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Abstract

Experiential learning opportunities promote skill in problem-solving and critical thinking, but they require unique assessment methods because traditional approaches are difficult to implement in the field. We have conducted a study tour course involving a canoe trip in a wilderness area in northern Minnesota since 2004. Here, we describe how we developed our course's learning experiences, ensured the learning experiences materialized, and assessed the student learning objectives. Proper planning can result in valuable, spontaneous learning experiences. We used a student journal, field-based quiz, and participation grade to effectively assess the breadth of student learning that was inherent in our course. Students indicated that they felt the three forms of assessment were effective and fair.

Introduction

Educators are increasingly encouraged to provide experiential learning opportunities that will provide students with technical experience, as well as skills in problem-solving and critical thinking (McCleery et al., 2005; Ryan and Campa, 2000). University administrators have encouraged faculty to develop these types of learning opportunities to increase student recruitment (Bringle and Hatcher, 1996). Experiential learning may also increase retention of students in programs (Millenbah and Millspaugh, 2003). Students benefit from experiential learning, as it integrates theory and practice, motivates learning, and encourages individual and group scholarship (Millenbah and Millspaugh, 2003).

Exams, term papers, homework assignments, presentations, group projects, and other tools can be used to provide a quantitative assessment of students during a course (Angelo and Cross, 1993). Although these traditional means of assessment may help to evaluate a student's progress toward completing some learning objectives, the methods may not adequately evaluate a student's ability to think critically or solve problems (Angelo and Cross, 1993; Ryan and Campa, 2000), both of which are primary objectives of an experiential learning course. Millenbah and Millspaugh (2003) suggested that new assessment techniques are needed to implement experiential learning effectively.

Experiential learning encompasses a range of possible course structures, such as service learning, research-based learning, and problem-based learning (Ryan and Campa, 2000). Here, we focus on the "study tour," a group of students and faculty traveling to a new location with unique ecological features and processes. In our case, we were interested in exploring the ecology of the Boundary Waters Canoe Area (BWCA) Wilderness in northern Minnesota. Our goals for the course are to: (1) expose Nebraska students to a different ecosystem, and (2) challenge them to examine how they value wilderness and its conservation. The course provides a unique opportunity for students to engage with a new ecosystem in which they may apply principles they have learned in their natural resource courses at the University of Nebraska-Lincoln (UNL). The BWCA Wilderness is a 4,410-km2 federal wilderness area designated by the Wilderness Act of 1964 (Heinselman, 1996). Campsites are provided in the Wilderness and the BWCA Act of 1978 limits travel to non-motorized watercraft along 1,931 km of canoe routes (Ohmann and Ream, 1971).

We found very little information available to guide our plans to provide learning experiences in a remote wilderness, as we developed this course. Thus, our objectives are to describe how we: (1) developed learning experiences, (2) ensured the learning experiences materialized, and (3) assessed the student learning objectives.

The Course

"Wilderness Ecology" is a two-credit field course offered annually during summer sessions at UNL since 2004. Students may take the course after their freshman year. The course begins with a two-day trip from Nebraska to Minnesota. Upon arrival, we

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engage students in a one- to two-day initial learning experience at a lodge outside the boundary of the BWCA, followed by a four- to five-day canoe trip into the BWCA. The course concludes with a one- to two-day trip home to Nebraska. Because of federal regulations, our backcountry canoe trip is conducted by dividing our class into small groups of nine or less people; each group consists of five to eight students and one or two faculty members. Students camp in tents and prepare their own meals during the canoe trip.

We plan our trips for mid-May, so that we can hold pre-trip meetings during the preceding spring semester. These meetings focus on trip preparations: supplies, equipment, wilderness etiquette, safety, canoeing lessons, and initial group formation. We have used 12-passenger vans or charter buses to transport students from Nebraska to Minnesota, and we select lodges in Minnesota based on instructor familiarity, space, facilities, current fire restrictions, and potential learning experiences. The lodges provide canoes, packs, tents, camp equipment, and food for our canoe trip. Our five study tours to the BWCA have included 68 undergraduate and four graduate students, two staff, and seven faculty. Our trip received $4,500 in logistic support and $21,500 in undergraduate scholarships during 2004-2008 from the UNL School of Natural Resources and College of Agricultural Sciences and Natural Resources, respectively. The trip fee for students has been $450-600, excluding tuition. Evaluations of the study tours by students have been very favorable (means of responses to "Overall rating of trip" ranged from 3.7 to 3.8 on a 4.0 scale) and frequently have included comments such as "great trip, great faculty" and "I absolutely loved this class!"

