AFFECTIVE EDUCATION BY DESIGN: AN EXPERIENTIAL PEDAGOGY FOR NATURAL RESOURCES EDUCATION

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ABSTRACT

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Attitudes and values are considered an important component of learning in higher education, but natural resources and environmental education programs typically emphasize cognitive gains in the design of instructional activities and subsequent assessments. This research suggests that greater consideration of affective learning outcomes should be more explicitly considered to better achieve learning goals, and identifies experiential learning as a pedagogy that integrates the three domains of learning to facilitate the cognitive and affective development of students. In the first chapter, the relationship between attitudes and subsequent behaviors is explored from various theoretical perspectives in the context of environmental education. It is argued that greater attention to how attitudes are formed and shaped, as well as characteristics of attitudes that influence how resistant to change they are, is necessary to achieve broader goals of affective development. Direct experiences as they relate to the development, accessibility, stability, and strength of attitudes are identified as a significant factor, with important implications for affective learning in higher education. The second chapter explores the influence of experience across the cognitive, affective, and psychomotor domains of learning and presents various approaches for incorporating experiential learning into college and university curricula. Two course models at Michigan State University (MSU) that employ experiential learning pedagogies are described in detail, as well as the benefits and constraints of each model, and concludes with a discussion of barriers to implementing experiential learning pedagogies into college and university curricula more broadly. The third chapter links theory and practice to

explore how various dimensions of environmental attitudes are influenced as an outcome of experiential learning in both MSU courses. Connectedness to nature, which measures the cognitive, affective, and experiential components of an individual's relationship with nature, is identified as a relevant construct to assess affective development in the context of learning goals for both courses. Experiential learning was demonstrated to significantly increase overall nature relatedness, as well as the affective and cognitive aspects of students' connectedness to nature as an outcome of learning in both MSU courses. The experiential dimension of connectedness to nature was not influenced by course participation, and may be a relic of students' past experiences in and with nature that contributed to their choice of major. Results indicate that experiential learning to increase students' connectedness to nature may be more impactful for students in other disciplines, those with lower initial nature relatedness scores, or individuals with less previous experience in nature. These results suggest that affective learning outcomes can be achieved when they are explicitly considered in course and curriculum design, and provides evidence in support of experiential learning as a useful pedagogy for the affective development of undergraduate students. The final chapter of this dissertation shifts focus from affective learning gains to cognitive ones to assess whether learning outcomes are influenced by order of instruction in an experiential learning activity. Results indicate that order of instruction does not influence how well students learn course material when experiential pedagogies are employed. The significance of experiential learning on affective and cognitive learning outcomes in higher education to better achieve learning goals warrants further consideration.

This dissertation is dedicated to all of the students who taught me as much as I taught them and who are the source of inspiration and subject of this research.

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CHAPTER ONE: ATTITUDES AND ENVIRONMENTAL BEHAVIOR

Introduction

A primary goal of many environmental and natural resources education efforts is to develop the knowledge, skills, and attitudes of students in order to promote social responsibility and environmental stewardship in their everyday lives ((Huber, 2018; Savitz-Romer, Rowan-Kenyon, & Fancsali, 2015; Wolff & Booth, 2017). That is, effective education programs should not only provide the cognitive scaffolding but also facilitate the development of a framework of attitudes and values with the ultimate goal of promoting environmentally responsible behavior. Higher education institutes across the country are increasingly including education for sustainability in their institutional mission and vision statements as a goal that transcends majors and disciplines (McIntosh et al., 2008; Shephard, 2008). Although attitudes have long been considered an important component of higher education (Bloom et al., 1956; Krathwohl, Bloom, & Masia, 1964), the primary emphasis of most environmental and natural science programs has been to provide basic knowledge of ecological principles with little attention given to the development of attitudes and values as they relate to environmentally-conscientious behavior (Bradley, Waliczek, & Zajicek, 1999; Pooley, 2000). Recent scholarship has demonstrated that increased knowledge alone is not sufficient to drive behavioral change (Ajzen, 2001; Heberlein, 2012), and that attitudes are among the most important determinants of behavior (Garrison, 1995; Kraus, 1995). If a goal of higher education is to produce informed, global citizens who behave as environmental stewards, greater attention should be given to affective learning outcomes both within courses and across the curriculum.

The following sections of this chapter will explore the relationship between attitudes and behaviors from various theoretical perspectives to understand how affective outcomes may be better achieved in education programs that seek to influence students' attitudes and values with regard to the environment. This is not intended to be a comprehensive review of all theories relating to behavioral-change, but rather a general overview of the most widely applied conceptual frameworks from various disciplines. In this synthesis, it is noted that the frameworks intended to predict how people behave suffer from issues related to the operationalization of attitudinal concepts, as well as an emphasis on factors that moderate the relationship between attitudes and behaviors without consideration of the antecedents of attitudes as they relate to behavior. It is argued that greater attention to how attitudes are formed and shaped, as well as characteristics of attitudes that influence how well they predict subsequent behaviors, is necessary in order to achieve broader goals of behavior change. Direct experiences as they relate to the development, accessibility, stability, and strength of attitudes are identified as a critical aspect of the educational process, and that affective learning outcomes occur regardless of whether they are explicitly considered, with important implications for how education programs are designed.

In the second chapter, I explore the influence of experience across the cognitive, affective, and psychomotor domains of learning and present various approaches to incorporating experiential learning into higher education courses more broadly. Two course models at Michigan State University (MSU) that employ experiential learning pedagogies are described in detail, as well as the benefits and constraints of each model, and concludes with a discussion of barriers to implementing experiential learning pedagogies into college and university curricula. The third chapter links theory and practice to explore how various dimensions of environmental attitudes are influenced as an outcome of experiential learning in both MSU courses. The final chapter assesses whether cognitive learning outcomes are influenced by order of instruction in an experiential learning activity in one of the MSU courses.

Literature Review

Theory of Planned Behavior

One of the most influential theories regarding the prediction of behavior is the theory of planned behavior (Ajzen, 1991; Chao, 2012). The theory of planned behavior was developed as an extension of Fishbein and Ajzen's (1975) theory of reasoned action which states that an individual's intention to exhibit a particular behavior is affected by their attitude toward the behavior and by a subjective norm about the perception of how others view the action. Both the theory of planned behavior and the theory of reasoned action suggest that behavioral intentions are the best predictor of behavior (Ajzen, 1991). These behavioral intentions are influenced by attitudes toward the behavior, perceptions of norms regarding the behavior, and the extent to which the individual perceives that the behavior is under his or her control. Though not explicitly included in the framework, there are several beliefs that underlie the three proposed determinants of behavioral intention: behavioral beliefs regarding how favorable or unfavorable an evaluation is of the behavior in question, normative beliefs which refer to the perception of social pressure to perform or not perform the behavior, and control beliefs regarding the perception of ease or difficulty of performing the behavior (Azjen, 1991). These beliefs do not necessarily have to be grounded in factual information; they may be biased, inaccurate or irrational. Once formed, they provide a consistent foundation from which attitudes, subjective norms, and the perception of control result in behavioral intentions (Azjen and Fishbein, 2005). Attitudes as a more general construct are only implicitly considered in the theory of planned behavior in so far as they influence the beliefs that underlie the three main determinants of behavioral intention.

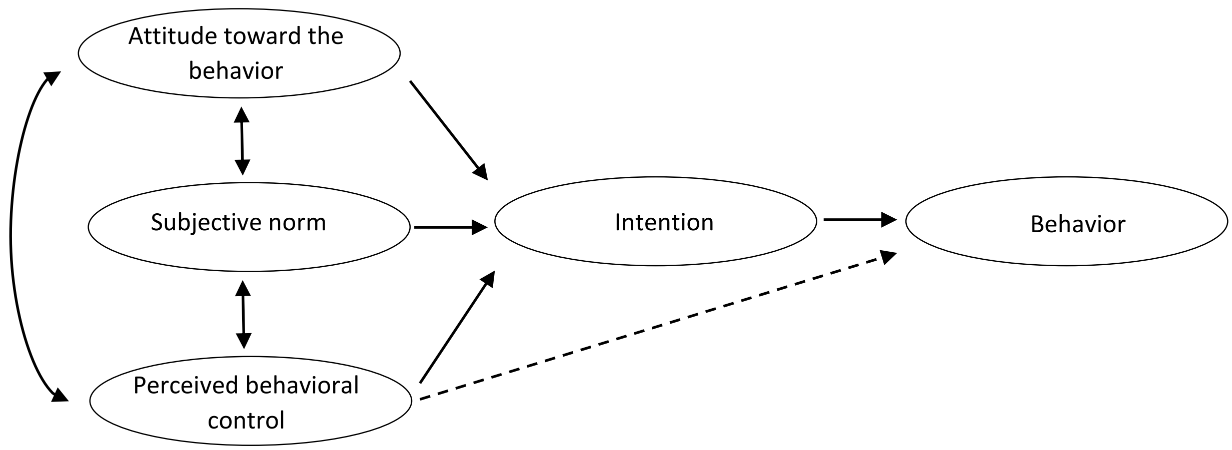

Figure 1. Theory of planned behavior as presented by Ajzen (1991).

Norm-Activation Theory

In contrast to the theory of planned behavior, the norm-activation theory was developed specifically for altruistic behaviors (Schwartz, 1977). According to this theory, there are three factors that are important in determining altruistic behavior: personal moral norms that are activated when individuals perceive conditions which pose threats to others (or, an awareness of consequences), and the belief that personal action can be taken to avert those consequences. The values-beliefs-norms (VBN) theory extends norm-activation theory by expanding the focus beyond altruistic motives to include egoistic and biospheric values as well (Stern, 2000). In terms of environmentally responsible behavior, the VBN theory posits that pro-environment behaviors stem from acceptance of personal values or norms, the belief that things important to those values are under threat, and the belief that personal action can be taken to alleviate the threat. The process moves from central elements of values and belief structures toward more focused beliefs about human-environment relationships, the perceived consequences of that relationship, and the perception of one's ability to take corrective action. Personal norms are then activated by the perceived consequences and ability to take action, which in turn influences actual behavior. Values, beliefs, and norms, as conceptualized in this theory, are what Stern calls ‘attitudinal factors’ that may influence pro-environmental behavior.

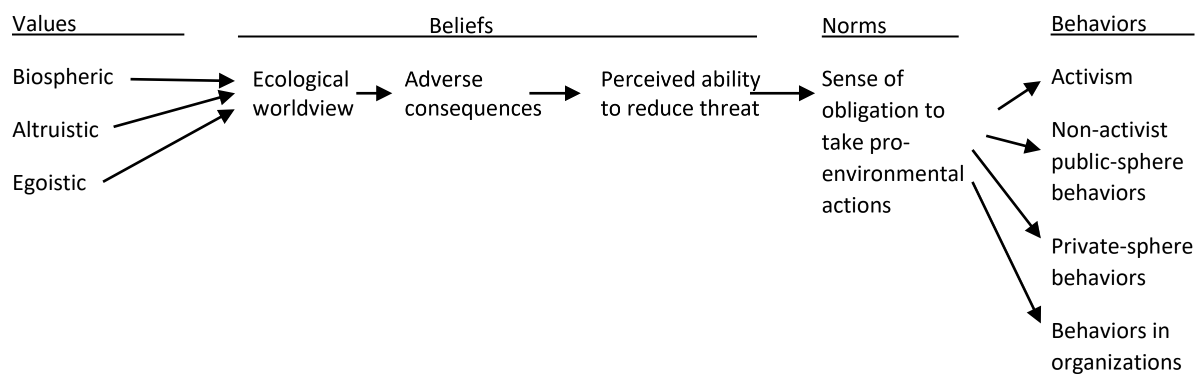

Figure 2. Value-belief-norm theory of environmentally responsible behavior as presented by Stern et al. (2000).

Model of Responsible Environmental Behavior

In a meta-analysis of 128 studies pertaining to environmental behavior research, Hines et al. (1986) synthesized an empirically-derived model of responsible environmental behavior (REB). Similar to the theory of planned behavior, behavioral intention was the single best predictor of behavior in the REB model, but behavior was also found to be influenced by contextual factors such as economic constraints, social pressures, or the opportunity to choose other behaviors or actions (Hines et al., 1986). In the REB framework, factors that influenced intention to act included personality factors, knowledge of issues, knowledge of action strategies, and action skills related to the behavior. In this model, attitudes are conceptualized as one type of personality factors, along with locus of control and personal responsibility. Although behavioral intention is considered the best predictor of behavior, the inclusion of knowledge of issues and knowledge of action strategies as precursors to intent suggests that education focusing on the cognitive domain of learning may indirectly influence environmentally responsible behaviors by making students aware of a wider set of alternative actions.

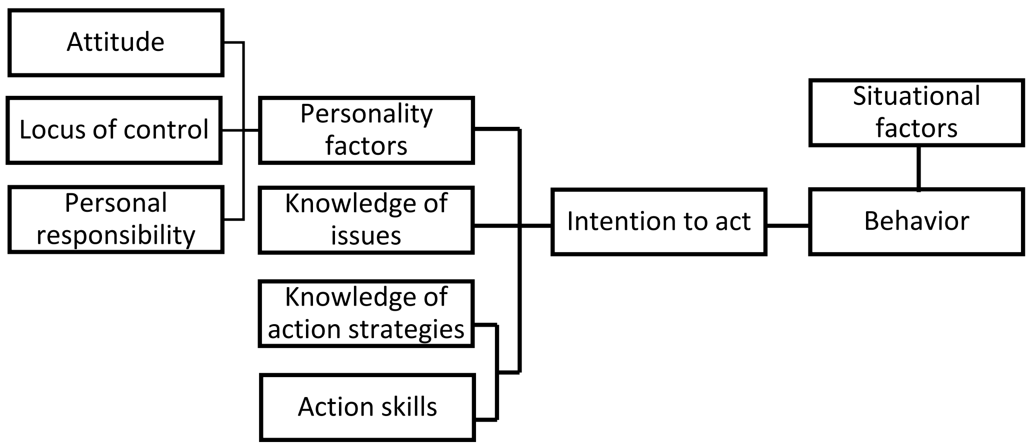

Figure 3. Model of responsible environmental behavior (Hines et al., 1986).

Commonalities and Constraints

All of these models (and additional frameworks not considered here such as those grounded in social theory) have some validity in certain circumstances, though no single theory has been demonstrated to be consistently superior in predicting environmental behaviors. Indeed, all of these frameworks are conceptually similar but differ in the operationalization of individual components. Some researchers have argued for the inclusion of additional variables that either directly influence behavior or moderate the relationship between attitudes and behaviors (e.g. Fishbein and Yzer, 2003; Klockner, 2013). For example, Klockner (2013) integrated the theory of planned behavior and value-belief-norm theory with the intention of making it applicable across more situations and for a suite of general environmental behaviors. His meta-analytical structural equation modeling approach allowed for the consideration of interactions between individual variables, and, importantly, confirmed that all of the variables included in both models as significant with regard to predicting environmental behavior. However, including additional variables or integrating multiple theories appears to only moderately improve the ability of any model to predict environmental behavior (Fishbein and Yzer, 2003; Klockner, 2013; Kollmuss and Agyeman, 2002) and results in increasingly complex theoretical frameworks with limited practicality.

