



Improving Ecological Literacy in Research and Outdoor Education

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Abstract

In recent years, a conceptual understanding of the natural world has diminished due to a lack of exposure, attachment, and the separation in our daily lives from connection to these spaces. Research and education in scientific disciplines in relation to natural history is difficult due to a lack of funding, the loss of intergenerational knowledge wealth, and a shift in priorities and lifestyle. In our post-COVID world, the majority of people are spending most of their time in the built environment [1]. There are concerns that this deficit of exposure to the natural world can lead to problems with mental and physical health [2]. This shift in practice can be attributed to shifting societal norms and technological changes, but we can look to those same technological advancements to bring about a renewed interest and understanding of ecological systems. Through the use of applications, software, and mobility tools combined with an emphasis on research and outdoor education, we can restore access to knowledge in ecological literacy in natural systems. This information can help restore a connection to the environment and bridge the understanding of natural environments. This study explores the impact of several tools on research and undergraduate education and finds that participants who utilize these applications gain greater access to this information and knowledge acquisition.

Keywords: *Natural History, Outdoor Education, Research, Ecological Literacy, Technology*

1. Introduction

Students don't go outside anymore. Only 6% of American children between the ages of 9 and 13 play outside unsupervised [3]. While 70% of adult generations report they spent time playing outside or walking or biking to school, their children spend a third of that time dedicated to those same outdoor activities [4]. A study conducted by the Outdoor Foundation found that nearly half of all Americans don't participate in outdoor recreation [5]. A new survey found the COVID pandemic is leaving its mark by shifting behaviors towards remaining home [1], with the majority of adults spending less than an hour away from home per day. These behaviors are becoming embedded in our culture and modeled by our children. This extinction of experience, as Robert Pyle called it, discourages positive emotions, attitudes, and behavior with regard to the environment, implying a cycle of disaffection toward nature [6]. Meanwhile, 8- to 18-year-olds devote an average of 7 hours and 38 minutes to using entertainment media across a typical day [7].

E.O. Wilson used the term Biophilia to characterize the ineffable feeling of well-being we receive in exchange for our innate connection to nature [8]. Wilson argues that this human need is tied to our evolutionary capacity to survive and is deeply rooted in the fabric of our DNA. In stark contrast, the noticeable absence of interaction with nature is theorized to result in negative impacts on physical, mental, and physiological health [9-14]. With his seminal text, *Last Child in the Woods* [15], Richard Louv coined the term Nature Deficit Disorder to describe the behavioral problems that can result from human development deprived of time outside. Louv posits that the majority of American children are suffering from a lack of biological connection to the natural world. While most studies concentrate on the American population, a surge in electronic device addiction that further divides human capacity for engagement indicates this epidemic likely has worldwide proportions. Scientific studies have demonstrated that an established intimacy with the natural world can decrease depression and



aggression, as well as reduce stress and anxiety [16-19]. Conversely, children in outdoor-education settings demonstrate increases in problem-solving, self-esteem, and the motivation to learn [20].

2. Establishing a New Paradigm

We must use education as a platform to reestablish the connection between humans and nature. Active learning can be a powerful tool for knowledge acquisition. As early as 1949, Ralph Tyler recognized the importance of Constructive Engagement, a concept that highlights the deep learning benefits from active engagement in education [21]. Research shows that real-world experiences and inquiry-based learning increase knowledge and retention [22].

Accompanying the worldwide trend in nature deficit is a loss of knowledge of our landscapes and the common species that occur within these systems. The famous science writer, paleontologist, and evolutionary biologist Stephen Jay Gould wrote, "We cannot win this battle to save species and environments without forging an emotional bond between ourselves and nature as well – for we will not fight to save what we do not love [23]." While technology may be partly to blame for this disconnect, these same technological tools can be employed to restore ties to the natural world through the access to knowledge they enable. With the recent pandemic and move online for a number of field courses, these tools also made it possible to transition to a flipped classroom design where students were directing their investigations [24]. Learning ecology requires a diverse approach to learning. Educators can adapt the use of these technologies to create student-centered classrooms that encourage personalized learning [25].