Students vary in their experience of wilderness living and canoeing, which provides an educational challenge and opportunities for leadership training. At present, most of our participants have declared majors in Fisheries and Wildlife or other majors in the UNL School of Natural Resources. Thus, most have a basic background in biology, soils, botany, and zoology. Upper-level students have more training in ecology and wildlife management. One student had extensive coursework in meteorology, which added a new, useful aspect to the trip. Few students from Nebraska have previous experience in a boreal ecosystem. The diverse background of students, in addition to the spontaneous nature of the course, creates a learning environment in which students as well as faculty act as educators. Faculty teams (three or four individuals) are chosen to represent fields related to our learning objectives (Table 1).

Learning Objectives and Experiences

We developed seven learning objectives (Table 1) that directly motivate the learning experiences we provide for the students (Black and Wiliam, 1998). Learning experiences for a study tour course are unique, as students and faculty can literally be engaged at every moment of the day; wolves howling at night wake us in our tents and provide us with an excellent, yet unplanned learning experience. Our learning experiences are usually not scheduled, and we have chosen to have few formal lectures in our course. Although learning experiences are not highly structured, we arrange the framework and route of our course to ensure learning objectives can be achieved mostly through serendipitous experiences. Our basic intent is to plan a trip route in which there is a high probability of certain experiences occurring, while maintaining flexibility to take advantage of any situation as a learning experience. Planning different trip routes for the backcountry portion of the trip each year ensures a high degree of spontaneous learning. Below, we explain how we engage students in learning experiences.

Table 1. Student learning objectives for a course in "Wilderness Ecology" at the University of Nebraska-Lincoln with tools used to assess the progress of student learning. A '■' indicates which learning objectives are evaluated by each assessment tool.

Learning Objectives	Assessment Tools		
	Journal	Participation Grade	Quiz
1. Describe the major components of the Boundary Waters Canoe Area Wilderness ecosystem.	■		■
2. Understand the influence of geology and fire on forest composition and structure.	■		■
3. Understand limnological processes that influence structure and chemistry of BWCA lakes.	■		■
4. Understand the diversity and roles of the vertebrate animal communities within the ecosystem.	■		■
5. Understand the attributes of a federal wilderness area, including the cultural history and management programs currently in place.	■		■
6. Develop an awareness of wilderness areas and their impact on our lives.	■		
7. Demonstrate the role of teamwork in wilderness living.	■	■	

The first learning objective is for students to *"Describe the major components of the Boundary Waters Canoe Area Wilderness ecosystem."* Students must be able to identify trees, plants, fish, and birds before they can adequately discuss the functional relationships between them. Field guides are our primary resource, but we also rely on personal

experiences of faculty and students. We instruct continuously on this objective—relying heavily on impromptu encounters. At each encounter we point out the features that distinguish organisms and reinforce lessons in identification of species not present. For example, we must distinguish between different conifer species. Pine (*Pinus* sp.) and spruce (*Picea* sp.) needles roll easily between the fingers, while fir (*Abies* sp.) and eastern white cedar (*Thuja occidentalis*) needles are flat. Once we demonstrate these differences, we refer back to needle shape when we encounter new trees. We plan our trip to maximize the diversity of plant communities along the route. We also take advantage of the expertise of our faculty members by presenting one-hour learning experiences designed to provide basic information on plant and animal identification, forest and aquatic ecology, and soil structure before we break into smaller groups for our travel into the wilderness.

We begin instructing on our second objective, *"Understand the influence of geology and fire on forest composition and structure"* during the drive from Nebraska to Minnesota. As we pass the biogeographic boundaries between the tall grass prairie, hardwood forest, and boreal forest, a distinct shift in the tree species occurs along Interstate 35. We typically stop at three or four locations with unique geologic or ecologic features as we travel northward to illustrate and emphasize the changes occurring in the environment. The visible evidence sparks a discussion of the underlying geological changes and the effects of the last glaciation. Our faculty with expertise in geology and soils relate basic concepts during the one-hour learning experiences prior to our canoe trip. In the BWCA, we plan our route to pass through areas with interesting fire history (Heinselman 1996), as well as topographic gradients. Our routes usually incorporate forest stands ranging from one year post-fire to old-growth stands (>200 years).

