson et al. 2009) through webinars and chat rooms, and students would register for independent study at their home institution. When the PINEMAP proposal was
awarded, a team of interested faculty began planning the course, which was offered in the second semester of the students’ 1st year of their program (Spring 2012) and again 1 year later to incoming students (Spring 2013).

The course was designed to meet two broad goals:

• Engage graduate students in exploring climate change mitigation and adaptation issues in southern pine forests and

• Build capacity for integration among research disciplines and between research and Extension.

The diversity of students and the limited time for interaction necessitated that the course introduce foundational concepts and skills. The course was designed for students to increase their understanding of specific topics, including climate, climate change, the carbon cycle, carbon sequestration, environmental controls on pine productivity, policy and economic drivers of regional pine management, education and communication principles of effective outreach strategies, the process of program development and evaluation, and strategies used by Extension to support changes in behavior, as well as to gain an appreciation for the breadth and complexity of the project. We were keenly interested in providing a common background and appreciation for the diversity of disciplines that are working together in the project and practice in synthesizing ideas from several disciplines, i.e., interdisciplinary integration. The course introduced integrated research and encouraged discussion and exploration. Because PINEMAP is charged with producing real-world outcomes, understanding stakeholder needs and distributing research findings to meet those needs is essential; this concept formed the foundation for the assignment with Extension faculty.

The Course

The course was first offered to 22 graduate students at 8 universities in Spring 2012. Twenty students completed an online evaluation at the end of the course, and a summary of evaluation responses was presented at the project’s annual meeting. Meeting participants (approximately 45 faculty, 15 staff and postdoctoral fellows, and 20 students) discussed strategies that could be used to improve the course for the second offering. A number of logistical changes were made (Table 1), and the second course was offered to 19 students at 8 universities in Spring 2013. Evaluation data were collected via an online survey at the end of the term and comments during the last course webinar. The course description below reflects the improved version offered in 2013. The course syllabus, assignment descriptions, and evaluation are offered to readers on the Journal of Forestry website.3

The first component of the course focused on introducing students to climate change mitigation and adaptation issues in southern forests. We used faculty webinar presentations and readings to introduce students to the range of disciplines and research questions being addressed within the proj-

<table>
<thead>
<tr>
<th>Design component</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Rationale for change</th>
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<tbody>
<tr>
<td>Course credit</td>
<td>Option of 1 or 2 credits of independent study, either pass/fail or graded, depending on advisor and student preference.</td>
<td>Required 2 credits of independent study, for a letter grade.</td>
<td>Students working in groups need to be able to expect the same amount of effort from each other. The diversity of pass/fail and credit options in year 1 created an unfortunate range of student expectations for workload and time.</td>
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<td>Readings</td>
<td>Each faculty suggested readings based on their expertise and topic.</td>
<td>Faculty were limited to assigning 2 key articles to introduce their area of expertise.</td>
<td>Students were overwhelmed with the reading load in the 1st year and, as a result, many stopped doing the readings.</td>
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<td>Webinar length</td>
<td>2 h, including presentation and discussion.</td>
<td>1.5 h, with a recommendation that the presentation be no longer than 1 hr, followed by at least 30 min for discussion.</td>
<td>Interaction was expected, but difficult to guarantee, perhaps due to faculty’s inexperience with distance education.</td>
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<td>Faculty involvement</td>
<td>12 faculty gave presentations from 6 institutions; 7 faculty helped coordinate assignments 1 and 2.</td>
<td>8 faculty gave presentations from 3 institutions (3 taped webinars were used from 2012); advisors graded assignment 1; 4 faculty coordinated assignment 2.</td>
<td>While the ability to bring in experts for webinars is a significant benefit, reducing the diversity offered a bit more control of content and improved course management.</td>
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<tr>
<td>Graduate advisor</td>
<td>Not involved, other than to provide a grade for independent study credit.</td>
<td>Graded assignment 1 with a course rubric and provided a grade for independent study credit.</td>
<td>Involving the student’s advisor created more ownership at the home institution.</td>
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<tr>
<td>Online discussion</td>
<td>Students were encouraged to post on the online discussion board each week.</td>
<td>Students were required to post reading reflections on the online discussion board twice per week.</td>
<td>While the requirement was necessary to get the discussion started, some topics and some faculty were better at generating interesting discussion than others.</td>
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<tr>
<td>Assignments</td>
<td>Two group assignments: one disciplinary group explaining their common areas of research; one interdisciplinary group writing an Extension fact sheet.</td>
<td>One individual assignment exploring integrated research; one interdisciplinary group assignment focused on planning and writing an Extension fact sheet.</td>
<td>The first group assignment in year 1 required faculty coordination for each group, which was challenging to manage. Offering one individual assignment increased student comfort. Enough time for writing, editing, reviewing and revising a fact sheet is essential, however, and in both offerings, students felt rushed at the end of the term, even with 5 total weeks to work on assignment 2.</td>
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Table 1. Changes to the design of the Climate and Forests graduate course were based on evaluation comments from students and faculty.
Table 2. Webinar topics for each week of the two offerings of the Climate and Forests graduate course.