In the interest of parsimony, new theories for environmental behavior prediction or the addition of other variables in existing theories may not be necessary or particularly useful, at least with regard to applications in education domains. Although each model differs in how attitudes are conceptualized, there is general agreement that attitudes are an important determinant of behavior (Garrison, 1995; Kaiser et al., 1999; Kraus, 1995)). Rather, the predictive validity of any model may be improved by further consideration of how attitudes are operationalized within each framework as well as antecedents of attitude (and by extension, attitude change).

Attitudes consist of several separate but interrelated elements: affective (positive or negative feelings toward an attitude object), cognitive (beliefs one holds about the attitude object), and behavioral (overt actions or responses to the attitude object) components (Ajzen and Fishbein, 2005; Eagly and Chaiken, 1993; Kaiser et al., 1999; Olson and Zanna, 1993). Further, attitudes can generate different affective, cognitive and behavioral responses (Eagly and Chaiken, 1992). The relative importance of each of these components and subsequent responses necessarily varies among individuals and across contexts, and may help inform the observed inconsistencies in the attitude-behavior relationship. For example, two individuals can share the same attitude that invasive species are bad, but act on the attitude with entirely different behaviors depending on the relative importance of each component of the attitude and relevant situational factors. One person may donate money in support of a local conservation organization while the other volunteers their time removing invasive plants from local water bodies. Similarly, an individual may believe invasive species are bad but not feel inclined to perform any behavior to mitigate their negative impacts if the attitude is relatively weak, even if there are no situational barriers to performing a behavior. Therefore, studies that only employ a single attitudinal measure, or those that methodologically do not allow for multi-dimensionality in attitude scales, will insufficiently capture all the elements of an attitude.

A better understanding of the structure of attitudes has important implications for educators. It is not a coincidence that the three components of attitudes—the affective, cognitive, and behavioral—parallel the three domains of learning identified by Bloom et al. (1956) in their seminal taxonomy of educational objectives: the cognitive, affective, and psychomotor. The three domains of learning and the three components of attitudes are closely interrelated, making it difficult to parse the individual influences of any element. For example, development in the cognitive domain of learning would necessarily impact cognitive elements of student attitudes as they increase their knowledge on a particular topic, but increasing knowledge could also impact behavioral elements of attitudes by making students more aware of a broader range of options for action. The second domain in Bloom's Taxonomy is the affective domain, which emphasizes growth in attitudes and emotions (Krathwohl et al., 1973). Of particular interest to environmental and natural resources education, the affective domain of learning describes a hierarchy of increasingly complex changes in behavior as values or attitudes are learned (Krathwohl et al., 1973). The last domain of learning is the psychomotor, which includes physical movement and the development of skills (Simpson, 1972), which could influence affective and behavioral components of attitudes by making them familiar or more comfortable with particular actions or behaviors. Understanding how course activities influence various dimensions of attitudes is critical to design courses that better achieve sustainability and stewardship goals as an outcome of learning.

Regardless, even allowing for multidimensionality of attitude constructs, these frameworks do not address ways attitudes are formed, influenced, or changed over time. What may be more useful with regard to inducing stewardship behaviors through education is greater consideration of the antecedents to-- and characteristics of-- attitudes. Understanding how attitudes are formed and what characteristics of attitudes influence their predictive ability with regard to behaviors can help educators consider various classroom approaches that are more likely to induce affective development of students and influence future behaviors.

Attitudinal Characteristics and Development

Recent scholarship by Glasman and Albarracìn (2006) and Kraus (1995) identify several characteristics of attitudes that contribute to their ability to influence future behaviors: attitude accessibility, stability, certainty, affective-cognitive consistency, and direct experience with the attitude object. Attitudes are more likely to influence behavior when they are easy to retrieve from memory (Fazio, 1989). Higher accessibility of an attitude increases the likelihood that it will be used as criteria in behavioral decisions (Fazio et al., 1989). Attitudes are formed through affective and cognitive components (Kraus, 1995), and these components can differ in terms of how accessible they are. For example, Verplanken et al. (1998) observed that affective judgements required a shorter response time than cognitive judgments, suggesting that affective aspects of attitudes may be more accessible than cognitive aspects. In addition to accessibility, the ability of attitude to predict behavior is stronger when affective and cognitive beliefs are consistent with each other (Kraus, 1995). The accessibility and strength of an attitude also help determine how stable it is, such that highly accessible and confidently held attitudes increase attitude stability, which leads to higher attitude-behavior consistency (Glasman and Albarracìn, 2006). Thus, the relative contributions of each characteristic of attitudes on the relationship between attitudes and behavior are difficult to disentangle because they both directly and indirectly influence each another. One significant factor that moderates the stability, accessibility, and strength of an attitude-- and therefore resulting behaviors-- is direct experience with the attitude object.

Attitudes formed by direct experience tend to be stronger and more clearly defined than those formed by indirect experiences (Fazio and Zanna, 1978; Kraus, 1995). Further, direct experiences help shape attitudes with strong object-evaluation associations, increasing how accessible they are from memory (Fazio, 1986). Attitudes that are formed through direct experience tend to be affectively-based while those formed through indirect experience are more cognitively-based (Duerden and Witt, 2010; Millar and Millar, 1996), and affect-based attitudes tend to be better predictors of behavior (Millar & Millar, 1998). Indeed, several researchers have noted the influence of direct experiences on attitudes and subsequent behaviors (e.g. Cooke and Sheeran, 2004; Fazio et al., 1990; Kollmuss & Agyeman, 2016; Kraus 1995; Rajecki, 1982).

The significance of direct experiences on affect has important implications for education programs both within and outside the classroom. If behavior change is a primary goal in higher education, then it is important to identify ways educators can influence attitudes as a precursor to environmental stewardship behaviors. Specifically, it is posited that incorporating experiential learning into course activities and instructional design as an approach to elucidate more affective learning outcomes warrants further consideration. Experiential learning theory and its impacts on all three domains of learning is explored in greater detail in subsequent chapters.

CHAPTER TWO: EXPERIENCE AND HIGHER EDUCATION

Introduction

The previous chapter identified direct experience as a significant construct with regard to the cognitive and affective development of students as an outcome of course learning, with important implications for higher education institutions that seek to develop the knowledge, skills, and attitudes of graduates to better prepare them for active and participatory citizenship in a global society. This chapter explores the influence of experience on the cognitive, affective, and psychomotor domains of learning (Bloom et al., 1956), and presents experiential learning theory as a framework for incorporating experiential pedagogies into classroom practices. Two course models that use experiential learning techniques in their design are presented in detail, with a discussion of the benefits and constraints of each model as well as barriers to infusing experiential learning pedagogies into higher education curriculum more generally.

Experiential Learning Theory

Experiential learning is a pedagogical approach to teaching and learning in higher education that places students in direct contact with the concepts being studied (Kolb, 1984). Experiential learning emphasizes direct experience as a central element in the learning process, in contrast with cognitive or behavioral learning theories, which focus on cognition over affect and do not consider the role of the subjective experience in the process of learning (Kolb and Boyatzis, 2001). This chapter frames the role of experience in higher education with Kolb's (1984) experiential learning theory, which proposes that learning occurs through a continuous cycle of experience and reflection that results in abstract conceptualization and transfer of information to new situations and contexts. The foundation for experiential learning theory can be traced back to John Dewey (1938), an early proponent of the role of individual experience in learning. A recurrent theme in Dewey's writing on education is producing an active and informed citizenry; thus, Kolb's experiential learning framework aligns with the broader goals of environmental education.

The experiential learning cycle involves four interrelated stages that students move through in a continuous cycle that promotes higher order thinking and lifelong learning skills: 1) concrete experience, 2) observation and reflection, 3) abstract conceptualization and generalization, and 4) active experimentation (Kolb, 1984). Experiential learning theory posits that knowledge is created as students reflect on experiences resulting in abstract generalizations that can be applied in new situations and contexts (Kolb, 1984). New experiences become embedded in an existing framework of understanding that is used to inform or refine abstract generalizations, resulting in deeper learning that may be transferred to other new contexts for further refinement (Kolb, 2015). In this way, experiential learning theory is particularly conducive for the development of lifelong learning skills, as new experiences continually inform, refine, and adjust an individual's understanding of a particular concept or issue in a perpetual cycle of learning. It is important to note that although this cycle places an emphasis on concrete experience as a foundational element for learning, there is no obligatory starting point in the learning cycle (Millenbah et al., 2000). The significance (or lack thereof) of where a student enters the experiential learning cycle is explored in greater detail in chapter four of this dissertation.

The experiential learning cycle draws many parallels with the scientific method and the concept of scientific thinking more broadly. Scientific thinking is a way of reasoning grounded in observation, formulating hypotheses, experimentation, and evaluating results which may lead to new observations or questions to be answered in a lifelong pursuit of deeper understanding (Handelsman et al., 2007). In the same way that experiential learning is a perpetual cycle of thinking and doing, scientific thinking also has no end point; new information continually refines abstract conceptualizations of phenomena and leads to new questions and hypotheses. Both scientific thinking and experiential learning emphasize the process-- rather than the outcome – of learning. A primary result of most scientific research is not discovery but rather the improvement and refinement of theory with new information. Similarly, students who are able to apply the scientific method to the process of thinking are therefore not "done learning" upon graduation, but rather are equipped with the skills to continue refining and improving their knowledge and understanding through the process of lifelong learning and critical thinking.

Elements in the experiential learning cycle also overlap considerably with key principles for successful learning identified by Brown et al. (2014) in their evidence-based synthesis of research that bridges concepts from cognitive psychology on how people learn with practical applications in educational science. For example, one key principle for successful learning is making learning concrete and relevant to students' lives (Brown et al., 2014). This principle parallels the concrete experience component of the experiential learning cycle. All experiences are necessarily unique to individuals because their understanding of an experience is embedded within the context of social, cultural, and environmental influences that inherently vary across students. Experiential learning therefore allows for differences in how students construct meaning from the same concrete experience, increasing salience by making learning personally relevant to each student. Likewise, Brown et al. (2014) identified the need to help students think more abstractly so that understanding can be generalized and applied in new contexts, which corresponds directly with the abstract generalization component of the experiential learning cycle. Another key principle of successful learning is elaboration, which aligns with the active experimentation component of experiential learning whereby new understanding is transferred and applied in new and different contexts. The only stage in the experiential learning process not explicitly acknowledged as an independent principle of successful learning is reflection, though Brown et al. (2014) suggest reflection is important to two key learning principles: elaboration and retrieval. Reflection allows for elaboration through the process of generalization and transfer, and makes retrieval of information more salient through practice.

Although the language and conceptualization of elements differ between the successful learning principles identified by Brown et al. (2014) and components of the experiential learning cycle, the application of experiential learning theory as a holistic pedagogy to improve student learning outcomes across all domains of learning merits further consideration.

Experiential Learning and Bloom's Taxonomy of Educational Objectives

Bloom's Taxonomy of Educational Objectives is a widely-applied foundational framework for classifying learning objectives in classroom instruction across people, subject matter, and grade levels (Bloom et al. 1956). Bloom's Taxonomy consists of three domains, or dimensions: cognitive (knowledge), affective (attitude), and psychomotor (skills). Each domain is hierarchical, consisting of multiple levels of understanding with increasing complexity such that a student must attain prerequisite knowledge and skills at lower levels before development at higher levels.

Experiential Learning Impacts

Cognitive Domain

The cognitive domain of learning emphasizes knowledge, comprehension, and critical thinking. This domain is conceptualized as two-dimensional with cognitive processes on one axis and classification of knowledge types on the other. The process dimension contains six levels of increasing complexity: remember, understand, apply, analyze, evaluate, and create. Within each cognitive process level, there are four types of knowledge that range from more concrete to abstract: factual knowledge, conceptual knowledge, procedural knowledge, and metacognitive knowledge (Anderson et al. 2001). As students move through iterations of experiential learning cycle, they also simultaneously move toward higher levels of cognitive learning involved in the analysis, synthesis, and evaluation of information. Mastery of these higher levels of cognition through experience lay the groundwork for critical thinking (Barr and Tagg, 1995; Eyler, 2009; Heinrich et al., 2015; Millenbah and Millspaugh, 2003), improved retention of knowledge (Ballantyne and Packer, 2009; Bauerle and Park, 2012; Rickinson, 2003), and greater ability to transfer knowledge to new situations (Ballantyne et al., 2001; Millenbah and Millspaugh, 2003), all of which contribute to deeper learning and understanding than is possible with traditional approaches to learning such as those involving rote memorization that only target lower cognitive processing levels (Coker and Porter, 2015).

Affective Domain

The second domain in Bloom's Taxonomy is the affective domain, which emphasizes awareness and growth in attitudes, emotion, and feelings (Krathwohl et al. 1973). This includes external and internal factors that influence a student's ability to learn, such as values, social pressures, stereotypes, perceptions, or feelings (Krathwohl et al. 1973). This domain contains five hierarchical levels that range from the simplest behavior to the most complex: receiving, responding, valuing, organizing, and characterizing. Research suggests that experience promotes affective development in several ways. Generally speaking, direct experience has been demonstrated to be a significant influence on the development, accessibility, stability, and strength of attitudes (e.g., Glasman and Albarracìn, 2006; Kraus, 1995). When students learn through experience, they develop stronger feelings of self-efficacy which contributes to internal motivation for learning (Ambrose and Poklop, 2015; Battersby, 1999), and lifelong learning in particular (Eyler, 2009). Some researchers have observed that experiential learning helps to induce a personal, emotional attachment to the subject of learning by increasing relevance to students' everyday lives (Ballantyne and Packer, 2005; Brody, 2005; Dresner and Gill, 1994; Emmons, 1997; Nesbit and Mayer, 2010). Other research suggests that that there is a strong social component whereby learning is enriched through shared common experiences, both between teachers and their students and among student peers (Brody, 2005; Campa et al., 2004; Hornsey, 2008; Lave and Wenger, 1991; Nesbit and Mayer, 2010; Scarce, 1997).

Psychomotor Domain

The last domain of learning objectives is the psychomotor domain. This domain includes physical movement, coordination, and the use of motor-skills and learning objectives for this domain generally emphasizes a change or development of skills. Experiential learning lends itself to growth in the psychomotor domain, as students learn and practice new skills through direct contact with the subject being studied.