Another objective of our course is *"Understand limnological processes that influence structure and chemistry of BWCA lakes."* Students are in very close contact with the water during the four- to five-day canoe trip in the BWCA. We use a secchi disc, a dissolved oxygen/temperature meter, and water chemistry kits (pH and alkalinity) to describe physical characteristics of the lake—often from a flotilla of canoes gathered around an instructor. This objective requires the most expensive and heaviest equipment that must be stowed, portaged, and protected during the canoe trip. Equipment care is part of the learning experience.

We use a variety of methods to approach our next objective, *"Understand the diversity and roles of the vertebrate animals within the ecosystem."* Many of our students have taken general zoology prior to our course, but few have encountered a pine martin (*Martes americana*), heard a white-throated sparrow (*Zonotrichia albicollis*), or seen a northern pike (*Esox lucius*). As animals are more elusive than trees and other plants, our instruction is a bit more opportunistic as we come upon chance events. Witnessing a bald eagle take a pike 50 meters from your canoe demonstrates predator-prey dynamics very effectively, but cannot be planned. We encourage students to bring fishing equipment and provide an opportunity to purchase proper permits. Emptying the stomach contents of a filleted lake trout (*Salvelinus namaycush*) during a shore lunch can reveal its diet, in addition to providing clues as to the best lure to use when fishing. We also carry standard sampling equipment with us: mist nets for songbirds, Sherman traps for small rodents, minnow traps and seines for fish sampling along shorelines, and hand nets for aquatic invertebrates. Small mammal and minnow traps around campsites provide the students with an impromptu survey of rodent and fish populations. Small mammal trapping success prompts discussions about potential effects of campsites on rodent distribution and density. Over-enthusiastic students usually provide a real-time creel survey of the fish in many lakes. We obtain Institutional Animal Care and Use Committee approval and state and federal permits for all capturing and handling of live animals.

We also use animal signs as a teaching tool. Gray wolves (*Canis lupus*) and moose (*Alces alces*) are not commonly seen or heard, but we have found wolf and moose scat on each trip. Beaver (*Castor canadensis*) dams, lodges, and cuttings provide ample evidence of one of the most important species of animal in the area. Beavers were critical to the early exploration and commerce of the BWCA and much of North America. Red squirrel (*Sciurus vulgaris*) middens can also provide evidence of the species' presence on isolated islands. Thus, tracks, scat, and other sign provide good opportunities for students to identify species and hypothesize about habitat use and behavior of animals.

We have found that a flexible trip schedule, which includes rest days or a base-camp trip structure, allows students time to explore and investigate their surroundings. Faculty may have the desire to schedule every hour of a course, but the opposite approach has provided the best results in our field course.

We have developed two learning objectives that deal with the characteristics and uniqueness of wilderness areas. The first is, *"Understand the attributes of a federal wilderness area, including the cultural history and management programs currently in place."* Nebraska has little federal land and almost no federally designated wilderness, so we have found that students from Nebraska generally have little concept of the federal wilderness system, its political and social history, and the federal rules and regulations governing its management. We introduce the concept of wilderness in pre-trip materials, and share the U.S. Forest Service permit process with the students. We emphasize the unique rules and regulations (four-canoe groups, one group per campsite, no

cans or bottles, etc.) prior to the trip as well. We have included U.S. Forest Service employees as resources to explain the history of the area and active management of the BWCA. Around campfires, we discuss the native peoples of the area, early European explorers and fur traders, and more recent interests in extraction of timber, minerals, and recreational resources. The second wilderness-related objective is, *"Develop an awareness of wilderness areas and their impact on our lives."* We hope that students will perceive that we believe the field course should be as much about "awe" and inner reflection as it is about ecology (Lucas, 1963). We also encourage students to seek out quiet, secluded rocks and to write in their journals. We encourage discussions of still waters, solitude, wilderness ethics, and the importance of preserving wilderness for future generations. Students have responded by packing out other campers' trash. We often select readings from "The Singing Wilderness" (Olson, 1956) around the campfire or at a meal.