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Welcome, orientation, introductions</th>
<th>Welcome, course overview; climate basics</th>
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<tbody>
<tr>
<td>Week 2</td>
<td>Impact of climate change on forest ecosystems</td>
<td>Climate modeling</td>
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<tr>
<td>Week 3</td>
<td>Climate model projects in southern United States</td>
<td>Forestry basics</td>
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<tr>
<td>Week 4</td>
<td>Southern forest futures: comparing driving forces</td>
<td>Forests and climate</td>
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<tr>
<td>Week 5</td>
<td>Biology, economics, and scale effects on carbon implications of using biomass for energy</td>
<td>Genetics and adaptation</td>
</tr>
<tr>
<td>Week 6</td>
<td>Work in teams on assignment 1</td>
<td>Life cycle assessment</td>
</tr>
<tr>
<td>Week 7</td>
<td>Work in teams on assignment 1</td>
<td>Perceptions of climate change</td>
</tr>
<tr>
<td>Week 8</td>
<td>Review posted presentations from research teams on your own</td>
<td>Southern forest futures (asynchronous)</td>
</tr>
<tr>
<td>Week 9</td>
<td>Review posted presentations from research teams on your own</td>
<td>Exploring the world of extension webquest (asynchronous)</td>
</tr>
<tr>
<td>Week 10</td>
<td>Spring break</td>
<td>Spring break</td>
</tr>
<tr>
<td>Week 11</td>
<td>Group discussion of research presentations</td>
<td>Audience assessment: forest landowners</td>
</tr>
<tr>
<td>Week 12</td>
<td>Effective Extension programming</td>
<td>Assignment 2 discussion</td>
</tr>
<tr>
<td>Week 13</td>
<td>Challenges to communicating about climate</td>
<td>Extension product quality control</td>
</tr>
<tr>
<td>Week 14</td>
<td>Climate decision support system</td>
<td>Integration and team science</td>
</tr>
<tr>
<td>Week 15</td>
<td>Interdisciplinary research</td>
<td>Report on extension assignment and course evaluation</td>
</tr>
<tr>
<td>Week 16</td>
<td>Report on Extension assignment and course evaluation</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Two versions of assignments from the Climate and Forests graduate course.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
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<tbody>
<tr>
<td>1. Integrated research</td>
<td>Work with students in your research area and a faculty leader to better understand the literature and goals of research in this area. Explain your field to other students via a video, website, readings, or slide presentation that will be posted for others to view during weeks 8–10. Prepare discussion questions to encourage other students to ask questions during the week 11 webinar.</td>
</tr>
<tr>
<td>2. Extension products</td>
<td>Work with your assigned group and faculty leader to identify a target audience, understand their need for information or skills, and revise or develop an Extension program or product to meet this need. Your outreach tool (slide presentation, website, or fact sheet) should be reviewed by Extension faculty with a formative evaluation tool that you develop. Revise your product in accordance with that feedback. Topics were drought, insect pests, risk management, and climate forest interactions.</td>
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</table>

This enabled students to gain familiarity about the project as a whole and appreciate the diversity of perspectives that are essential to approaching the complex topic of forest management in a changing climate (Table 2). Because some students lacked a background in each topic, presenters approached their area of research from a basic framework (e.g., what is important to learn, what we know already, what tools we use to explore, and how we approach interesting research questions). Students were encouraged to contribute to webinars (either via the chat function or by speaking) and required to contribute to the online discussion board twice a week. Faculty leading the webinars prompted the online discussion with questions about the readings the week before their presentation so they could use student comments and questions during the webinars. This section of the course culminated in an assignment that enabled students to explore their own area of research in more detail (year 1) or write a paper on the potential for integrated research (year 2) (Table 3).

