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Ecology Education Via Fish Sampling: Reflections on a Field-Based Experiential Learning

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Abstract

Because it allows students to make connections between theoretical ideas and actual environmental observations, experiential learning is crucial to ecology education. This reflection article details a field-based fish sample exercise that three final-year undergraduate biology students participated in at Sungai Labu, Sepang, Selangor, Malaysia. Students obtained hands-on experience in freshwater ecology by active involvement in fish sampling, habitat assessment, species identification, and ecological debates. The exercise improved knowledge of invasive species, ecological relationships, habitat heterogeneity, biodiversity, and human impacts on river ecosystems. Additionally, students improved their critical thinking, teamwork, environmental awareness, and observational skills. The outdoor experience showed that one of the best ways to teach ecology is still through direct involvement with natural ecosystems. In addition to being a scientific exercise, fish sampling was used as a teaching tool to improve students' understanding of freshwater biodiversity and ecological literacy. The study emphasizes how crucial experiential learning is to undergraduate biology education.

Keywords: Field-Based Learning, Ecology Education, Fish Sample, Freshwater Ecology, Biology Education, Experiential Learning

Introduction

At its core, ecology is an observational discipline that seeks to understand the interactions between organisms and their surrounding environment. Although ecological concepts can be introduced through lectures and textbooks, genuine understanding often develops through direct engagement with natural ecosystems. Experiential learning emphasizes learning through experience, reflection, and application, allowing students to transform observations into meaningful knowledge and understanding [1,2]. In ecology education, experiential approaches have been shown to strengthen scientific observation, environmental awareness, and critical thinking by enabling students to interact directly with ecological systems rather than relying solely on classroom-based instruction [3,4].

Because ecosystems are dynamic, complex, and influenced by multiple interacting biotic and abiotic factors, field-based learning is especially valuable in ecology. Students are exposed to authentic environmental conditions where physical, chemical, and biological components operate simultaneously. Such experiences encourage observation, critical thinking, problem-solving, and scientific inquiry while helping students connect theoretical concepts with real-world ecological processes [5]. Field activities have also been recognized for enhancing environmental literacy, collaborative learning, and students' confidence in interpreting ecological phenomena through direct experience [4].

Fish sampling is a particularly effective experiential learning activity because it exposes students to biodiversity assessment, habitat evaluation, ecological interactions, and field research methodologies. Through direct observation and collection of aquatic organisms, students gain practical insights that cannot be fully achieved through classroom instruction alone. Fish sampling also provides opportunities for students to develop skills in species identification, ecological interpretation, data collection, and environmental assessment while fostering curiosity and scientific inquiry [3,4]. This paper reflects on a fish sampling activity conducted at Sungai Labu and evaluates its educational significance for undergraduate biology students, particularly in promoting experiential learning and ecological understanding.

Study Location and Field Work

On May 24, 2025, the fieldwork was carried out in Sungai Labu, Sepang, Selangor, Malaysia (Figure 1). The river has comparatively little anthropogenic disruption and is mostly flanked by agricultural landscapes. The location offered the perfect setting for teaching students about freshwater ecology, habitat evaluation, and biodiversity observation.

Dino, Zackh, and Sayed, three biology final-year students, took part in the activity. Cast nets (jala ikan) were used for fish sampling. Students participated in fish collecting, specimen handling, species identification, habitat observation, and ecological conversations. Instead of emphasizing passive observation, the activity focused on experience learning through direct engagement.



Figure 1: On May 24, 2025, three final-year undergraduate biology students in Sungai Labu, Sepang, Selangor, Malaysia, undertook a fish sampling operation. The river served as an outdoor classroom for hands-on instruction in freshwater ecology, habitat evaluation, and biodiversity assessment

Fish Sampling Learning Outcomes

Students were directly exposed to freshwater environments and biodiversity during the outdoor activity. Students saw variations in vegetation structure, habitat features, water movement, and substrate composition. They were able to recognize habitat heterogeneity and comprehend how environmental factors affect the existence and distribution of species thanks to these observations.

Students were also introduced to biodiversity assessment through fish sampling. Students were able to analyze morphological traits, talk about species identification, and investigate ecological adaptations using captured specimens (Figure 2). Discussions about the ecology of invasive species, habitat degradation, and freshwater ecosystem management were sparked by the discovery of invasive Amazon sailfin catfish (*Pterygoplichthys* spp.). This species' existence turned a theoretical classroom subject into an actual ecological case study.