Again, the critical planning component is to provide adequate time for these conversations and experiences. Short travel days and routes that do not require exhaustive effort are conducive to completing this objective. The typical faculty response might be to engage students in a lecture after breakfast or dinner, but we have found that the most effective approach is to allow students to explore, provide time and direction to find quiet moments to reflect, and to close the day with group conversations around the campfire.

Our last course objective is, *"Demonstrate the role of teamwork in wilderness living."* Just as we hope the BWCA wilderness inspires awe and appreciation, we hope the experience of surviving for several days together inspires a sense of community and synergy among our students. Indeed, from a programmatic level, our wilderness trip is seen as one way of developing community bonds among faculty and students that help retain students and inspire alumni to stay in touch (Millenbah and Millspaugh, 2003). Logistically, our field course is not a place for students who are not interested in the good of the group. Learning to work together to portage canoes and equipment or correctly hang packs in 'bear country' is just as important as identifying trees. The students are forced into learning experiences that relate to this objective as faculty and students work together to prepare meals and create an efficient camp.

Assessment Tools

Assessment is a key part of every course (Angelo and Cross, 1993). We devised three forms of assessment for our course, which alleviated two challenges we faced: (1) an awareness of the value of wilderness areas is one of our learning objectives, and (2) traveling during a field course and traditional test writing are logistically difficult to combine. A third challenge we faced was that the experience of each student is unique; it is this aspect of student learning that we want to assess, rather than rote memorization of facts and figures.

Table 2. Rubrics used for subjective journal and participation grades for a course in "Wilderness Ecology" at the University of Nebraska-Lincoln

Score	Trip Journal	Trip Participation
90-100	1. Complete for each day of the trip	1. Enthusiastic team participant.
	2. Descriptive observations of day's learning experiences are complete and thorough; integrates personal thoughts and reflections.	2. Contributed greatly to group's success in camp and on the trail.
	3. Shows progress towards completing learning objectives.	3. Acted as a natural resource professional during the trip.
80-89	1. Complete for each day of the trip	1. Willing team participant.
	2. Descriptive observations of day's learning experiences are mostly complete and thorough; limited personal thoughts and reflections.	2. Contributed to group's success in camp and on the trail.
	3. Progress towards completing learning objectives is fairly obvious.	3. Acted as a natural resource professional during the trip.
70-79	1. Journal is not complete.	1. Participated in the team.
	2. Observations of day's learning experiences are adequate, but are lacking in description.	2. Did not negatively affect group's success in camp and on the trail.
	3. Learning objectives appear to have been met, but daily progress is not completely obvious in journal.	3. Did not act as a natural resource professional during the trip.
60-69	1. Journal is not complete.	1. Little participation in the team.
	2. Observations of day's learning experiences are not adequate.	2. Some negative effect on group's success in camp and on the trail.
	3. Very little evidence of daily progress towards meeting learning objectives.	3. Did not act as a natural resource professional during the trip.
0-59	1. Journal is not complete.	1. No participation in the team.
	2. Observations of day's learning experiences are not complete.	2. A total negative effect on group's success in camp and on the trail.
	3. No evidence of daily progress towards meeting learning objectives.	3. Did not act as a natural resource professional during the trip.

Student journals

We asked students to complete a learning journal during the course (Farrell, 2007), which accounted for 30% of their final grade. Journal entries allowed students to frame their experiences in their own style of learning (Brualdi, 1996), as students could write in various styles and draw images that captured their thoughts. Journals require solidly constructed rubrics for assignment of grades (Farrell, 2007; Tierney and Simon, 2004). We provided the students with a rubric that emphasized our learning criteria (Tierney and Simon, 2004): completeness of journal entries, documentation of learning experiences, integration of personal thought and reflection, and evidence of completion of learning objectives (Table 2).