The second major component of the course prepared students to integrate research and Extension. Webinars and readings about the Cooperative Extension Service, communication skills, needs assessments, writing style, and formative evaluation were offered as they pertain to the audience of forest managers and landowners. Students were assigned to multidisciplinary and multiuniversity groups and asked to develop a forest and climate fact sheet for a specific audience. Groups first selected a target audience and completed readings to learn about the demographics and needs of their audience. Next, groups selected a specific topic and developed a fact sheet outline that was presented during a webinar for feedback from Extension specialists and classmates. Draft fact sheets were developed and submitted to Extension specialists who used a reviewer response form adapted by each student group to provide feedback about the appropriateness of the vocabulary, tone, and information for the intended audience; revised versions of the fact sheet were submitted for a grade. This assignment also helped students integrate disciplinary perspectives as they addressed perceived stakeholder needs.

The universities began their spring semester over a 3-week period, necessitating that the course begin when the last university’s term started, since a synchronous webinar was an important way to introduce students to each other. The course ended during the exam week of the universities that began their term first and allowed for the three different spring break weeks. This gave us 14 weeks in which to hold the 90-minute webinar (of which two were asynchronous),
assuming everyone would take 1 week off for their spring break.

Course Evaluations

We conducted an online course evaluation at the conclusion of each course, asking about course structure, expectations, the online environment, and assignments and requesting suggestions for future courses. The year 1 course evaluation contained 11 open-ended questions and 3 with rating scales (both rising 4-point and 5-point agree/disagree items); year 2 evaluation included 8 open-ended questions, 3 items with a rising 4-point scale, and 11 with a 5-point agree/disagree scale. Most students completed the evaluation: 91% in year 1 and 89.5% in year 2. We report first on the responses regarding the online and distance element of the course, then on students’ perception of the assignments and their achievement of the course objectives, and, finally, on their ideas about the nature of interdisciplinary research in general.

Online and Distance Element

Student comments about the course focused a great deal on the logistics and nature of an online course that engaged students from a number of universities. This was a first attempt at distance education across multiple universities for most of the students and faculty involved, and all learned from their experiences. Revising and repeating the course enabled us to improve both the structure and content. Although any course evaluation will probably result in positive and negative comments, the students in both offerings agreed that the course was an unparalleled opportunity to learn from a rich assortment of speakers and gain an orientation to the interdisciplinary, regional project. A sampling of some of the open-ended comments related to course logistics is provided here:

In general, I found the online webinar thing to be pretty uncomfortable personally…. But I thought all of the instructors were great and were clearly experts in their respective fields. (year 1)

A strength of this course is definitely the amount of information and communication with other members of the PINEMAP network. (year 1)

The online format is challenging for group projects and interacting with classmates, but I don’t think there was a better alternative; it was handled well. (year 2)

I generally liked the online format. In the discussion forum, the format allowed me to consider what my classmates wrote before responding. (year 2)

Feedback from the first offering was helpful in redesigning the course for the second offering. The requirements for the course were adjusted, which resulted in more appropriate expectations for students and instructors (Table 1). In addition, faculty became more adept at eliciting online discussion with open-ended questions, pauses, and directed questions.

Assignments and Objectives

Regarding the course goals, students agreed that the course enabled them to learn more about the project, to become more aware of other disciplines, and to learn more about stakeholder needs and Extension products, with scores falling between 3 (“fairly well”) and 4 (“very well”) (Figures 1 and 2). The slight differences in questions and the small sample size do not enable us to suggest that there is a significant difference between the two course offerings, but we believe the shifts in perspective reflect the changes in assignments and expectations (Table 3).