In a related vein, some researchers indicate that increased sensory engagement in natural learning environments is an important component of the learning experience (Auer, 2008; Nesbit and Mayer, 2010; Packer, 2006). Other scholarship suggests that engaging all the senses improves student learning and memory (Moreno and Mayer, 2007; Shams and Seitz, 2008). In natural resource and environmental education fields more broadly, experiential learning pedagogies have been demonstrated to better prepare students for careers by linking education experience with practical work experience (Cantor, 1995; Domask, 2007; Millenbah and Millspaugh, 2003).

Experiential Learning in Natural Resources Curricula

Natural resources professionals in the 21st century face increasingly complex and unprecedented challenges in their careers. Population growth and climate change place new burdens on natural resources, contributing to deforestation, overexploitation, pollution, and social conflict over increasingly limited resources. Higher education in natural resource fields has struggled to adjust and has been criticized by agencies for failing to adequately prepare graduates for careers (Bleich and Oehler, 2000; McMullin et al., 2016). In order to better prepare students for careers in natural resources and related fields, university curriculum must reflect the need to produce students who are equipped to effectively function as professionals with the ability to tackle new complex issues with uncertain solutions as they emerge. Both public and private-sector natural resource employers identify critical thinking, problem solving, lifelong learning, communication, and interpersonal skills as necessary skills for graduates entering the job market (Bleich and Oehler, 2000; McMullin et al., 2016; Stauffer and McMullin, 2009; Wolff and Booth, 2017).

While this section focuses on natural resources education in particular, the broader goals of learning in higher education echo those from natural resources and related disciplines: "colleges are being asked to prepare graduates with analytical and critical thinking skills, strong communication and technological skills, while at the same time preparing them for active participation in a rapidly changing environment with a commitment to maintaining the integrity of our global ecosystem" (p. 331 Wille, 1997). As the future generation of leaders and problem solvers, undergraduate students today need the same interdisciplinary analytical thinking, communication, and interpersonal skills required by emerging professionals to have successful careers in natural resources fields (NSF, 1996). Efforts to improve university curricula in natural resources may similarly inform the evolution of higher education curricula more broadly to better prepare graduates to be active participants in an increasingly global society.

While traditional lecture-based approaches to education allow for greater breadth of content, Matter and Steidl (2000) suggest that natural resources curricula should not place such a large emphasis on passive transmission of knowledge from teacher to student through lectures. Ryan and Campa (2000) argue that new professionals will be inadequately prepared for careers if only exposed to lecture-based instruction, yet a large majority of undergraduate science, technology, engineering, and mathematics (STEM) courses continue to rely on this method of instruction (NSF, 1996). Further, undergraduate students already face a demanding and compressed curriculum (Matter and Steidl, 2000; Rickinson, 2003), and adding additional course requirements is not a realistic option for many institutions. Rather, colleges and universities may better prepare graduates by considering ways to improve existing course offerings by training them how to think critically and to be lifelong learners. Indeed, lifelong learning is already a skill required by professionals in natural resources fields, as evidenced by the occurrence of training workshops or short courses targeted at professional society meetings. Time and financial constraints also limit students' ability to take field positions, study abroad, or take intensive field courses (Millenbah et al., 2000). Incorporating experiential learning pedagogy into existing classes can benefit students who otherwise might not gain valuable and practical field experience from summer courses or internships, without adding new graduation requirements to the curriculum. The following section describes two courses that use experiential pedagogies at MSU. Benefits and constraints for each course model are also discussed, and barriers to implementing experiential learning in university curricula more broadly.

Models for Integrating Experiential Learning into Natural Resources Curriculum

Field Course

An intensive two-week field course in the Department of Fisheries and Wildlife at MSU, the Introductory Field Experience in Fisheries and Wildlife (FW238) offers students a fully immersive interdisciplinary educational experience in a unique setting. MSU is fortunate to have a mutually beneficial partnership with a large, private hunting club located just a few hours away from the main campus. The exclusive club allows students to reside on their property and in exchange, students provide valuable evaluations of the fish and wildlife populations and habitats on their property and management recommendations. Because the course is off-campus, enrollment is limited by travel and bed space with a maximum enrollment of 15 students. Through demonstrations, hands-on applications, and problem-based learning, students integrate biology, ecology, resource economics, forestry and social science through the process of conducting field measurements and then analyzing and summarizing data to develop a scientific report including suggestions for management that addresses multiple stakeholder perspectives. The course syllabus is provided in the appendix. Learning goals for the course include:

- To gain knowledge and experience implementing field techniques for natural resources conservation and management
- To understand the ecology and biology of a north-central Michigan ecosystem, including identification of nature flora and fauna
- To understand the complexity involved in designing and conducting research projects and apply knowledge derived from such projects to natural resources management
- Build personal relationship with nature

Material is presented primarily in the field, with very few lectures that are generally limited to delivering organizational content. There are no prerequisite classes for enrollment, therefore the course begins with students learning and practicing basic field skills such as using compasses and GPS units and learning to identify local biota. Starting the course with instruction on basic field techniques and identification provides students an entry point for learning various field sampling techniques, including: fish diversity sampling, fish growth and aging, deer population estimates and habitat surveys, bird point counts, grouse drumming surveys, small mammal trapping, vegetation and other habitat sampling measurements, and camera trapping.

Some basic identification of local biota is necessary before students can consider the functional relationships between them and their habitats, therefore we provide continuous instruction on this point and reinforce identification skills by taking advantage of impromptu encounters. In the field, serendipitous learning opportunities abound and cannot be planned in advance. For example, when animal signs such as scat or tracks present themselves, students can work together to identify the animal and then make subsequent observations or predictions about habitat use and animal behaviors.

Each student is assigned to one of four project groups: fish, deer, grouse, and song- and migratory birds. Students collect and analyze data to evaluate the distribution, density, and health of various species of particular interest for club members, and are required to consider diverse stakeholder perspectives in articulating various management recommendations for the hunting club. Project topics are selected based on the interests of the hunting club, seasonal and time constraints, and to provide students with a broad overview of both fisheries and wildlife-related field techniques. Instructors assign 3-4 students to each group based on academic level, previous experience, and a coarse ranking of students' personal preference. The entire class participates in data collection for every project, while each project group is responsible for analyzing and summarizing their respective data. Techniques are practiced and reinforced through repetition of measurements in new locations throughout the duration of the course. The project topics remain consistent from year to year, which improves our efficiency and helps reduce some of the time required in advance to prepare for and plan the course. An additional benefit to using the same research design over time is the creation of a long-term database that students can use to evaluate changes over time, as well as differences between various forest communities, forest stand ages, or the impacts of timber harvest and succession on various wildlife populations. Course instructors are responsive to the needs and interest of the hunting club and emerging natural resources issues by adjusting the topics or foci of project accordingly.

Assessment

At the end of the course, groups present their project results and management recommendations at an event structured similar to a public forum. All club members are invited to attend and encouraged to ask questions and discuss the project results. While the projects themselves and the presentation of results is a group effort, each student is required to individually submit a written report four weeks after the completion of the course. These assessments provide students practical experience in oral communication for diverse audiences, as well as practice developing scientific writing skills. The written report assignment is provided in the appendix. Because some fundamental knowledge is required to make connections among organisms and the habitats they inhabit (as well as the human impacts on those habitats), we include a field practical exam in our assessment. Exam questions include field identification, short answer synthesis items, and practical skill assessments such as compass reading or pacing. We also require students to maintain a reflective and up-to-date field journal with daily entries.

This is a critical evaluative component, in part because our days are long and packed full of experiences and activities that it can be hard to remember what we did on which particular days. More importantly, journals give students the opportunity to reflect on their learning experiences, which is a key component of the experiential learning cycle (Farrell, 2007). Further, the journals allow students to frame their learning in the context of their own individual learning preferences and styles (Brualdi, 1996). The last major assessment is a participation grade. In this course design, active participation in all required activities is mandatory for learning. The participation grade also assesses team-working and problem solving skills, and how well the student represents the Department of Fisheries and Wildlife and Michigan State University through professional conduct in the field and as respectful invited guests of the hunting club.

Field-Based Campus Course

In contrast with the intensive field course, the Fundamentals of Fisheries and Wildlife Laboratory (FW101L) is a campus-based course that includes a significant field component. Enrollment averages around 70 students across three lab sections. In this more traditional, semester-long course, students attend one 50-minute "lecture" and a 3-hour lab each week. It is structured such that students are introduced to a new topic each week in lecture, and then attend a lab related to that topic later in the week. Most of the labs involve field trips to various ecosystems in the greater Lansing, Michigan area, where students can apply lecture material in a real-world setting. The course syllabus includes a full list of lab activities and is provided in the appendix. Course learning goals include:

- Become a better naturalist
- Acquire an appreciation for outdoor preparedness
- Gain basic knowledge of Michigan's ecosystems and diversity of life

- Develop healthy attitudes toward learning
- Exposure to consumptive and non-consumptive values of fish and wildlife
- Examine and reflect on own personal values of fisheries and wildlife
- Build personal relationship with nature

This course is designed to expose students to a broad range of natural resource-related topics through direct contact with the material being studied. In addition to species identification skills, students also learn practical field skills such as compass reading and using GPS units, various fish sampling techniques (and under what conditions each are appropriate), outdoor preparedness etc. A full list of lab activities is provided in the appendix.

The structure of this class also allows for spontaneous learning opportunities that arise and cannot be replicated in a classroom setting. For example, the discovery of a deceased deer can prompt a discussion of chronic wasting disease, the impact humans have on wildlife populations, as well as the role of hunting in disease control. Students learn basic plant, animal, fish and bird identification in each of the various ecosystems we visit, giving them the perspective to begin considering the complex ecological relationships that exist in various habitats. It also offers first-hand experience in observing the impacts that humans have on these systems both currently and in a historical context.

Assessment

Because active participation is necessary for learning in this course, attendance is a major component of the participation grade. Unless weather conditions become dangerous, we do not cancel lab for bad weather, and consider being prepared to work outside in all conditions an important component of their Fisheries and Wildlife education and natural resources-related careers in general. Students are also assessed based on performance on two practical exams: a midterm and comprehensive final exam. Due to seasonal and logistical constraints, exams take place inside, and include identification questions, short answer, and some skill-based competencies that can be administered to roughly 70 students in a short period, such as compass reading. There are also various homework assignments that ask students to make animal behavior observations and consider factors that influence animal behavior in various settings (on campus versus a woodlot). Lastly, students are required to write a 6 to 8-page essay that reflects on their learning and experiences in the course. In particular, students are asked to consider what knowledge they have gained, new skills learned, and whether course experiences impacted their natural resources-related values or their personal connection to nature. Guidelines for the reflective essay assignment is provided in the appendix.

Student Feedback and Learning Outcomes

Students rate both courses very highly in anonymous, standardized end-of-semester instructional ratings. In course evaluations from 2013 through 2017, 91.4% of students in the campus-based course and 97.2% of the field course gave it an overall rating of “superior”. When asked about general attentiveness during class, 99.9% of students rated the field course as “superior” or “above average,” while 90.6% of students gave the same ratings in the campus-based course. Self-perceptions of greater competence in this subject as a result of these courses were similarly high: 99.9% of students in the field course and 91.1% of students in the campus-based course rated each class as “superior” or “above average.” With regard to overall enjoyment, the campus-based course was rated as “superior” or “above average” by 96% of students, and 100% of students in the field course. It is worth noting that 97.2% of students considered the field course as “superior” with regard to their overall enjoyment, with the remaining 2.7% of students indicating the course was “above average” in this respect. No student rated the field course as “average” or lower in terms of their overall enjoyment.

While there were significantly more students enrolled in the campus-based course, response rates for both classes were similarly high (81.4% versus 74.0%% in the campus-based course and the field course, respectively). Student course ratings are not mandatory, but the university incentivizes participation with course surveys by releasing grades more quickly to students who have completed their evaluation, or who have explicitly declined to participate. Because evaluations are voluntary, there may be some bias toward students who are generally more engaged already. However, it is unlikely that increasing the response rate in either course would significantly change the patterns of student responses.

In addition to course ratings, open-ended course evaluation questions and reflective essay content provide additional support for the impact of these courses. A recurring theme from these assessments was the value of the learning experience in connecting students to real-world applications of their course learning. For example, one student in FW101L wrote, “This class has also really driven home the idea of continuity and really bridges together the ideas you learn in ecology to real life actualities. You can learn about things like the intermediate disturbance hypothesis in a book and through a power point but when you're standing in a field and having someone explain it to you is a whole new ball game. It really changes how you think about the things you learn in the classroom when you can go out and see them. Going out and being able to identify the different plants and organisms and understanding what their role in that ecosystem is changed how I view what we learn in the classroom drastically.”

Many students mention how these courses helps prepare them for careers in natural resources. For example, a student from FW238 wrote, “This was also the first and only class so far that had actually prepared me for a professional position within FW to the extent that it did. Before I ever began a field job, I was able to get a taste of what it would be like. This is something that no other class allows students to do. Getting hands on experience to apply to future positions is so valuable.” Similarly, a student from FW101L commented, “Standing in the lake seining for fish in the worst monsoon of a downpour I have ever been outside in and remotely enjoying it was comforting. It's to know that I did that and survived in a class in college instead of getting to my first job and being put in crappy conditions and not knowing what to do. These are experiences that will help in the long run and will make the transition to the professional world smoother.”

Other students commented specifically on their personal relationship with nature: “Whether it was knowledge learned while electrofishing, skills associated with identifying plants, or an increase in openness to attitudes in human dimensions, this class has gone far in increasing my relationship with nature. I have become a better naturalist and am now even more aware and inquisitive than I was before. I have a new respect for what fisheries and wildlife managers must know and use every day.”

Students respond overwhelmingly positively to their experiences in both of these courses. In addition to learning valuable skills and knowledge in a hands-on, real-world setting, their passion for this field is reinforced and contributes to their desire to continue learning. A student articulates this point: “I find that when I further my education in the realm of Fisheries and Wildlife, a positive feedback loop is created, where by learning more I am encouraged to continue learning. This idea became apparent to me the more I would venture into the wilderness. With the ability to identify plants and animal species, they seem to become more and more familiar to me. The more familiar I become with these species, the more I seem to enjoy the fact that they even exist. By learning more I hope to deepen that familiarity, with an ultimate goal of looking at these species not as different organisms, but as friends and families. The Anishinabe once considered wolfs to be their brothers while eagles were sent from The Great Creator to watch over them. I hope to reach such a level of connection to the natural world, to the point where I feel more at home out there than I ever would in a house."

These evaluations, in addition to the personal observations of the instructors, suggest that the experiential approach to teaching these two courses is both meaningful and impactful for students in terms of the knowledge, skills, and attitudes gained through participation in these classes. The influence of experiential learning on student attitudes about nature and the environment is explored further in chapter three of this dissertation with a quantitative assessment of affective learning gains from both of these courses.