We used the journals to evaluate all learning objectives (Table 1). We emphasized to the students that their journals would be the most valuable way for them to demonstrate their individual progress toward the course goals. We have increased the amount of time allotted to students to write in their journals during the trip since our earliest offering of the course. Course evaluations from students in 2006 and 2007 revealed that students felt journals were an effective way to express their experiences and impressions of the trip (mean of 3.6 on a 4.0 scale, n = 26).

Trip participation

We evaluated the last learning objective, *Demonstrate the role of teamwork in wilderness living* (Table 1) with a participation grade, which accounted for 30% of the course grade. Student behavior in field courses should be a direct correlate of their developing professionalism. Poor teamwork and poor judgment can lead to dangerous situations in a wilderness-based course, so the relative value of this portion of their grade demonstrates our expectations. As with journal entries, a clear, reliable rubric is critical for subjective assessments (Tierney and Simon, 2004). Our learning criteria were team participation, contributions to group success, and professional conduct (Table 2).

Our instructors are clear about expectations of students prior to the trip. The academic success of the course is dependent on the excursion being more than just a fishing trip with buddies. We consider our undergraduate students to be natural resource professionals, and the course is a university-associated professional activity. The road-trip or campfire atmosphere has potential to create situations where students feel too casual. We discuss situations that arise with regard to insensitive language or inappropriate behavior, and our guidelines of 'professional conduct' are critical to these discussions. We are considering using a formal team-based approach, in which students provide a portion of the assessment of their fellow professionals (Michaelson et al., 2002). Evaluations from students in 2006 and 2007 revealed that students believed grading procedures were explained well (mean of 3.7 on a 4.0 scale, n = 26), which indicated that the students were aware that their behavior and participation would be evaluated and incorporated into their grade for the course.

Field-based quiz

Our last form of assessment of student learning was a field-based quiz, which accounted for 40% of the course grade. At the conclusion of the canoe trip, we asked students to provide three essay or short answer questions and the answers to their questions. Students were encouraged to use their journals as a source of questions and answers. Faculty gathered the submissions, and selected five questions that effectively covered the academic learning objectives (Table 1). We asked students to select four of the five questions to answer for their quiz. We gave the quiz at our lodge or at a suitable stop on the return trip to Nebraska. Evaluations from students in 2006 and 2007, revealed that students felt the quiz was a fair way to express their knowledge of information presented during the trip (mean of 3.9 on a 4.0 scale, n = 26).

Summary

Field courses are unique, because learning experiences cannot be planned with certainty. Further, assessment of field courses requires methods related to course objectives, which usually entail non-traditional methods of assessment. We found that a student journal, participation grade, and field-based quiz were effective methods to assess the breadth of student learning that was inherent in our course. Our evaluations of students revealed that students also felt the three forms of assessment were effective and fair.

Our experience with a field course in the BWCA suggests that ecosystem exploration, with adequate time for observation, reflection, and interaction, is an effective way to increase student knowledge, critical thinking, problem-solving, and professionalism. Anecdotally, we have observed increased cohesiveness among students and faculty who tripped together. Our department offered a similar BWCA experience during the 1970s and 1980s; alumni often regard it as their fondest memory of their undergraduate program and many are still in touch, professionally and personally, with colleagues they engaged on the trip.

The success of the wilderness course has led our faculty to expand our study tour offerings to include a tropical ecology course in Puerto Rico, an ecology course in Namibia, and a geology-ecology course to the Big Bend region of Texas. The addition of these trips has coincided with a 50% increase in our undergraduate enrollment in the Fisheries and Wildlife major. Although experiential courses have been valuable to our program, we have been mindful that the costs of our courses may be prohibitive to

some students. We encourage the development of course-specific scholarships to support deserving students.

We encourage administrators to find ways to support faculty who plan and carry out a high-quality experience for students. Study tour experiences are valuable to academic programs, but they require inordinate amounts of planning to create the serendipitous learning experiences that are the foundation of their value. Thus, they may require unique administrative approaches to factor planning and course leadership into the calculation of teaching loads.

Many of our faculty enjoy leading field courses more than any other type of learning experience, but experiential learning courses take substantial time to plan and execute well. The set of assessment tools we developed are effective and critical to the success of our course. We believe that a poorly planned field course will probably fail to meet its learning objectives. Similarly, a field course with assessment methods that are mismatched with learning experiences will not adequately evaluate student growth.

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