Students in both years also agreed that the course assignments and concepts helped them learn about integration that will be useful for the project, with scores falling between 4 (“agree”) and 5 (“strongly agree”) (Table 4). A sampling of the open-ended
Table 4. Postcourse attitude scores for the Climate and Forests graduate course suggest that the course met its objectives.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Year 1, n = 20</th>
<th>Year 2, n = 17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment 1 was an effective mechanism for learning about my research goals</td>
<td>4.25</td>
<td>4.0</td>
</tr>
<tr>
<td>Assignment 1 was an effective mechanism for learning about interdisciplinary research and integration</td>
<td>3.95</td>
<td>4.12</td>
</tr>
<tr>
<td>Interacting with people outside my area of expertise helped me understand more about what I bring to PINEMAP</td>
<td>4.35</td>
<td>4.47</td>
</tr>
<tr>
<td>Assignment 2 was an effective mechanism for learning about Extension product development</td>
<td>4.12</td>
<td>3.76</td>
</tr>
<tr>
<td>The course covered information that I could not easily obtain at my institution</td>
<td>4.12</td>
<td>3.76</td>
</tr>
<tr>
<td>The course increased my readiness to conduct or participate in integrated research</td>
<td>4.41</td>
<td>4.41</td>
</tr>
<tr>
<td>The benefits of the opportunity to hear from professors from a range of disciplines and institutions outweighed the challenges of online, distance learning</td>
<td></td>
<td>4.41</td>
</tr>
</tbody>
</table>

* 5 point scale: 1 = strongly disagree; 5 = strongly agree.

comments offered related to the assignments is provided here:

I enjoyed interacting with the other graduate students through the webinars and the assignments. I feel this is where I learned the most about what they are doing and how our aims fit together. (year 1)

Teamwork is hard! Teamwork with all the people from different schools is even harder. (year 1)

The readings and diversity of speakers are the course’s best assets. I learned so much about climate change, forest management, and PINEMAP that wouldn’t be covered in a typical course. (year 2)

Interdisciplinary Research

In addition to course evaluation questions, we solicited open-ended comments in response to two questions: “What are three factors that motivate you to explore/participate in interdisciplinary research?” and “What are three factors that could be obstacles to your interdisciplinary research endeavors?” Responses from both years were reviewed and coded into themes, and those mentioned by more than three students in each year are summarized here.

The major themes about motivations to engage in interdisciplinary research included the following: this type of research is essential, real-world problems are all interdisciplinary, and funded research projects in the future will be those that solve important problems. These themes suggested that students want to make a difference and value a broader perspective. Respondents mentioned that they find learning about new areas interesting and challenging. Interdisciplinary work enables them to ask and approach bigger and more meaningful research questions, and students found that compelling. The following sample of the open-ended comments illustrates these themes:

To be able to make my research better by combining it with someone else’s. (year 1)

To personally learn more about other disciplines that will help me convey my science to others. (year 1)

The need to approach research across multiple disciplines to reach better conclusions and take all things into consideration. (year 1)

Relating my research to real life human implications. (year 2)

I always like to know the things that interest me. It could broaden my horizons and improve the understanding of my own research. (year 2)

Potential obstacles to engaging in interdisciplinary endeavors included a recognition that interaction with those from different disciplines can require that people step out of their familiar world and reveal that they lack the knowledge and language to effectively communicate with others. Obtaining that knowledge and appreciating other perspectives requires an investment of time. The following comments illustrate these perceived obstacles.

Everyone is so highly knowledgeable at their specific skill set, and often times it is complex, so for others to get up to speed on that area of research is difficult. (year 1)

It is difficult to step out of one’s comfort zone and the degree of understanding is low at the start. If the subject is something one had not much background in, it is a big turn off. (year 1)

Lessons Learned

The experience of conducting this course pushed faculty and students into using distance education media and enabled us to share our expertise more broadly. Although this experience was tied directly to a funded project, it may be possible for other teams of faculty to engage students in interdisciplinary projects simply because of a curiosity or interest in a topic. The following reflections on four elements that were attempted in this experience are offered for faculty who might consider similar opportunities.

Regarding Distance Education

Most of the faculty and many of the students were new to distance education and sometimes felt they were forced into an uncomfortable environment. At the same time, they recognized that technology can support learning. As technology improves and as we all become more familiar with these systems, skills and confidence will improve. Regardless, however, some strategies for motivating participation are more effective than others. It may be helpful to include someone on the team who has successfully taught classes on...
line. Faculty who thrive on feedback from interacting with students may have to develop opportunities to create that feedback—the “ah-ha” moments are harder to detect across time and space. Students for whom English is a second language is harder to interact differently, which could improve their engagement (if they have time to type responses) or restrict it (if they are expected to speak on a synchronous webinar).