Benefits and Constraints

Field-based instruction is inherently unpredictable. Inclement weather, faulty equipment, serendipitous wildlife encounters and other unforeseen circumstances can make pre-planned learning objectives difficult to achieve. While these unexpected events add a layer of complexity for instructors, the unpredictability of field settings can also be advantageous for student learning and development. For example, unforeseen challenges (such as rain halfway through sampling, or a forgotten piece of research equipment) forces students to work together to address and solve problems as they arise, and are difficult to model in a classroom setting. Dealing with unexpected challenges, while stressful, can help improve students' confidence in their ability to deal with other problems as they arise (Millenbah et al., 2000), and provides first-hand knowledge and experience in a relatively low-stakes environment to better prepare them for higher stakes real world situations they may encounter in their careers.

The development of community and shared learning experiences among students is considered an important component of learning in general, but especially in natural resources and related fields (Campa et al., 2004; Goralnik and Nelson, 2011). While both course designs contribute to a shared sense of community among students and strengthen cohorts, the intimate setting and nature of the intensive field course allows for more personal contact and social interaction than is possible in a weekly 3-hour lab. For example, one student from FW238 noted, "Never have I made such strong and lasting connections with other students that fostered cooperation, excitement about the topics, and an overall great learning environment."

Still, students in FW101L also benefit from shared experiences with their peers. One student wrote, "It also gave each section really good opportunities to bond and get to know each other, more than most other classes by far. In doing so, it really showed us another aspect of enjoying the outdoors, that it doesn't just build relationships with the outdoors but is a fantastic way to build bonds and relationships with others as well." Additionally, the small class size of the field course allows for a high level of interaction and deeper relationship between instructors and students, and more opportunities for every student to engage with and practice field techniques to prepare them for careers in natural resource fields.

Although the sense of community, personal interaction, and opportunity for direct engagement is greater in the field course, the campus-based laboratory is able to accommodate significantly more students. However, enrollment in the campus-based course is still limited by travel logistics, as transporting even modest numbers of students can be a challenge. Additionally, enrollment is further restricted by the nature of field instruction where larger groups are less likely to be able to hear, see, and engage directly with the concepts being studied.

Regardless of these limitations, each individual section of the campus-based course can hold almost twice as many students as one semester of the field course.

While the campus-based course also requires less advance preparation time and has fewer logistical considerations, it is limited by shorter class sessions. Further, the field course includes a course fee to cover the cost of meals and travel, which could make the class unaffordable for some students. It is an on-going challenge for the field course to increase enrollment while maintaining quality instruction and a high degree of contact between instructors and students and also remain affordable to students from all socioeconomic backgrounds. Similarly, both courses would greatly benefit by exploring ways to become more inclusive for disabled and minority students. In particular, the intimate setting and community building strength of the field course may be helpful for making diverse students feel more welcome in a field with historically low minority enrollment.

Barriers

One perceived limitation to experiential learning activities versus more traditional lecture-based approaches is that the amount of time required for students to progress through the learning cycle limits the breadth of content that can be covered (Millenbah and Millspaugh, 2003). While lecturing allows for greater coverage of material in a shorter time, research has demonstrated that this approach is not conducive to deep learning, retention of information, or the development of critical thinking skills (Millenbah and Millspaugh, 2003; Ryan and Campa, 2000). The trade-off between breadth of content and depth of learning must be carefully considered when deciding whether experiential learning is right for a particular activity (McKeachie, 1999).

Planning experiential course activities also takes more time and advance preparation. In addition to teaching responsibilities, faculty are expected to maintain productive research programs and actively serve on various committees and organizations. The promotion and tenure process at many universities tends to value research productivity over teaching and service, providing little motivation for faculty to commit the time and effort to transform their classrooms. Recognizing effective educators and providing incentives for faculty to explore professional development opportunities related to the scholarship of teaching and learning in general will help higher education institutions better achieve broader undergraduate education goals. In a related vein, experiential learning opportunities also require more administrative support with regard to travel arrangements, field and research equipment, and additional instructional personnel such as teaching assistants.

Some experiential learning activities, such as study abroad, can be prohibitively expensive for students. Even the addition of a moderate course fee for food and lodging in a field course can prevent students from being able to participate in valuable and enriching learning opportunities. Other students may need their summer income and are thus unable to participate. Institutions should seek a balance between low-cost and high-quality experiential learning options, but also need to provide scholarships or other financial assistance for low-income students.

Conclusion

Experiential learning is a holistic theory of learning that emphasizes both content and process (Kolb and Boyatzis, 2001) by placing students in direct contact with the concepts being studied. More research is needed to explore the impacts of various experiential approaches on student learning across all three domains of learning. Further, much of the existing literature emphasizes development in the cognitive domain of learning, with a dearth of research investigating affective growth as an outcome of experiential learning. The next chapter attempts to address this shortcoming by explicitly assessing affective development as an outcome of course learning in the two classes described in detail in this chapter. Regardless, a better understanding of how various experiential activities influence a range of student learning outcomes is of critical importance in developing practical guidance for educators seeking to improve student learning in their courses.

CHAPTER THREE: AFFECTIVE EDUCATION BY DESIGN: AN EXPERIENTIAL PEDAGOGY FOR NATURAL RESOURCES EDUCATION

Introduction

The affective domain of learning considers students' awareness and growth in attitudes, emotions, and feelings, and includes external and internal factors that influence a student's ability to learn, such as values, social pressures, stereotypes, perceptions, or feelings (Krathwohl et al. 1973; Martin and Briggs, 1986). Attitude research has primarily emerged from behavioral psychology to explain how attitudes induce behavior change or predict future behaviors (Fazio, 1989; Glasman and Albarracìn, 2006; Kraus, 1995), and offers a useful theoretical perspective from which to consider the role of attitudes in learning. Attitudes have long been considered an important component of learning (e.g. Bloom et al., 1956; Gagné, 1977; Krathwol et al., 1973). Recent scholarship suggests that attitudes and emotions influence where attention is directed, which information students attend to during learning, and how they respond to new information (Weiss, 2000). Advances in cognitive psychology have also suggested that emotions influence memory, attention, and decision-making (O'Regan, 2003; Weiss, 2000), a perspective supported by recent developments in neurology which have identified that emotional responses and cognitive reasoning processes both originate from the same region of the brain (O'Regan, 2003).

The concept of self-efficacy has also emerged out of the realm of cognitive psychology and relates to an individual's belief in their ability to achieve goals (Bandura, 1977). In education applications, self-efficacy is particularly relevant with regard to growth or fixed mindsets (Dweck, 2007), or the degree to which a student believes that learning outcomes are within her control, and is a necessary precursor to understanding student motivation. Other scholarship has also suggested that student behavior and performance in courses is also influenced by their attitudes, values, and expectations about learning (Halloun, 1997; Hammer 1994, 1995; May and

Etkina, 2002; Perkins et al., 2005), and that deeper learning occurs when emotions are engaged (Pierre and Oughton, 2007).

The significance of attitudes in learning is also supported by its inclusion in various taxonomies of educational outcomes. For example, Bloom et al. (1956) identified affect as one of three domains of learning in their attempt to produce a classification system of objectives that can be used to inform instructional design and assessment of learning. Though Bloom's Taxonomy remains the most widely applied and referenced taxonomy, critics have argued that its usefulness is limited because it is largely descriptive and does not offer practical guidance for educators in designing courses or curricula to achieve desired learning goals, nor does it identify methods of assessing whether learning goals are achieved (Martin and Briggs, 1986).

Another taxonomy of learning was developed by Gagné (1977) that not only provides a classification system of learning outcomes similar to Bloom's, but also presents relevant theories of instructional design at each level of learning in the hierarchical taxonomy, with guidance for the assessment of learning at each level. While Bloom's Taxonomy separated learning goals into theoretically discrete domains, Gagné's Taxonomy identified five broad categories of learning objectives, including one that considers affective outcomes. However, the primary emphasis of Gagné's classification is on cognitive elements of learning, and therefore remains less prescriptive with regard to the development of attitudes through education (Martin and Briggs, 1986). A shortcoming of both taxonomies, and in education research more broadly, is a disproportionate emphasis on cognitive outcomes and their treatment of cognition as independent of affect (Littledyke, 2008; Martin and Briggs, 1986; Pooley and O'Conner, 2000).

In addition to the role of attitudes in memory, attention, and motivation, there is growing recognition that affective education is necessary to develop the 'soft skills' required by graduates to be successful in their careers (Wolff and Booth, 2017). Recent scholarship suggests that an emphasis on disciplinary knowledge and skills in higher education is producing graduates who lack the social, emotional, and affective skills that are considered vital to employers in the 21st century (Kingston, 2017; Miller, 2015; Savitz-Romer et al., 2015). Wolff and Booth (2017) identify several essential qualities of graduates that transcends disciplines: people skills including teamwork and cross-cultural competence, problem-solving abilities and critical thinking, adaptability, strong communication skills, and habits of lifelong learning. Scholars argue that greater attention to affective growth of students is necessary to better prepare students for success in their careers and everyday lives (Savitz-Romer et al., 2015).

While affective development is identified as an important component of higher education, traditional paradigms have focused primarily on cognitive development through the passive transmission of knowledge from teacher to student (Littledyke, 2008; Martin and Briggs, 1986), without consideration of affective learning outcomes. Even when affective learning goals are explicitly identified, instructional design methodologies and classroom assessment techniques still target cognitive objectives, with affective objectives falling to the wayside. Many educators may be hesitant to consider affective learning outcomes in their courses because they are difficult to operationalize in summative course assessments, or because they believe that affective change occurs over longer time periods than is possible in the context of a single course (Martin and Briggs, 1986; Shepherd, 2007). Educators may also avoid affective learning assessments because they are averse to charges of indoctrination or imposing their own ideas of how individuals should live their lives (Carlson, 2006; Heimlich and Ardoin, 2008; Martin and Briggs, 1986). However, affective growth is necessarily an outcome of learning, regardless of whether it is explicitly recognized as such, and greater consideration of the affective development of students can help institutions and educators achieve broader goals of learning across cognitive and affective domains.

While there is abundant research on instructional design and assessment of cognitive learning gains across all disciplines, much less work has been done to identify classroom activities that promote the affective development of students. This research seeks to address this by explicitly considering instructional design and pedagogies that target affective learning outcomes. A synthesis of learning theory with theories of attitude structure and change from behavioral psychology perspectives identifies experiential learning as a pedagogical approach to promote concurrent cognitive and affective growth. A case study of two courses that employ experiential approaches offer useful insight in both the design of activities and courses to facilitate affective development as an outcome of learning, but also provide an example for assessing affective growth in the context of the learning goals for both courses.

Theoretical Background

Before pedagogies that facilitate affective growth can be identified, greater consideration of the structure of attitudes and how they can be influenced or changed in the context of learning is needed. The following section merges theories from cognitive science, education, and behavioral psychology to inform affective development from an instructional design perspective.

Attitudes and Learning

Attitudes are conceptualized as consisting of three main components: cognition, affect, and behavior (Ajzen and Fishbein, 2005; Kaiser et al., 1999; Martin and Briggs; 1986). The affective component of attitudes refers to evaluative or emotional responses to an attitude object, while the cognitive component relates to beliefs or knowledge about the attitude object. Behavioral components are overt actions and responses to an attitude object, or, more generally, a tendency to act. Although they are treated as theoretically discrete components, all three elements of attitudes are closely interrelated and disentangling the separate influences of each component is impractical. For example, cognitive elements are necessary precursors to affective elements because an object must be recognized in order to be evaluated. Likewise, a behavioral response to an attitude object is informed by knowledge or beliefs about available options for action. Similarly, the three components of attitudes can interact to generate different affective, cognitive, and behavioral responses (Eagly and Chaiken, 1993). Two individuals can share the same attitude that burning fossil fuels is bad for the environment, but act on the attitude with entirely different behaviors depending on the relative importance of each component of the attitude and relevant situational factors. One person may opt for public transit or bike transportation while another might invest in an electric vehicle. Conversely, an individual may believe fossil fuels are bad for the environment, but not feel inclined to change any behaviors to mitigate negative impacts if their attitude is relatively weak, even if there are no situational barriers to performing a behavior.

Consideration of the structure of attitudes has important implications for educators. The three components of attitudes—the affective, cognitive, and behavioral—parallel the three domains of learning identified by Bloom et al. (1956) in their seminal taxonomy of educational objectives: the cognitive, affective, and psychomotor. The three domains of learning and the three components of attitudes are closely enmeshed, making it difficult to parse the individual influences of any element. For example, development in the cognitive domain of learning would necessarily impact cognitive elements of student attitudes as they increase their knowledge on a particular topic, but increasing knowledge could also impact behavioral elements of attitudes by making students more aware of a broader range of options for action. Thus, growth in any domain of learning certainly influences one or more components of attitudes. Indeed, research has suggested that cognitive development and affective growth occur concurrently and are mutually supportive (Lave and Wenger, 1991; Martin and Briggs, 1986; Resnick and Klopfer, 1989). Greater consideration of affective goals need not occur at the expense of cognitive ones, as attendance to affective development supports cognitive development and can better achieve learning goals than a focus solely on cognition.

Affective Education by Design

Though research suggests cognition and affect are highly integrated, education research has focused primarily on knowledge, or the cognitive domain (Littledyke, 2008; Martin and Briggs, 1986). Even when affective learning goals are explicitly stated, pedagogies that promote affective development of students are seldom considered in course design or included in learning assessments. In considering how to design courses and activities for affective outcomes, it is valuable to first look at theories of attitude development and change. Emerging primarily from behavioral and social sciences, most research on attitude development and change seek to better understand, predict, or change human behavior. Still, this perspective offers useful applications in the realm of teaching and learning, particularly in the context of how student's attitudes can be influenced both as an important process and outcome of learning.

Attitude Attributes

Olson and Zanna (1993) identify three characteristics of attitudes that influence how resistant to change they are: accessibility, strength, and ambivalence. Attitudes that are more accessible from memory have a stronger influence on subsequent attitudes and actions toward a relevant attitude object (Fazio, 1990). Some scholars suggest that the affective, cognitive, and behavioral components of attitudes also differ in terms of how accessible they are (e.g.

Verplanken et al., 1998). Their study found that affectively-based judgements were more accessible than cognitively-derived ones, based on participant response times to questions of how they felt or how they thought about a series of attitude objects. Attitude strength also influences how accessible they are, as stronger attitudes result in quicker retrieval than less important attitudes (Krosnick and Abelson, 1992). Krosnick and Abelson also identify several dimensions that contribute to the strength of attitudes: extremity, intensity, stability, certainty, importance, and knowledge. These dimensions also directly relate to attitude ambivalence such that attitudes characterized as low in these dimensions are more ambivalent and thus less resistant to change (Olson and Zanna, 1993).

