UNDERGRADUATE EDUCATION

Free Online Multiplayer Games as Inclusive Tools for Teaching Ecology

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Abstract

Teaching ecology is the primary way of communicating the current knowledge in the discipline to future generations. Besides general tools (e.g., lectures, videos, simulations, and having students read published literature), experimenting and field practices are two principal ways to teach ecology. However, funding shortages along with the fact that some phenomena occur in large spatial and long temporal scales, hinder the use of experiments and fieldwork in pedagogy. Computer-based games are interactive digital tools that were initially designed to be entertaining and engaging. In addition, they are effective motivational educational tools that are already being used in the pedagogy of various majors. Still, few studies have assessed the application of games in teaching ecology. Although those studies reported positive feedback from the students, they reported that making these games is expensive and time-consuming. Therefore, educators would benefit from using free and globally accessible games. Here, I introduce the application of online multiplayer games in teaching ecology. Recently, I explored a snake game in which its environment resembles artificial ecosystems. Each player (i.e., each snake) can be regarded as an individual of a population or a species within a community. Then, a couple of general ecological rules, phenomena, and analyses can be easily inferred from these games. I asked the undergraduate students to play these games, collect the data, and write a report on their analysis. The students deduced different ecological phenomena from their in-game experience and reported these games are useful and fun to play. Many games have been produced to increase global awareness of human actions on the environment. These games are geared toward various age groups, including children, young adults, and adults. Two obstacles hinder the use of these games in pedagogy. First, most of the games are not globally accessible, and second, their effectiveness in teaching

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has not been assessed yet. I envision a future where online games are integrated as part of the pedagogy in ecology. These games are globally accessible, therefore, no barriers exist to test the application of these games. I encourage the readers to conduct a global survey on their usefulness. This might be a step toward reaching a globally inclusive pedagogy in ecology.

Key words: *games; inclusive methods; pedagogy; teaching.*

Introduction

We are in an age of climate and land use changes, where these two greatly alter biodiversity, species existence, ecosystem services, and supplies (Foley et al. 2005, Pecl et al. 2017, Woolway et al. 2020, Winkler et al. 2021, Jaureguiberry et al. 2022). Teaching ecology is one of the main ways to ensure the communication of our current knowledge within the discipline to future generations (Nordlund 2016, Cooke et al. 2021, Žalėnienė and Pereira 2021, Ruhl et al. 2022). Undergrad students have difficulties understanding ecological rules or phenomena, especially those that occur at larger spatial and longer temporal scales (Finn et al. 2002, King et al. 2014, Cooke et al. 2021, Lortie 2023). Although experimentation and field practices facilitate teaching, testing these above-mentioned phenomena in the real world is expensive or impossible (Finn et al. 2002, Stafford et al. 2010, Ruhl et al. 2022, Kamarainen et al. 2023). This problem gets worse in the global south, where educational budgets are relatively low and there is a lack of infrastructure (Birdsall 1996, Glewwe and Kremer 2006, Glewwe and Muralidharan 2016).

The application of games, specifically computer-based games, in teaching various majors is already proven (Whitton and Moseley 2012, Felszeghy et al. 2019, Coleman and Money 2020). These teaching tools have many pros and cons already discussed in the literature (Arango-Lopez et al. 2018, De Freitas 2018, Acquah and Katz 2020). There are games that have been designed to teach ecology (e.g., The Floristic Relay Game; Ortiz-Barney et al. 2005 and The Insect Predation Game; Hoback and Smith 2006) or increase environmental awareness, for example, Eco Tycoon (Wikipedia Contributors 2023), Rivercraft (UK Environment Agency 2022), Eco (Wikipedia Contributors 2024a), Plasticity (Larreina Morales and Gunella 2022), and Terra Nil (Wikipedia Contributors 2024b). Also, some web pages list environmental science Apps, games, and websites, for example, common sense education (https://www.commonsense.org/education/lists/excellent-ecology-and-environmental-science-apps-games-and-websites). The biggest problem, which I have encountered, is that most of these games are not globally accessible.

Few studies mentioned the use of games in teaching ecology. For example, Ameerbakhsh et al. (2019) compared two methods of using a serious game for teaching marine ecology in a university and declared that students enjoyed using the game and said it was useful for learning. Furthermore, King et al. (2014) integrated a mobile-based game application into a forest ecology course. They reported that ~80% of students were able to engage with this learning technology successfully. Designing new games or writing a computer-based game dedicated to teaching was the costly part of these studies, making those games unavailable for global access. Two successful studies use purely entertaining games for ecological learning. Coroller and Flinois (2023) suggested that the skill to identify collected specimens in-game is transferrable to real-life organisms. Drew et al. (2017) used Pokémon GO to teach principles of ecology. They found that students showed an improved ability to ask scientific questions on data and explain in-game phenomena in an ecological framework.

Online multiplayer snake games and their use in teaching

Recently, I have found free online multiplayer snake games. In these games, online players eat dots or other circle-shaped objects to grow big. Further, a player can hunt the other players and what remains from the body of the dead snake can be eaten with a bonus of 10-fold to the normal foods of the game. As the players eat lots of food and hunt other players, they will grow bigger reducing the available space for the other players. These online games can be played using PCs, mobile phones, and tablets. During my play runs in the *snake.io* platform, I found the frequency distribution of the top 10 players very similar to the different rank-abundance models. Also, the behavior of players, where large players avoid contact with each, other reminded me of the niche compartmentalization phenomena.

To test whether students can perceive any ecological rule/phenomenon from these games, I asked my undergraduate students at the Ferdowsi University of Mashhad in the Plant Ecology course to play this game 100 times. I have set this work as an optional task. For each run, I asked them to note their scores along with those of the 10 top players. I asked them to write a one-page report analyzing their findings and examining the ecological phenomena they observed when playing the game. Approximately 50% of students did the assignment. They had an age range from 20 to 23. They reported this game as an enjoyable task and deduced various ecological phenomena from the game. For example, they declared that the players' behavior to gain scores resembles different competition strategies; after the elimination of the largest snake, there is a period when the number of snakes increases, however, they grow and disappear at a faster pace compared to the presence of a large snake. The students likened it to the early stages of succession. The presence of one very large snake leads to the faster elimination of other snakes due to the space shortage; some of the students report this phenomenon as similar to the presence of dominant (maybe invasive) species in an ecosystem.

Conclusion

By engaging the students in playing this game, I asked them to act as "ecological detectives" (Hillborn and Mangel 1997) and observe the game environment to find ecological clues. This game is free and can be accessed globally. An important issue is whether games can be used to introduce concepts to students, as opposed to solidifying knowledge of concepts learned through lectures. We can evaluate the application of games in these two manners, simply by asking students with ecological and no ecological backgrounds to play the game and correlate their in-game experience with environmental attributes they are familiar with. Playing this game will be useful for undergraduate students who are taking general ecology, animal or plant ecology, and biodiversity courses. Further research can be conducted to test the usefulness of these games in teaching ecology globally. There is no barrier to using these games and they are free and accessible. Including these types of games in the pedagogy of ecology can be a step toward making ecology a more inclusive major. Considering the pros and cons of using games in learning, I believe that the use of digital learning resources is required to be accompanied by field or laboratory experiments (Stafford et al. 2010).

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Open research statement

No data were collected for this article.

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