Fish sampling operations carried out during the field exercise are shown in Figure 2. (A) Students setting up a net in the river. (B) Analyzing collected specimens, such as invasive Amazon sailfin catfish (*Pterygoplichthys* spp.). Students learned about species identification, biodiversity assessment, and practical ecological field techniques through the exercise.



Figure 2: Fish sampling activities conducted during the field exercise. (A) Students deploying a cast net in the river. (B) Examination of captured specimens including invasive Amazon sailfin catfish (*Pterygoplichthys* spp.). The exercise exposed students to practical ecological field methods, species identification, and biodiversity assessment

The exercise improved comprehension of ecological relationships and ecosystem functioning. Students talked about species relationships, habitat utilization, resource availability, and environmental adaptation. Additionally, they looked at the potential effects of nearby agriculture practices and other human influences on freshwater ecosystems. These conversations emphasized the interdependence of ecological processes and promoted systems thinking.

Significantly, scientific field procedures were introduced to the students. They obtained hands-on experience in ecological research by handling fish specimens, installing cast nets, and analyzing field observations. The exercise showed how uncertainty, unpredictability, and environmental complexity are frequently present in ecological investigations, offering important insights into the process of producing scientific knowledge.

Reflections Thoughts on Experiential Education

The fish sample exercise effectively linked practical field experience with theoretical ecological knowledge (Figure 3). In order to comprehend how ecological ideas function in actual ecosystems, students were allowed to observe the concepts that were covered in lectures. Effective learning happens when experience is converted into understanding through application and reflection, according to experiential learning theory [2]. This method was demonstrated by the activity.



Figure 3: After a successful fish sample at Sungai Labu, Sepang, Selangor, Malaysia, students' excitement and experiential learning outcomes. Fish specimens gathered during the field practice are shown by Dino, Zackh, and Sayed from left to right. The image demonstrates how field-based experiential learning fosters positive emotional involvement, a sense of accomplishment, teamwork, and satisfaction

The growth of scientific observation and critical thinking abilities was one of the most important results. Pupils gained the ability to recognize ecological patterns, pose inquiries, and analyze their surroundings. They actively interacted with the ecosystem and took part in the learning process as opposed to passively absorbing knowledge. An essential component of experiential education is this kind of involvement [6].

Additionally, the activity encouraged motivation, teamwork, and communication. For fish sampling to be successful, participants had to work together and share tasks. After successful fish captures, the students' positive emotional reactions showed excitement, self-assurance, and contentment (Figure 3). These encounters improved participation and deepened understanding of ecological fieldwork.

The exercise promoted environmental care and awareness in addition to academic learning. Students developed a greater understanding of freshwater biodiversity and the significance of aquatic ecosystem preservation. Reflection on environmental responsibility and the role of ecological research in tackling current environmental concerns was prompted by direct engagement with nature.

Conclusion

The fish sample exercise illustrated the educational benefits of experience learning in the subject of ecology. Students learned about biodiversity, habitat features, ecological interactions, invasive species, and environmental factors through hands-on experience in a freshwater ecosystem. Through involvement and observation, ideas presented in lectures became concrete experiences.

Critical thinking, communication, teamwork, scientific observation abilities, and environmental awareness were all enhanced by the activity. Students actively participated in ecological research rather than being passive consumers of knowledge. Both academic knowledge and professional skills pertinent to the biological sciences are strengthened by such encounters.

In the end, fish sampling is a useful teaching tool for ecology courses for undergraduates. Field-based experiential learning fosters ecological literacy, environmental responsibility, and an appreciation of biodiversity by putting students in close contact with natural ecosystems. Maintaining opportunities for real-world fieldwork is crucial for preparing next biologists and environmental scientists as ecological issues become more complex.

Declaration on the Use of Artificial Intelligence

The author declares that generative artificial intelligence tools were used in a supportive capacity during the preparation of this manuscript. These tools assisted with language refinement, structural organisation, and stylistic clarity of the text. All ideas, interpretations, reflections, and conclusions presented in this paper are the author's own and are grounded in personal experience and scholarly judgment. The author retains full responsibility for the content, accuracy, originality, and integrity of the manuscript.s

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