The relative contribution of each characteristic of attitudes is difficult to disentangle because they both directly and indirectly influence each other. For example, the accessibility and strength of an attitude also help determine how stable it is, such that highly accessible and more confidently held attitudes increase stability and reduce attitude ambivalence (Glasman and Albarracìn, 2006). However, one significant factor that moderates the stability, accessibility, and strength of an attitude is direct experience with the attitude object. Attitudes formed by direct experience tend to be stronger and more clearly defined than those formed by indirect experiences (Fazio and Zanna, 1978; Kraus, 1995). Further, direct experiences help shape attitudes with strong object-evaluation associations, increasing how accessible they are from memory (Fazio, 1986). If direct experience is a significant influence on attitudes in general, identifying ways to incorporate experience into classroom activities has important implications for higher education.

Experiential Learning

Experiential learning is an approach to teaching and learning that emphasizes direct contact with the concepts being studied (Kolb, 1984). It is in contrast with more traditional approaches in which students passively receive information through lectures or assigned readings (Millenbah and Millspaugh, 2003). Experiential learning theory suggests that learning occurs as a continuous cycle involving four interrelated stages: 1) concrete experience, 2) observation and reflection, 3) abstract conceptualization and generalization, and 4) active experimentation (Kolb, 1984). New knowledge is created as students reflect on new experiences, resulting in abstract generalizations that can be applied in new situations and contexts (Kolb, 1984). New experiences are embedded in an existing framework of understanding that is used to refine abstract generalizations, leading to deeper learning that can be transferred to other contexts and refined further (Kolb, 2015). The conceptualization of experiential learning as a continuous cycle of development is particularly conducive for lifelong learning, as new experiences continuously inform, modify, and adjust an individual's understanding of a particular concept.

All experiences are necessarily unique to individuals because their understanding of an experience is embedded within the context of social, cultural, and environmental influences that inherently vary across students. Experiential learning therefore allows for differences in how students construct meaning from the same concrete experience, increasing salience by making learning personally relevant to each student. Ajzen (2001) suggests that increasing relevance and engagement makes attitudes stronger, more accessible, and subsequently more resistant to change. In the context of instructional design, experiential learning presents a logical pedagogy for affective learning.

Other scholars have identified experiential learning as conducive to affective growth (e.g. (Goralniket al., 2012; Johnson and Frederickson, 2000; Proudman, 1992). In a description of conditions necessary for the development of moral reasoning through education, Martin and Briggs (1986) suggest that experience, reflection, and interaction with the learning environment are critical elements. Their emphasis on the role of experience and subsequent reflection on that experience in the development of moral reasoning skills supports the contention that experiential learning is also affective learning. However, very little research has evaluated the influence of experiential instruction on affective learning outcomes. Existing literature on this subject remains largely descriptive (e.g. Domask, 2007; Millenbah and Millspaugh, 2003), and generally measure cognitive gains in assessments of learning (e.g. Gosen and Washbush, 2004; Taraban et al., 2004). Thus, this study sought to evaluate the effectiveness of experiential learning on student affective development in a case study of two natural resources courses at Michigan State University.

A Case Study: Experiential Natural Resources Education

The influence of experiential learning on affect is particularly relevant in natural resources education-- and in environmental education more generally-- because these programs seek to influence students' attitudes and values as an outcome of learning. Additionally, graduates of undergraduate natural resources programs need to be prepared for careers in a future characterized by rapid social, environmental, and technological change. Success in this field requires more than foundational knowledge; the ability to think critically, solve new and emerging problems, and being prepared to learn new techniques and technologies as they arise are essential skills for natural resource professionals.

The significance of experiential learning in preparing undergraduate natural resources students for success in their careers has been documented elsewhere (Hix, 2015; Ewert, 1996; McCleery et al., 2005; Millenbah and Millspaugh, 2003; Quesada-Pineda, 2011), though very few studies have evaluated affective learning outcomes. In the rare instances where affective outcomes are assessed, research tends to be anecdotal and speculative. For example, Boyle et al. (2007) suggests that fieldwork enhances affective learning outcomes, but quantified affective gains using student self-perceptions of enjoyment and usefulness as an estimate of motivation. While enjoyment and utility of a learning activity can result in increased motivation, it is possible that a student can enjoy an activity without finding it directly useful for their development and therefore exhibit less motivation for learning. Similarly, Powell et al. (2009) include affective learning goals in their wilderness ecology field course, such as developing an awareness of wilderness areas, but only state that this objective is assessed through reflective journals without also describing what constitutes sufficient evidence that this objective was achieved.

Assessment is a critical component of every course (Angelo and Cross, 1993), but assessing affective learning outcomes remains challenging. What assessments may be deemed appropriate should be considered on an individual basis in the context of specific learning goals for each course or activity. The two experiential undergraduate natural resource courses included in this study explicitly seek to develop students' personal relationship with the environment, thus, connectedness to nature was identified as a useful tool for assessing this learning goal.

Connectedness to Nature

Connectedness to nature refers to an individual's sense of oneness with the natural world, and is considered by environmental psychologists to be an important construct with regard to addressing contemporary environmental problems (Tam, 2013). The connection between humans and nature has origins in Wilson's (1984) biophilia hypothesis which suggests that humans have an innate desire to relate to the natural world, though foundational conservationist Aldo Leopold

(1949) also espoused the importance of recognizing our connection to nature. Connectedness to nature is particularly relevant in the context of natural resources education, because humans are necessarily a component of the system being managed, and resource professionals must sustainably balance the needs of many stakeholders and the resource itself.

Connectedness to nature has emerged in several theoretically distinct constructs. While some concepts address affective considerations (e.g., Mayer and Frantz 2004; Nisbet et al. 2009), others evaluate individual beliefs about the degree of inclusion of nature in self (Schultz 2002), the disposition to connect with nature (Brügger, Kaiser, & Roczen, 2011), or the role that nature plays in defining a person's identity (Clayton 2003). Despite theoretical differences, recent scholarship has noted a considerable empirical overlap among the various measures of connectedness to nature (Bruni, Chance, Schultz, & Nolan, 2012; Restall & Conrad, 2015; Tam, 2013), indicating strong convergent validity that suggests there may be a single higher-order construct underlying the various measures. Most research related to connectedness to nature is embedded within the domain of environmental psychology (e.g. Beery & Wolf-Watz, 2014), with very few studies examining the construct from an education perspective, despite significant implications for natural resources education and environmental education more broadly.

Research Objectives

The primary question this research seeks to address is how experiential learning as a pedagogical approach to natural resource education influences student's connection to nature as an outcome of learning.

Specifically, this research will:

1. Evaluate how experiential learning influences undergraduate students' connectedness to nature as an outcome of learning.

2. Assess experiential learning more broadly as a pedagogical approach to natural resources and environmental education.
3. Evaluate various dimensions of students' connection to nature among undergraduate students.
4. Quantify changes in various attitudinal dimensions as an outcome of course learning.

Methods

Courses

Two introductory Fisheries and Wildlife courses at Michigan State University (MSU) employ experiential learning theory in their design and implementation. The first class, Fundamentals of Fisheries and Wildlife Ecology and Management Lab (FW101L) is a traditional semester-long course in which students attend one 50-minute lecture and one 3-hour lab each week. FW101L is structured such that students are introduced to a new topic each week in lecture, and then attend a lab related to that topic later in the week. The majority of the labs for this class involve field trips to various ecosystems in the greater Lansing area, where students can apply the lecture material in a real-world setting.

The second course, Introductory Field Experience in Fisheries and Wildlife (FW238) is a two-week long field course in northern Michigan. Material is presented through a mix of lectures and labs, although most of the learning takes place in the field through demonstrations, hands-on applications, and problem-based learning. Undergraduate students majoring in Fisheries and Wildlife at MSU are required to take either FW101L or FW238, but there are no prerequisite courses for either class. While there is some overlap in course activities, FW238 places a larger emphasis on research techniques and data collection in a field setting with minimal lecture content. An explicit goal of both courses is for students to develop a closer relationship with the environment, and to gain the knowledge and skills necessary to be successful in natural resource-related fields.

Scale

The nature relatedness (NR) scale was developed by Nisbet et al. (2009) to describe an individual's degree of connectedness with the environment. This scale encompasses multiple aspects of an individual's relationship with nature, representing an internalized identification with nature, an external, nature-related worldview, and a physical familiarity with the natural world. In the context of this research, the NR scale was selected because it is explicitly multidimensional by encompassing the cognitive, affective, and experiential aspects of connectedness to nature; components that conveniently parallel the three domains of learning. The original scale contains 21 Likert-scale questions which asks participants to rate how well each item describes them, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A copy of the survey instrument is provided in Appendix 1. Per Nisbet et al. (2009), the three factors are identified as NR-Experience, NR-Self, and NR-Perspective. Demographic characteristics of student respondents was also collected, including gender, age, and class rank.

Procedure

Students across four semesters of FW101L (n=183) and three semesters of FW238 (n=18) voluntarily participated in this research. Roughly half of students in FW101L were freshmen or sophomores (50.82%), compared to only 36.84% of students in FW238. FW101L respondents were 45.4% male and 54.6% female, while FW238 respondents were 47.4% male and 52.6% female. Students from both courses were primarily under the age of 21 (82.0% for FW101L and 68.4% for FW238). Race and ethnicity information was not collected, though enrollment data provided by the Office of Planning and Budgets indicate the proportion of minority undergraduate students enrolled in the fisheries and wildlife program is significantly lower than that in the College of Agriculture and Natural Resources (4.2% vs. 13.6%) and across the university in general (22.6%).

Students were surveyed during the first week of classes and again at the end of the semester, prior to final exams. Of the 239 number of students who completed the initial survey in FW101L, 183 also completed the post survey as well. In FW238, 23 students completed the initial survey, with 18 also completing the post survey.

Additionally, Amazon.com's Mechanical Turk (MTurk) program was used to collect baseline data on environmental attitudes held by a nonrandom sample of the general public (n=242). MTurk is an online survey tool wherein registered workers complete tasks for pay. For this study, we paid participants $0.05 for completing the survey, with participants taking an average of 2.36 ± 1.17 minutes to submit their responses. Mean respondent age was 30.6 years old (SD=10.07), with 62% male respondents and 38% female. A majority of participants (70.3%) reported having earned a bachelor's degree or higher. While we did not include any diversity questions in our survey, MTurk participants have been identified as more diverse than typical American college samples (Buhrmetser et al., 2011), but offer a useful comparison to the student population from this study.

Analysis

Data were examined for missing values and outliers. There was no indication that missing data were not random. Preliminary factor analyses were conducted excluding participants with missing values. Values for missing data were imputed from that individual's average survey score. Inserting imputed averages for missing values did not change the mean score for each factor or for the scale overall, and allowed for the inclusion of additional respondents in subsequent analyses. Plots of factor scores were examined for outliers, and appeared to be bivariate normally distributed.

Appropriate items were reverse scored prior to analysis. Following the analytical procedure of Nisbet et al. (2009), an exploratory factor analysis (n=221) with maximum likelihood method was conducted to explore the structure of NR items using student pre-scores. An oblique promax rotation was used to examine structure of NR items as we expected the factors to correlate, although less satisfactory orthogonal rotations were also explored. Rotated factor patterns and final communalities were used to evaluate the suitability of each item within extracted factors. Items that did not load on any factor were removed stepwise, until only items with factor loading > 0.32 remained.

The first factor, NR-Experience (Nisbet et al., 2009), reflects a physical familiarity with the natural world and the level of comfort with and desire to be out in nature. The second factor, NR-Self, represents an internalized identification with nature, reflecting feelings and thoughts about one's personal connection to nature. The third factor, NR-Perspective, reflects an external, nature-related worldview, a sense of agency concerning individual human actions and their impact on all living things.

NR scores for each factor were computed as the average of all items contained in that factor, as well as an overall NR score calculated as the average of all retained item scores. Fifteen items were retained in the final analysis. Chronbach's alpha was used to evaluate instrument reliability for the entire 15-item scale and each individual subscale. Due to smaller sample sizes in some courses, age was coded into bins to prevent collecting individually identifiable information. Additionally, few students were in the 25+ years age groups, and as such, ages were lumped into two broad categories (17-24, and 25-30+ years) for analysis.

A general linear model (GLM) was used to evaluate factor score response to gender, age, and class rank. In the GLM, gender, age, and class rank were treated as categorical effects. An interaction term between age and gender was also explored. Model-based least square means and model-based standard errors were used to account for sample size imbalance for these effects. The magnitude of effects was quantified using Cohen's *d*, calculated by dividing the difference between means by the pooled standard deviation of the data. Following convention established by Cohen (1988), effect sizes of 0.00, 0.20, 0.50, 0.80, and 1.2 correspond to zero, small, medium, large, and very large effects, respectively.

Changes in factor scores were computed as the difference between the factor pre-score and the factor post-score for individual students, reflecting changes in attitude as a response to the course. I initially evaluated whether the change in factor scores was related to the course the students took (FW101L vs. FW238). Although the difference between classes was significant for NR-Experience ($F=4.92$, $p=0.03$), there was not a significant difference for NR-Self ($F=0.00$, $p=0.99$), NR-perspective ($F=2.18$, $p=0.14$), or for the overall NR score ($F=2.55$, $p=0.11$). Additionally, the sample size for FW238 was small ($n=18$), limiting further evaluation of factors influencing attitudinal change. As such, both classes were combined in subsequent analyses. A paired t-test was used to evaluate changes in student scores, and a General Linear Model was used to evaluate whether the change in score depended upon demographic characteristics or the initial, pre-class score.

To evaluate whether undergraduate Fisheries and Wildlife students have different attitudes with regard to the environment than the general public, a series of independent sample t-tests were used to compare student pre-scores for each factor and the scale overall to corresponding MTurk respondent scores.

Results

Factor Analysis

Three factors were extracted (first three eigenvalues 6.21, 2.42, 1.06), accounting for 41% of the total variance. Catell's scree plot method also suggested a three-factor model. Stepwise deletions of items that did not load significantly on any factor eliminated six questions with low loadings, reducing the number of survey items to fifteen. Of the remaining items, two communalities were low (<0.3) and these items were not easily assigned to a single factor. However, reliability analysis and inter-item correlations suggested all 15 items contributed to one or more of the three factors.

Table 1 contains factor loadings for each of the scale items. Factor loadings and inter-item correlations suggest that the primary contributors to each factor were generally consistent with findings from Nisbet et al. (2009). Several items loaded more heavily on different factors than those observed by Nisbet et al. (2009), but these were all factors with low communalities.