Regarding Multiuniversity Education

Students appreciated interaction with faculty and students outside their university, in part because of the promise of working with these people over the life of the funded project. They requested opportunities to meet in person. If students are aware of and value the additional expertise that is available through partnerships with other institutions, this realization may be enough to overcome the challenges of distance education. As budget cuts hamper universities’ ability to replace positions, seeking expertise across a region may be useful. Engaging faculty at each institution to coordinate local contributions could be an effective strategy (Thompson et al. 2009), particularly if they already know each other. The coordinating challenges of working across multiple institutions, however, limit the practicality of this feature to faculty who are already cooperating on a research project or have external funding. Smaller partnerships of two to three institutions would be more easily facilitated if funding is not prompting collaboration.

Regarding Interdisciplinary Education

Complex problems require interdisciplinary approaches to understand the issues and synthesize appropriate solutions. Coursework is one strategy for introducing students to the variety of disciplinary perspectives that contribute to an issue. Attracting students from multiple disciplines is ideal, and respecting their knowledge and deficits as everyone learns to communicate with each other is an important component of these courses. A team-taught approach or a variety of guest speakers could provide these disciplinary foundations; regardless of the format, coordination and clear expectations are essential. Group assignments that enable students to synthesize and apply multiple perspectives help achieve the goal of interdisciplinarity. As students gain an appreciation for other disciplines, however, they may feel less impressed by their chosen area of study or abilities. An expert’s perspective, after all, is more likely to assume that what one knows is commonplace and what other fields offer (especially very different areas) an absolute mystery. Helping students see value in their discipline and their individual contribution is an important aspect of this type of course.

Regarding the Extension Connection

Most higher education institutions seek opportunities to practice the scholarship of engagement and convey research findings to those who can use them. Forestry programs located within land-grant universities can easily engage their Cooperative Extension Service or education facility to facilitate this aspect of a course, and these skills can apply to a variety of outreach opportunities. Graduate students appreciated gaining skills associated with writing for general audiences, communicating to practitioners, conducting needs assessments, and evaluating programs so that they may effectively share their research with others.

Summary

If we are to meet the challenge of disciplinary integration presented by the NRC (2009), graduate education should prepare students to work on interdisciplinary teams and to generate researchable questions, solve problems, obtain grant funding, and communicate findings to stakeholders. This will require an introduction to other disciplines so they are familiar with their approaches and perspectives and are able to have conversations with colleagues. The more disparate the disciplines, the more challenging these conversations are, as even basic assumptions about reliable and valid data may be different. This process requires an awareness of communication skills to be able to detect and understand each other’s needs and shape messages appropriately. An integrated course can be an opportunity to achieve these goals and can occur in an online, multi-institution, interdisciplinary platform. Our experiences are offered to allow others to experiment with these new opportunities.

The materials from this course have been converted into a new course on managing natural resources through adaptations associated with climate change for at least one of the participating universities, and although it will be offered online, it will not involve students from other universities. Negotiating an memorandum of understanding (MOU) for waiving tuition fees for students at other institutions may be an option if a consortium of universities wished to institutionalize their collaboration. Otherwise, faculty at each institution could be involved in offering a joint course.

There is strong support in the literature and among PINEMAP students and faculty for integrated graduate education in two forms: an interdisciplinary approach to research and engaging stakeholders through Extension or outreach programs. Attracting faculty and students from several institutions may be one strategy to create enough students to justify the time and energy spent on a new course. Our experiment was based on a grant-funded opportunity, and that may be a necessary incentive for faculty and students. Students may be hesitant to take additional coursework once they launch their data collection if it appears to take them away from their focus. Faculty who stress the importance of integrated research and Extension, however, may convince students to engage in such a course voluntarily. As we continue to learn how to use technology to engage learners across distance, opportunities to integrate will likely increase.

Endnotes

1. For more information, see www.pinemap.org.
3. Please visit www.jofonline.org for details.

Literature Cited


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