In this study, we explore the wide range of natural history and taxonomic identification resources available through electronic platforms, applications, and software to find which are the most useful and which are being employed by faculty and students the most. These tools can help restore the love of discovery and an appreciation of biodiversity. increases student involvement and furthers the development of practical scientific skills, such as species identification and biodiversity recognition.

3. Methodology

While traditional dichotomous keys are still necessary for the identification of obscure or unique taxa, a number of useful electronic resources and tools are available to educators to assist students with biodiversity recognition and learning local species. Typically, printed keys are vital for specialized identification, but these publications can be difficult for new users to find, use, or adopt. The majority of modern students default to using electronic tools that are readily available, have an easier user interface, and provide a much quicker means of finding a result as compared to the more traditional methods. Teaching students about natural history can increase student involvement while simultaneously developing practical scientific skills. It is important that educators familiarize themselves with these tools and identify the most valuable electronic tools in their region to assist students with these taxonomic identification shortcuts. We surveyed a total of 45 students and educators from biology courses to inquire about what tools they are using to secure species identification or facilitate knowledge transfer of natural history and taxonomy.

4. Results

Some of the most popular resources identified by students surveyed include iNaturalist, Seek, Merlin eBird, Google Lens, eBird, Discover Life, Plant Net, Bug Guide, Mushroom World, USDA Plants Database, Nature ID, Plant This, Wikipedia, Google Gemini, and Chat GPT. All students used some form of assistance from applications on their phones or electronic resources online. 98% of students reported using Seek or iNaturalist, however they had been directed to use these resources for class projects. Only 7% of students mention using books, guides, or non-electronic sources for seeking information or confirmation of identifications. 47% of students reported relying on tools like Google Lens, Wikipedia, and Chat GPT due to their ease of use and accessibility. A number of students also reported using Reddit and subreddits specific to their investigation as a resource.

5. Introduction

The survey highlighted the need for instructors to guide students to use tools with social user confirmation (like iNaturalist) to assist in correct identification, rather than relying on popular tools like Google Lens and Chat GPT, which have the potential to provide positive identifications, but more often



can be misleading and are likely to misidentify organisms. The survey also showed that students are not using books and field guides, dichotomous keys, peer-reviewed literature, and grey literature to help in their identifications. Using common tools is fine for common species, but students must also learn to use tools that will allow them to make correct taxonomic identifications.

The discipline of natural history is by its nature a regional, place-based undertaking, so the more localized and specialized towards the demands of the researcher/project objectives/taxonomic group the resource is, the better it will serve the desired purpose. I-Naturalist and its sister application, Seek, continue to be the go-to applications for instructors and students worldwide for organizing natural history projects and for taxonomic identification [26].

This study was conducted in the Southeastern United States, and there will be regional specificity when finding the most useful tools for naturalizing in a given landscape. Flora Incognita (plants), Merlin and eBird (birds), and iRecord (UK/Europe species tracking) are popular platforms to support European biodiversity monitoring, featuring specialized apps for invasive species (EASIN), mushrooms (Pilzfinder), and urban wildlife.

When designing and executing projects that involve identifying local flora and fauna, most studies also look to iNaturalist as the resource of choice because it allows for real-time record keeping of species, dates, and localities with the possibility of including photographs. This enables other users from around the world to provide identification assistance, feedback, and confirmation of observations [26]. A number of citizen science projects take advantage of the capacity of these tools to aid non-professionals in data collection, which can expand the scope and efficiency of biological surveys. This extension of public awareness has the potential to extend to conservation goals [27]. Students feel more engaged when they are contributing to scientific discovery and research and real-world knowledge [28].

6. Conclusion

Restoring the connection between people and place is vital if we expect to persist without exceeding our demands on the natural environment. Giving people the power of identity within their place and a gateway to learn the species that surround them fosters a sense of connection. Tools like iNaturalist are valuable tools to help teach students about biodiversity and when people start learning about the world around them, they tend to continue learning new species in their area with the help of these tools [17].

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