Table 1. Rotated factor pattern for maximum likelihood extraction and promax rotation on nature relatedness (NR) items. Darker color indicates higher factor loadings.

	NR-Experience	NR-Self	NR-Perspective
My connection to nature and the environment is part of my spirituality.	0.04	0.73	-0.07
My relationship to nature is an important part of who I am.	0.10	0.74	-0.12
I feel very connected to all living things and the earth	-0.06	0.63	0.19
I am not separate from nature, but a part of nature.	0.02	0.45	0.21
I always think about how my actions affect the environment.	-.07	0.11	0.59
I am very aware of environmental issues.	0.13	-0.15	0.74
I think a lot about the suffering of animals.	-0.35	0.11	0.50
Even in the middle of the city, I notice nature around me.	0.21	0.13	0.43
My feelings about nature do not affect how I live my life.	0.00	0.33	0.10
The thought of being deep in the woods, away from civilization, is frightening	0.78	-0.15	-0.04
My ideal vacation spot would be a remote, wilderness area.	0.63	0.01	0.08
I enjoy being outdoors, even in unpleasant weather.	0.71	0.13	0.00
I don't often go out in nature.	0.41	0.09	-0.01
I enjoy digging in the earth and getting dirt on my hands.	0.50	0.19	-0.03
I take notice of wildlife wherever I am.	0.20	0.27	0.34

As expected, the three factors were significantly correlated with each other (Table 2). In particular, the NR-self and NR-perspective subscales were highly correlated, and may be an indication that these two subscales converge toward a single, broader affective construct. Items from these two scales are primarily where my results diverge from previous research as well. Regardless, the survey instrument demonstrated good reliability for the full 21-item scale

(Cronbach's α = 0.87) and each of the three subscales (0.84 for NR-Experience, 0.84 for NR-Self, and 0.83 for NR-Perspective).

Table 2. Inter- Factor correlations

	NR-Experience	NR-Self	NR-Perspective
NR-Experience	-	0.37**	0.18*
NR-Self	0.37**	-	0.46**
NR-Perspective	0.18*	0.46**	-

* *p* < .05, ***p* < .0001

Baseline Differences

For NR-Experience, there was not a significant relationship between students' pre-score and gender, age, class rank, or the gender*age interaction (F=1.82, p=0.09), although age appeared to be an important variable (p=0.02) in the full model prior to stepwise deletion. Following stepwise deletion of non-variables, the final model yielded no significant results in reduced models.

For NR-Self and NR-Perspective, there was not a significant relationship between pre-score, gender, age, class rank or the gender*age interaction (F=0.40, p=0.90 and F=1.22, p=0.30, respectively). Reduced models with stepwise deletion of demographic variables likewise yielded no significant results for either factor. For the overall NR score, there was no significant relationship between pre-scores and any demographic variables (F=0.57, p=0.78). Table 3 contains a summary of results.

Table 3. Influence of demographic variables on baseline NR scores for each factor and on the overall NR score.

	$F(7,180)$	p	R^2
NR-Experience	1.82	0.09	0.07
Gender	2.14	0.15	
Age	5.74	0.02	
Rank	1.71	0.15	
Gender*Age	0.12	0.73	
NR-Self	0.40	0.90	0.02
Gender	1.48	0.23	
Age	1.21	0.27	
Rank	0.17	0.95	
Gender*Age	0.18	0.67	
NR-Perspective	1.22	0.30	0.05
Gender	3.00	0.09	
Age	0.30	0.59	
Rank	0.68	0.61	
Gender*Age	1.37	0.24	
Overall NR	0.57	0.78	0.02
Gender	0.34	0.56	
Age	3.12	0.08	
Rank	0.51	0.72	
Gender*Age	0.66	0.42	

Course Impacts on NR

Factor scores across all the full NR scale and all three subscales were consistently high (on a scale of 1 to 5, with 5 being the maximum) prior to taking the class (Table 4), indicating that students generally started with a high level of nature relatedness. Following the class, there was no significant difference between pre and post scores for NR-Experience (t=0.81, df=203, p=0.42), but there was a significant difference in pre and post scores for NR-Self (t=3.85, df=203, p<.0001), NR-Perspective (t=4.12, df = 203, p<.0001), as well as overall NR (t = 4.10, df = 203, p<.0001). Cohen's d calculations indicated that changes in NR-Self, NR-Perspective, and overall NR were small in magnitude, but scores were approaching the maximum score of 5.0 for these factors (Table 4).

Table 4. Means, standard deviations, and effect sizes for differences in pre and post scores for each factor and overall

	Pre		Post				
	M	*SE*	*M*	*SE*	Difference	*t*(203)	*d*
NR-Experience	4.19	0.04	4.16	0.04	-0.03	0.81	0.07
NR-Self	4.17	0.03	4.27	0.04	0.10	3.85*	0.27
NR-Perspective	4.02	0.03	4.13	0.03	0.11	4.12**	0.29
Overall NR	4.13	0.02	4.19	0.03	0.06	4.10**	0.29

* $p < .05$, **$p < .0001$

General Linear Model evaluations of changes in the three NR components as a function of gender, age, class rank or interaction terms showed that none of these characteristics played a strong role in determining degree of change for any of the factors (Table 5). Reduced models, retaining only the best fitting characteristics likewise did not identify any significant relationships.

Table 5. Influence of demographic variables on change in scores pre- and post- for each factor and on the overall NR score.

	$F(7,158)$	p	R^2
NR-Experience	0.22	0.98	0.01
Gender	0.59	0.44	
Age	0.69	0.41	
Rank	0.21	0.93	
Gender*Age	0.00	0.96	
NR-Self	1.15	0.33	0.05
Gender	0.55	0.46	
Age	0.94	0.33	
Rank	1.26	0.29	
Gender*Age	1.15	0.29	
NR-Perspective	0.65	0.72	0.03
Gender	0.03	0.87	
Age	0.29	0.59	
Rank	0.93	0.45	
Gender*Age	0.05	0.83	
Overall NR	0.67	0.70	0.03
Gender	0.40	0.53	
Age	0.36	0.55	
Rank	0.84	0.50	
Gender*Age	0.45	0.50	

General Linear Model evaluations of changes in the three NR factors as well the overall NR score pre- and post- course participation as a function of initial pre-scores demonstrated a significant relationship for all individual factors and the overall NR score (Table 6). Positive slope estimates indicate that individuals who scored lower in each subscale and in their overall NR score had a greater overall shift in scores following course participation.

Table 6. Summary of regression results evaluating influence of student pre-scores on change in scores pre- and post- course participation.

	β	$SE\ \beta$	$F(1,204)$	R^2
NR-Experience	0.28	0.046	36.65*	0.15
NR-Self	0.47	0.055	72.89*	0.26
NR-Perspective	0.47	0.049	91.02*	0.31
Overall NR	0.34	0.051	44.05*	0.18

*p<.0001

MTurk Comparison

Independent samples t-test analyses indicate there is a significant difference between MTurk respondent and student pre-scores for NR-Experience, NR-Self, and overall NR, but not for NR-Perspective (Table 7). Cohen's d calculations indicate that the differences in NR-Experience and overall NR were very large, the difference in NR-Self was medium in magnitude, and that there was a small difference in NR-Perspective (Table 7).

Table 7. Means, standard deviations, and effect sizes for differences in factor scores between MTurk participants and student pre-scores

	MTurk (*n*=242)		Students (*n*=262)			
	M	*SE*	*M*	*SE*	*t(504)*	*d*
NR-Experience	3.26	0.04	4.19	0.04	17.63**	1.57
NR-Self	3.80	0.04	4.17	0.03	6.90**	0.62
NR-Perspective	3.93	0.04	4.02	0.03	1.79	0.16
Overall NR	3.66	0.03	4.12	0.02	11.33**	1.01

$^{**}p < .0001$

Discussion

The primary purpose of this research was to evaluate the effectiveness of experiential learning in influencing elements of students' nature relatedness as an outcome of course learning in two introductory fisheries and wildlife courses. Participation in both courses significantly influenced students' overall nature relatedness, the extent to which they identified themselves as a part of nature (NR-Self), and their external, nature-related worldview (NR-Perspective). There was not a significant change in students' physical familiarity with nature or comfort with and desire for nature contact (NR-Experience). These results were independent of demographic characteristics including age, class rank, and gender.

These results suggest that the degree of familiarity or comfort in nature was not impacted by course participation. High initial NR-Experience scores (mean=4.19) indicate that students were likely already comfortable in and familiar with nature prior to taking these courses, however Lankenau (2018) also observed a smaller change in the NR-Experience dimension relative to other NR dimensions as an outcome of learning in an undergraduate ecology course for non-science majors. In the context of this research, it is likely that students' previous experiences in and with nature influenced their choice of major. Indeed, recent scholarship suggests that students' backgrounds and interests, even those developed during childhood, were determining factors for choosing their major (Jones et al., 2010). The significant difference in nature relatedness scores between Mturk respondents and students provide additional support that students majoring in Fisheries and Wildlife are more comfortable with nature than the general public.

Additionally, the non-significant change in the NR-Experience dimension could also be indicative that this dimension of attitudes is more resistant to change, or that attitudes in this dimension are shaped at an earlier point in development. The creators of the original scale indicate that overall nature relatedness and each of the three subscales tend to be relatively stable over time (Nisbet et al., 2009), and Schultz (2002) also observed a high degree of stability in connectedness to nature over time. Other scholarship suggests that attitudes become harder to change with age (Braun and Dierkes, 2017; Clayton, 2003). However, significant changes in NR-Self, NR-Perspective, and overall nature relatedness indicate that it is possible to change attitudes as an outcome of learning in post-secondary education. Some research suggests that early life experiences in nature are important antecedents to adult environmental attitudes (Chawla, 1998; Ewert, Place, & Sibthorp, 2005; Kals et al., 1999; Wells & Lekies, 2006), and provide additional evidence in support of the contribution of previous experiences in choice of academic major.

Students who were lower in connectedness to nature demonstrated a greater increase across all dimensions and in overall nature relatedness, while those who scored higher prior to the course exhibited smaller increases, indicating that there may be a ceiling effect in nature relatedness. Similar results were observed by Dresner and Gill (1994) and Braun and Dierkes (2017), suggesting that lower levels of nature relatedness and less previous experience in nature may be a precursor to change. Taken together, it may be that increasing connectedness to nature through experiential learning may be more impactful for students in other disciplines, those with lower initial nature relatedness scores, or individuals with less previous experience in nature.

A similar study provides some additional context for interpreting these results. Lankenau (2018) observed significant changes in nature relatedness and all three subscales following participation in an undergraduate introductory ecology for non-science majors course (n=246). Students from this course had similar demographic characteristics to the students in the current study, but did not intend to pursue majors in scientific disciplines and had lower initial nature relatedness scores than students in the current study (mean scores = 3.43, 3.29, 3.72, and 3.22 for overall NR, NR-Self, NR-Perspective, and NR-Experience, respectively). Students in the courses we studied averaged approximately 4.1 in their nature relatedness score and subscale scores and showed an increase in score of approximately 0.1 in the NR-Self and NR-Perspective scales and 0.06 in the overall score. If we use the regression results reported here to extrapolate the expected change for our students if they would have started at a lower level of nature relatedness (i.e., at the mean level observed by Lankenau), we would have predicted an average increase of about 0.31 units. The magnitude of the predicted increase is larger than what Lankenau observed in his study group. Neither his study nor this one have followed up students beyond their initial response to the class, and as such, are not able to provide insight into the permanency of impacts.

Students from Lankenau’s study increased their nature relatedness as an outcome of course participation by an average of 0.21 across the full scale and all three subscales, despite being enrolled in a large lecture format course. He attributes this change to an intentional emphasis on developing students' relationship with nature throughout the course, with activities and assignments designed with this objective in mind. As further evidence of this assertion, Lankenau also surveyed the nature relatedness scores of students before and after taking courses where attitudinal development was not a goal, and observed no significant change in scores. Other scholarship has also reported no change in connectedness to nature of undergraduate students following environmental education programs (e.g. Ernst and Theimer, 2011; Nisbet et al., 2011), though these courses tend to emphasize the acquisition of knowledge in their design and implementation. These results suggest connectedness to nature can be fostered in adult learners, but only when this goal is explicitly considered in course design. Where feasible, experiential learning may better facilitate growth in nature relatedness over traditional lecture-format courses.

The nature relatedness scale was chosen because it measures the cognitive, affective, and experiential aspects of an individual's connection to nature, though it was expected that these elements would be highly correlated. Results indicate that each dimension was significantly correlated with the other two, with the strongest relationships between NR-Self and NR-Perspective, and NR-Self and NR-Experience. A weaker relationship was observed between NR-Perspective and NR-Experience. Similar results were obtained by Nisbet et al. (2009). It is logical that an individual's feelings, beliefs, and experiences are interrelated; someone who holds the perspective that humans are contributing to the destruction of the environment likely has personal experiences or observations (such as in a degraded habitat) that inform and bolster subsequent judgements of human impacts on the environment. Therefore, while the scale captures the affective, cognitive, and experiential dimensions of nature relatedness, it is difficult to distinguish individual contributions of the three dimensions on overall nature relatedness. Further, the degree of correlation between NR-Perspective and NR-Self suggest that these dimensions may converge toward one broader affective construct and the differences among these two dimensions indicated by the factor analysis could be a relic of how each item was worded.

Limitations and Future Directions

These results indicate that connectedness to nature can be increased as an outcome of experiential learning in higher education. However, generalizability is limited by the inclusion of only undergraduate fisheries and wildlife students who represent only a small proportion of the college student population. While the age range of student participants in this sample are generally representative of many higher education settings, there remains very little racial and ethnic diversity in undergraduate natural resources programs (Natural Resource Education and Employment Conference Report and Recommendations, 2012). As such, it is unclear if the changes in attitudes would be equal across individuals with different racial or ethnic backgrounds. Some scholars argue that connectedness to nature may be a “primitive” or non-conscious belief (Schultz, Shriver, Tabanico, & Khazian, 2004; Schultz and Tabanico, 2007), so measures that rely on self-reports may be biased. A more robust study might include explicit measures, such as the nature relatedness scale, and implicit measures to better understand the relationship between the two and assess how reliable self-reported measures of connectedness to nature are. The implicit association with nature test developed by Schultz et al. (2004) may add a deeper dimension to subsequent research, but its applicability in some field settings may be limited because it requires a computer to administer test questions and includes response times in calculating subsequent scores.

Another limitation of this study is the lack of a true control group, although similar results from Lankenau (2018) discussed above provide some additional context for interpreting the results of this study. This study measured changes in connectedness to nature over the duration of a single semester, although some research suggests that gains in connectedness to nature can decline over time (Lieflander et al., 2013). Longer-term follow up is necessary to determine whether changes persist over time, although high initial scores suggest that significant declines in nature relatedness of students in this study over time is less likely. The design of this research also did not allow for fine scale evaluation of specific activities; better understanding of the influence of experiential learning on affective learning outcomes may be gleaned from assessing individual activities, or implementing an attitude survey periodically throughout the semester. Instructional design may also be enhanced by a deeper understanding of how various experiential activities influence specific dimensions of attitudes. A mixed-methods approach including qualitative analyses would likely provide additional insights and may allow for the identification of specific activities that students perceive to be more or less impactful. Lastly, the nature relatedness attitude scale was chosen in the context of learning goals for these two courses. More research is needed to assess the influence of experiential learning on other affective outcomes more broadly, such as self-efficacy, motivation or engagement.

Broader Implications

Increasing connectedness to nature in adult learners has significant implications for environmental education programs that seek to change behavior. The extent to which an individual perceives themselves as a part of nature, rather than separate from it, is predictive of a range of environmentally-responsible behaviors (Dutcher et al., 2007; Mayer & Frantz, 2004; Nisbet, Zelenski, & Murphy, 2009), and, likewise, disconnect from the natural world may be contributing to environmental degradation (Louv, 2005). The closer an individual perceives themselves as a part of nature, the less likely they are to harm it (Duffy and Verges, 2010), thus, education programs that seek to increase connectedness to nature may be critical in achieving a sustainable future. Experiential learning offers one such pathway to facilitate this type of personal relationship with nature.

Conclusion

Childhood may be a critical time for the development of adult environmental attitudes, but education can facilitate connectedness to nature in adult learners. Even though students entering these courses were generally high in their initial measure of nature relatedness, participation in these experiential courses increased most measures of their relatedness. These results suggest that affective learning outcomes can be achieved when they are explicitly considered in course and curricular design, and identifies experiential learning as a useful pedagogy for the affective development of undergraduate students. Regardless, attitudes are an important component and outcome of the educational process, and should be given greater consideration in course and curriculum design. The impact of experiential learning on affective growth of students more generally warrants further study in other courses and disciplines.

CHAPTER FOUR: FLIPPING AN OUTDOOR CLASSROOM

Introduction

Experiential learning pedagogy includes a broad spectrum of activities that place students in direct contact with concepts being studied (Kolb, 1984). It involves four stages that students progress through in a continuous spiral that promotes higher order thinking: 1) concrete experience, 2) observation and reflection, 3) abstract conceptualization and generalization, and 4) active experimentation (Kolb, 1984). Grounded in early constructivist theories (e.g. Dewey, 1938), experiential learning theory posits that knowledge is created through the transformation of experience. The process of critical reflection allows learners to identify conceptual patterns and generalized understanding that can then be transferred and applied in new situations and contexts (Kolb, 1984). New experiences become embedded in an existing framework of understanding that is used to inform or refine subsequent generalizations, resulting in deeper learning that can be transferred to other new contexts for further development (Kolb, 2015). All experiences are necessarily unique to individuals because their understanding is embedded within the context of social, cultural, and environmental influences that inherently vary from person to person. Experiential learning therefore allows for students to construct their own meaning from the same experience, increasing salience by making learning personally relevant to each student. Proponents argue that experiential learning facilitates learning for a diversity of learning styles, in contrast with more traditional, lecture-based approaches that target auditory learners (Millenbah and Millspaugh, 2003).

In addition to accommodating more learning styles and promoting deeper learning, scholarship also suggests that experiential learning fosters critical thinking (Barr and Tagg, 1995; Eyler, 2009; Hix, 2015), improved retention of information (Ballantyne and Packer, 2009; Bauerle and Park, 2012; Rickinson, 2004), and lifelong learning skills (Eyler, 2009). Experiential learning is particularly relevant in natural resource curricula, as graduates need more than foundational knowledge and skills to be successful in a future characterized by perpetual social and environmental change, with new information and technologies emerging all the time. Experiential learning, with its emphasis on the *process* of learning, rather than the *outcome*, offers an effective pedagogy for the development of critical thinking and lifelong learning skills required by natural resource professionals to be successful in their careers.

Despite the benefits of experiential learning in the long term professional development of students, there have apparently been no empirically evaluations of the effect of where in the cycle a student begins. It is hypothesized that because learning is conceived as a continuous cycle, experiential learning outcomes will not be impacted by the order of instruction. This hypothesis was tested by reversing the order in which information was presented in an undergraduate experiential learning activity and assessing learning outcomes. Specifically, my research objectives were:

1) To evaluate the impact of order of instruction on student comprehension of experiential lab material, and
2) Assess learning outcomes as a result of experiential learning

These objectives were achieved by comparing the performance and understanding of students in a class where a) an experiential activity was first performed, and then a reading supplied for students to self-critique their work, and b) a reading was supplied for students to engage with the concepts behind the activity prior to conducting the activity.

Methods

Course

This hypothesis was tested in two semesters of a two-credit introductory laboratory course in the Fisheries and Wildlife (FW) Department at Michigan State University (MSU). The Fundamentals of Fisheries and Wildlife Ecology and Management Laboratory (FW101L) course involves one 50-minute lecture and a 3-hour laboratory each week, and is designed to introduce students to a range of contemporary issues and practices in natural resources. A majority of the labs involve field trips to various ecosystems in surrounding area, where students can apply lecture material in a real-world setting. This course has no prerequisite courses and is required curriculum for all students in the Fisheries and Wildlife major at MSU. Enrollment averages around 75 students across three lab sections each semester.

Out of 159 students in two semesters of FW101L, 118 voluntarily participated in this research for a response rate of 74%. Approximately half of students were freshmen or sophomores (47.4%), a majority were juniors (44.9%), and a small proportion were seniors or above (7.6%). Respondents were 55.9% female and 44.1% male.

Activity

Students were distributed across three separate lab sections, so while some content remained consistent across all three sections (e.g. plant communities associated with various ecosystems), unplanned serendipitous encounters presented different sections with varying experiences in a particular ecosystem. Therefore, a shelter building activity was chosen for this research because it offered a topic that allowed for greater control of instructional design and more consistency of experiences across different sections. Learning objectives for this shelter building activity include:

1) Learn how to construct shelter with appropriate materials, design, and location to survive for one night in Michigan during the fall season
2) Increase confidence in outdoor survival skills

Procedure

Students in each section were randomly assigned to groups of 4 or 5 (28 groups total) and were provided the same verbal overview to work together to construct a shelter for a single person to survive for one night under conditions typically experienced in Michigan during the fall season. Students from three sections (n=54) were then provided with a short 2-page reading that described in detail how to design and construct a debris shelter before groups were instructed to begin. Students from three additional sections (n=64) were instructed to begin constructing their shelters immediately following the general overview and provided with the same reading following the construction of their shelters.

Assessment

A brief formative assessment of shelter quality was conducted during lab using a rubric that rated each shelter in three main categories: location, thermal characteristics, and design. Assessment of location included proximity to water, food resources or rescue, visibility, and consideration of overhead danger. Thermal characteristics included size, insulation, and overhead cover. Design assessments included insulation material, structural integrity, and appropriateness of building materials. Each element of the formative assessment was given two points for full consideration, one point for incomplete consideration, and zero points for no consideration of each component. Scores across all categories were summed to provide the overall group assessment score. The formative assessment was conducted by the same instructor across all sections for consistency.

A summative post-class homework assignment was used to assess learning outcomes following the shelter building activity. This assignment was due three weeks following the activity and asked students to sketch or roughly diagram their ideal shelter under the same set of conditions as the physical activity. A scoring rubric was used to assess shelter diagrams according to size, location, insulation, and building materials. Three points were given to complete answers, two points for well-developed but incomplete or inaccurate responses, one point for brief mention without elaboration, and zero points for missing a concept all together. Scores were summed across all categories to calculate individual shelter scores.

Students were also asked to report their level of confidence following the outdoor survival lab on a categorical scale ranging from more confident to less confident, and to reflect on their shelter building experience more generally. Additionally, students were asked to describe their previous experience or instruction with outdoor survival or shelter building, including through scout programs, self-learning through books or online, military training, summer camp activities, or experiences with parents or other family members. The total number of previous experiences reported was summed so that higher values were indicative of more previous experience. Lastly, because we thought participation in various outdoor recreation activities might be broadly related to the development of outdoor survival skills, we asked students to indicate their previous participation in various outdoor activities, including: hunting, fishing, camping, hiking, kayaking or canoeing, trapping, or an open ended ‘other’ outdoor recreation category. The total number of different activities reported was also summed to provide the outdoor activities measure.

Analysis

Group formative assessment scores were compared using an independent samples t-test. Because summative assessment shelter scores were not normally distributed, a nonparametric Wilcoxon rank-sum test was used to explore differences between treatments. A general linear model (GLM) was used to evaluate shelter score response to treatment, gender, class rank, previous experience, and participation in outdoor activities. In the GLM, treatment, gender, and class rank were treated as categorical effects, while previous experience and participation in outdoor activities were treated as continuous variables. Model-based least square means and model-based standard errors were used to account for sample size imbalance for these effects.

Results

Groups that received the reading before building their shelter scored significantly higher in the formative assessment than groups that were given the reading after shelter construction ($t=4.42$, $df=26$, p-value = 0.0002). Out of 26 possible points, groups that received prior instruction scored 21.2 points on average, while those who were provided the reading after the activity averaged 15.6 points in the formative assessment. However, results of the Wilcoxon rank-sum test indicate that there was no significant difference between treatments in the post-class assignment ($Z=-1.6$, $p=0.11$, $n=54$ and 64 students receiving instruction prior to the activity and immediately following, respectively), with both groups scoring highly overall.

The full model relating final shelter scores with treatment, gender, class rank, previous experience, and participation in outdoor activities was significant ($F=2.16$, $p=0.043$), although previous experience appeared to be the only significant covariate ($p=0.05$) in the full model prior to stepwise deletion. Sequential removal of non-significant covariates yielded a final reduced model containing only previous experience as a significant covariate ($F=5.98$, $p=0.02$, Table 8).

Table 8. General Linear Model results of influence of demographic and experience variables on shelter scores. Degrees of freedom from each model are listed after the model statement.

	F	*p*	R^2
Model(7,110)	2.16	0.04*	0.12
Treatment	1.39	0.24	
Gender	1.64	0.20	
Class Rank	1.84	0.14	
Previous Experience	3.68	0.06	
Total Activities	0.04	0.84	
Model(6,111)	2.54	0.02*	0.12
Treatment	1.57	0.21	
Gender	1.61	0.21	
Class Rank	1.84	0.14	
Previous Experience	3.80	0.05*	
Model(5,112)	2.72	0.02*	0.11
Gender	1.34	0.25	
Class Rank	1.87	0.14	
Previous Experience	4.05	0.05*	
Model(4,113)	3.05	0.02*	0.10
Rank	2.03	0.11	
Previous Experience	4.77	0.03*	
Model(1,116)	5.98	0.02*	0.05
Previous Experience	5.98	0.02*	

* $p < .05$

Of the 118 students who participated in this study, 83 (70.3%) indicated that they were more confident in their outdoor survival skills following participation in this lab. 22.9% reported that they were somewhat more confidence, and 6.8% indicated their confidence level has not changed as a result of this activity. All of the students who reported no change in confidence were those with significant prior experience or training in outdoor survival skills. No students reported that they were not confident or less confident following the activity.

Discussion

The primary purpose of this research was to evaluate whether order of instruction matters in an experiential learning activity. While there were significant differences in shelter quality between treatment groups in the formative assessment, these differences were no longer detectible in the post-class shelter assignment. While the order of instruction did not influence summative learning outcomes for this activity, all scores were similarly high (mean = 9.1 and 9.56 out of 12 possible points for those who received the reading in advance and after the activity, respectively). The compression of scores at the upper end of the scale may have prevented our assessment rubric from detecting fine scale differences in student understanding on this topic. Beyond student comprehension of the material, an additional consideration is the duration of student understanding. This research assessed the retention of information in the short-term following the activity. Further research is needed to assess how well information is retained over longer time frames; some scholarship has suggested that a single experiential activity may not be sufficient to develop long-term recall of information (Montgomery and Millenbah, 2011). Consistent with this assertion, we found that the only significant covariate for summative shelter assessment scores was previous experience or training with outdoor survival.

These results suggest that order in which instruction is received does not influence learning outcomes in this particular experiential activity, but it would be useful to assess whether learning outcomes include more general skills related to outdoor survival, or whether order of instruction matters in achieving a more general suite of survival skills. For example, this activity emphasized conditions present in Michigan during the fall, but students could be assessed on how well they are able to transfer knowledge to other situations and contexts, such as other locations or times of the year.

Another learning goal for this activity was to increase students' confidence in their outdoor survival skills. Survey responses indicate that students overwhelmingly reported increased confidence in their outdoor survival skills following participation in this lab activity. Many attribute this increase to having concrete experience building a survival shelter. For example, one student wrote, "I think the part of the lab that changed my confidence was the fact that we were able to build a shelter hands on. It is one thing to "know" how, but different to actually execute the idea." The benefit of low-risk practice was another common theme in student responses. For example, one student stated that, "This was definitely an appropriate time to fail at such a task, rather than in an actual survival situation where a shelter that won't keep you warm is something much less forgiving."

Similarly, some students commented that this experience helped make them feel more comfortable in the outdoors more generally: "The most useful skill I learned that day was the proper shelter building basics associated with survival in the wilderness. Attributes such as proper size, location and building material can determine whether you live or die while stranded in wilderness. By learning such skills, I have realized the inherent fear I have had of nature has significantly lowered."

Although the order of instruction did not influence learning outcomes in this activity, more research is needed to explore whether instructional order matters in other experiential learning activities. The methodology employed in this chapter could be applied to other activities and courses to better understand the influence of order of instruction in an experiential learning environment. Other researchers are encouraged to apply this approach in new and novel situations to further understand the ramifications of instructional order on experiential learning outcomes.

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APPENDICES

APPENDIX A: FW238 Syllabus

COURSE GOALS

- To gain knowledge and experience implementing field techniques for natural resources conservation and management.
- To understand the ecology of a north-central Michigan ecosystem, including identification of native flora and fauna.
- To understand the complexity involved in designing and conducting research projects and applying knowledge derived from such projects to natural resource management.

COURSE FORMAT

Throughout the course, we will use demonstrations, hands-on applications, and problem-based learning. The variety of learning techniques are used to facilitate retention and application of material and enhance critical thinking skills that will provide students with a strong base for developing their career paths in the field of natural resources.

COURSE EVALUATION	NUMBER OF POINTS	% OF GRADE
Exam Practical	80	26.7
Group Presentation	70	23.3
Research Project	90	30.0
Field Journal	30	10.0
Class Participation	30	10.0
	300	100

The exam will cover material from all lectures and field activities and will be a combination of multiple choice, short answer, and essay.

Since assessing and managing components of ecological systems are challenging tasks for natural resource managers, it is critical that you understand the process of conducting fish and wildlife assessment and research and applying it to management issues. During this course, you will gain first-hand experience working in teams, conducting a small-scale project on a topic of your choice, identifying and using appropriate methodology to gather data, and demonstrating application of the results towards management.

GRADING SCALE

4.0 = 270 points (90%+)	3.5 = 255-269 points (85-89%)	3.0 = 240-254 points (80-84%)
2.5 = 225-239 points (75-79%)	2.0 = 210-224 points (70-74%)	1.5 = 195-209 points (65-69%)
1.0 = 180-194 points (60-64%)	0.0 = <194 points (< 60%)	

APPENDIX B: FW101L Syllabus

Class meeting: Wednesday 11:30 - 12:20 Room 225 Natural Resources

AND (Thursday 8-10:50 am or Friday 8-10:50 am or Friday 12-2:50 pm)

263 Giltner Hall (but we will almost never meet in this room)

Credits: 2

Catalog description: Natural history and ecology of primary terrestrial, wetland, and aquatic ecosystems. Species and communities in Michigan and the United States. Species identification in various ecosystem types. Impacts of disturbances on ecosystems. Field trips required.

Course Reading and Location of Assignment & Handouts: We will use the D2L online course management system, which can be accessed at: https://d2l.msu.edu Copies of class Powerpoint slides will be posted in, as well as laboratory assignments, readings, the course syllabus and any other course materials. You may decide what you want to print and archive for your own records and what you would like to keep electronically. It is, however, your responsibility to download and print all necessary materials before class.

Scholarly Expectations and Learning Outcomes: A basic assumption of this course is that learning results from continually using the contents of this course. While you are enrolled in FW101L, you will be presented with opportunities and responsibilities. Everyone will have the opportunity to learn — your responsibility is to maximize your learning from the course by being prepared for class, participating in class discussions and activities, and revisiting sites that we explore during lab sessions.

The major goals for you in this course are:

1. Help you become a better naturalist
2. Acquire an appreciation for outdoor preparedness
3. Develop healthy attitudes toward learning
4. Gain a basic knowledge of Michigan’s ecosystems and the diversity of life
5. Expose you to consumptive and non-consumptive values of fish and wildlife

GRADING:

	% of Grade
Exam 1	25%
Final Comprehensive Exam	30%
Homework	20%
Attendance/Participation	25%

Grade	Letter	%	**Grade**	Letter	%
4.0	A	93-100%	**2.0**	C	73-77%
3.5	A- / B+	88-92%	**1.5**	C- / D+	68-72%
3.0	B	83-87%	**1.0**	D	63-67%
2.5	B- / C+	78-82%	**0.0**	F	< 63%

In addition to these grading criteria, I reserve the right to fail any student who achieves a 60% or less on the cumulative final exam.

Another critical note is that we will use D2L to record your grades, and to allow you to check to see if we have received materials and recorded grades accurately, BUT, DO NOT rely on D2L to provide you with your overall weighted average.

ATTENDANCE AND ASSIGNMENT POLICIES:

Attendance will be taken in this class. I normally do not use this as an evaluative tool, but for this course, I want to emphasize your class participation as being critical, in addition to performance on tests. If you are unable to attend class, please let me know ahead of time or bring in a doctor's note the next class period. I view having 3 or fewer unexcused absences as being within the 4.0 range. More than 3 absences results in more points being taken off (see table below). I reserve the right to assign a failing grade for the course as a whole if a student misses 10 or more classes. Evaluating class participation can be very subjective, and because of this, my approach will assume you are performing at a 4.0 level. If I feel you are not participating adequately, or your participation is not professional, I will inform you of this in writing, and will discuss my concerns. If these concerns are not addressed, I may reduce your grade from the nominal value based on the number of absences.

Number of Unexcused Absences	Percentage	Number of Unexcused Absences	Percentage
0	100%	6	80%
1	97%	7	75%
2	95%	8	70%
3	93%	9	65%
4	90%	10	60%
5	85%	11	55%

Assignments are due on the date listed unless you have made specific arrangements ahead of time. All assignments must be turned in as hard-copy paper format (typed) or via a web-based interface, except in rare circumstances (e.g., hospitalization), when I will accept e-mail attachments. Assignments turned in late will be docked points according to the following schedule:

3-10 days late	Minus 25 percentage points
>10 days late	Minus 50 percentage points

I want to emphasize that if you have fallen behind in class, for whatever reason, I would prefer you to hand in work and learn the material rather than give up. Handing in work more than 10 days late means that you will receive a 50% at best for that assignment (which is failing, but may be offset by good test performance), but this is far better than receiving a 0% and not learning the material at all.

All students are expected to write exams on the date listed on the syllabus. Failure to attend the scheduled exam period can result in a zero for the exam. If circumstances arise where you are unable to take an exam on the specified date (e.g., conflict with scientific conference, conflict with religious observance), please see me as early as possible to make other arrangements. Students arriving late for an exam may not be given extra time to complete the exam. All exams are closed book, closed notes, and closed neighbor.

Academic Integrity and Dishonesty: Academic dishonesty is not tolerated at Michigan State University and the consequences for this are taken seriously and may have a range of outcomes. All members of MSU's community must be confident that the work of each individual has been responsibly and honorably acquired, developed, presented, and written. All students who are enrolled in university courses are expected to do their own work. Dishonesty includes, but is not limited to, cheating on assignments or exams; plagiarizing; engaging in unauthorized collaborations on academic work; submitting false records of academic achievement; and misusing, fabricating, or falsifying data. Instances of academic dishonesty will be dealt with on a case-by-case basis, and the penalty may range from receiving a zero on an assignment to failure for the class as a whole.

Inclusiveness and Professionalism: Numerous topics are covered in this course, and students are expected to be respectful of one another's views and comments. Everyone is expected to show a professional level of commitment to cooperatively learning the course material. Demonstrating professionalism in the classroom includes: (1) willingness and ability to participate in class discussions or ask informed questions about course material, (2) having a cooperative and responsible work ethic with the instructors and other students in class to maximize learning, (3) demonstrating quality and originality of individual and group work, (4) being on time, (5) having a professional attitude and respect for the class and individual peers, and (6) no disruptive behaviors. Professionalism also includes the ability to receive constructive criticism without resorting to avoidance behaviors or attitudes.

Students with Disabilities

So that all students have equal access in the course, please notify me if you have a situation that requires additional accommodations. Students with disabilities are also encouraged to contact the Resource Center for Persons with Disabilities at (http://www.rcpd.msu.edu/Services/Home) or 353-9642.

Exemptions for Religious Holidays:

If you have a conflict with course attendance or exam due to a religious holiday, see me ahead of time to make arrangements. Likewise, if you have a conflict with another course or professional activity (e.g., scientific conference), see me ahead of time.

Date	Topic	Assignments
Week 1	Baker Woodlot	
	Lecture: Course Introduction	
Week 2	Red Cedar Electrofishing	
	Lecture - prairie	Reading 1; Homework 1 (duck behavior) assigned
Week 3	Prairie Restoration (Field Trip)	
	Lecture – Maple River	Reading 2 assigned
Week 4	Maple River Game Area (Field Trip)	
	Lecture – threatened and endangered	Homework 2 (squirrel behavior) assigned
Week 5	Fenner Nature Center (Field Trip)	
	Lecture –Park Lake	
Week 6	Park Lake (Field Trip)	
	Midterm	
Week 7	Rose Lake Bog (Field Trip)	
	Lecture - Stream Invertebrates	Reading 3 assigned
Week 8	Stream Invertebrates	
	Lecture - furbearers	
Week 9	Kalamazoo Street	Homework 3 (animal tracks) assigned
	Lecture – Herptiles	Reading 4 assigned
Week 10	Dobie Road (Field Trip)	
	Lecture - Exotic species	
Week 11	Urban Wildlife – MSU campus	
	Lecture - Kellert	Reading 5; Homework 4 (human attitudes) assigned

Week 12	Demmer Center	Reading 6; Homework 5 (reflective essay) assigned
	No class	
Week 13	**Thanksgiving – no class**	
	Lecture – traditional ecological knowledge	
Week 14	Road Kill Dissection	
	Lecture - map reading	
Week 15	GPS	

APPENDIX C: FW238 Report Assignment

Your written report is worth <u>90 points</u>. The bulk of the points (80) will be awarded for paper structure and content within. The correct use of grammar and the absence of typographical errors will be worth 10 points. Please use 12-point font and double-space. Most papers will run about 8-10 pages, including tables and figures, but longer is acceptable. The addition of photographs may add to the paper length, but should not be used simply as "padding".

<u>Report Structure:</u> The report should be structured in the standard scientific journal submission format. This consists of the following six sections:

A. Introduction
B. Study Area
C. Methods
D. Results
E. Discussion
F. Management Implications

A. The <u>Introduction</u> of the report is worth **10 points**. The introduction should consist of background information (4 pts.), the rationale behind your project (4 pts.), and the goals and objectives of the project (2 pts.)
B. In the <u>Study Area</u> section, describe the area in which you performed your project. This section is worth **5 points**. Included in this section is information about climate, topography, soils, vegetation and land use in your study area.
C. The <u>Methods</u> section is worth **15 points**. In this section, describe what you did and why. Examples of reasons for using your methodology that will not be accepted in this report include examples such as "this was the only equipment available" or "this is what the instructor told me to do."
D. In the <u>Results</u> section, worth **15 points**, include information about what you found. This will include some text, but also figures and tables as appropriate. You should also provide some very basic descriptive statistics such as frequency of occurrence, means, and ranges. The figures and tables and readability of this section account for 10 points, the textual description of information presented in Figures and Tables is worth 5 points, and the accurate and appropriate referencing of Tables and Figures within your text is worth 5 points.
E. The <u>Discussion</u> section, worth **15 points**, is a very important section of this report. In this section you will be answering the questions: 1. Why did you obtain your results? and 2. How would you repeat this fieldwork in the future (i.e., would you change anything and why or why not)? Under question 1, you may receive up to 5 points for an explanation of the ecological factors responsible for your results and up to 5 points for an explanation of the methodological factors that were responsible for your results. You may receive up to 2 points for an explanation of any stochastic events responsible for your findings. The answer to question 2 is worth 3 points.
F. Finally, the <u>Management Implications</u> section is worth **20 points**. In this section, you will be explaining how Mark, the biologist/forester at Mid-Forest Lodge can use the results of your project to manage the property given lodge members' stated land management goals. Points for this section will be awarded based on: 1. tying your management implications to Mid-Forest Lodge's land management goals, 2. feasibility in terms of

time, money, equipment available, 3. the appropriateness of recommendations regarding their potential ecological impacts, 4. whether “long-term” recommendations are made, and 5. plans to monitor populations to assess whether desired results are being achieved through management recommendations.

G. You need to appropriately cite literature and sources throughout the paper whenever you base your writing on an external source. You should include a minimum of 3 peer-reviewed paper citations in your paper, and we would encourage you to use more.

FW238 Paper Grading Score Sheet

Item	Possible	Grade	Comments
Intro			
Background	4		
Rationale	4		
Objectives	2		
Study Area	5		
Methods	15		
Results			
Figures and Tables	5		
Citation of Fig and Tab	5		
Text	5		
Discussion			
Ecological	5		
Methodological	5		
Stochastic (Random)	2		
Changes	3		
Management Implications	20		
Grammar and spelling	10		

TOTAL	90		

APPENDIX D: FW101L Reflective Essay Assignment

Goals:

- Reflect upon your experiences in the class

One of the major goals for the class has been to help you become a better naturalist. Another way of putting this is that we have tried to help you refine and deepen your relationship with "nature." One way of assessing such a qualitative type of learning is to have you write a short essay reflecting on what your relationship to nature is, and how this class has changed or re-enforced this relationship. Include specific examples of labs or lab-related experiences that have affected that relationship. One way of thinking about this is to put your learning in the KSA framework of learning. The KSA framework is based on three elements, which can be defined using examples from the class:

K=Knowledge e.g., knowing how to identify species, knowing its habitat requirements

S=Skill e.g., being able to use binoculars better, being able to build a shelter

A=Attitude the various dimensions in the Kellert scale, e.g., have you become more ecologistic in your attitude

We would like you to write a relatively short (4-8 pages, double spaced, 1 inch margin, 12 point font) paper on your relationship to nature. This can be a photo essay if you like, but photos don't count for or against the length of the essay. Once you have completed your essay, we ask that use the dropbox in the class D2L site to submit your paper. Please use the following naming convention to help us identify your paper (eg: Daniel_Hayes_Reflective_Essay.doc). The grading rubric for the paper is at the end of this assignment. Below are potential topics or themes you might include.

- Some literature about relationships with nature emphasizes the concept of "place", and how we connect or relate to places and the elements of nature we encounter there.
- Have you developed a new affinity for groups of animals you were previously unaware of, or had a fear or negative view of
- Have you gained confidence in your ability to be prepared to venture into the outdoors alone
- Has your passion or love for nature changed
- Has your awareness of your surroundings in nature increased

In addition to being an assignment for this class, at you can submit an alternative assignment as an entry for the Rajendra Scholarship competition. When we visited the Baker Woodlot, you may have noticed that it has also been designated as the Rajendra Neotropical Migratory Bird Sanctuary, in memory of Rachana Rajendra. Rachana loved nature, and her parents sought to designate the woodlot as a sanctuary for both birds, but also for people to seek sanctuary from the hectic lives we lead. If you would like to compete for the scholarship ($500 as well as the recognition for your work), you can create a poster, video, or photo display focused on the Sanctuary. If you are interested, please see me to talk about options for this scholarship contest. You will also need to read over the materials provided in the Sanctuaries' web site(http://www.fw.msu.edu/giving/rachana_rajendra_bird_sanctuary), and incorporate some of that information into the paper.

Grading rubric (100 points total)

Criterion	Possible points					Points earned
Length of paper	50 points	1 or 2 pages 25 points	3 pages 40 points	4-8 pages 50 points	8 or more pages 40 points	
Development of one or more coherent themes	15 points	Doesn't follow any theme (chaotic) 2 points	Weak development of theme 5 points	Clear development of theme(s) 10 points	Superlative development of theme(s) 15 points	
Support for themes	15 points	Gives no examples of lab experiences to back up themes 2 point	Gives one example of a lab experience that affected relationship 5 points	Gives 2 examples of lab experiences that affected relationship 10 points	Gives 3 or more examples of lab experiences that affected relationship 15 points	
Overall readability	20 points	Difficult to read - many incomplete sentences,	Minor problems with	Extremely well written		

		doesn't use topic sentences for paragraphs, etc. 5 points	quality of writing 20 points	25 points		

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