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Research on the Data Education Ecosystem based on the Theory of Ecotones

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Abstract

This paper discusses the similarities between the digital education ecosystem and natural ecological ecotones, emphasizing fundamental characteristics of the digital education ecosystem such as its boundaryless and ever-changing nature, as well as its intersection with digital and educational ecosystems. It also elaborates on the similarities between the digital education ecosystem and the educational ecosystem, comparing their species exchange rates and diversity. The digital education ecosystem not only demonstrates a higher species exchange rate but also exhibits greater species diversity. Furthermore, the development of the digital education ecosystem relies on the joint participation of information technology enterprises and the education sector, alongside global governmental emphasis on educational informatization. Lastly, employing the theory of ecotones, the paper analyzes and explains some current issues in educational informatization, such as why certain teachers and students lack deep involvement in educational informatization.

Keywords

Digital Education Ecosystem; Ecotone Theory; Educational Ecology.

1. Introduction

Ecotone, also referred to as an ecological transition zone in some domestic literature, was introduced by the American ecologist F.E. Clements in 1905. Its initial definition referred to the tension zone where plant populations overlapped due to climatic influences. In 1953, E.P. Odum, considered the father of modern ecology, introduced the term "Ecotone" as the transitional area between two communities in his ecological masterpiece "Fundamentals of Ecology," developing an ecological conceptual framework to study ecotones. Leveraging the theory of ecotones, this project conducts ecosystem design integrating information technology and education, utilizing ecological metaphors as an innovative approach in today's technological domain. Metaphors prove particularly useful in the early stages of the design process, especially when the problem context is ambiguous or ill-defined. They aid in understanding based on known contexts and proposing innovative design solutions (Casakin, 2007).

We can term the ecological intersection of digital ecosystems and educational ecosystems as the "Digital Education Ecosystem," akin to findings by Prendergast (2000), which revealed certain similarities between the digital education ecosystem and natural ecological ecotones.

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2. The Similarities between the Digital Education Ecosystem and Natural Ecological Ecotones

2.1. The Digital Education Ecosystem: A Boundaryless, Ever-Evolving, Open Threshold Area

Firstly, the potential globally interconnected digital education ecosystem lacks clear boundaries, making it difficult to distinctly differentiate between the digital education ecosystem, educational ecosystem, and digital ecosystems. Secondly, the digital education ecosystem is in a constant state of flux. Different technologies and platforms give rise to diverse digital education subsystems, with species populations within each subsystem experiencing rapid growth and decline. Thirdly, the digital education ecosystem is an open space, reliant on external funding, technology, and various digital resources to maintain its ecological balance, fostering close connections with external entities. Lastly, it occupies the boundary zone between educational and digital ecosystems, known in innovative research fields as the "Liminal Zone," characterized by a heightened rate of innovation and a greater probability of innovative success. Over the past decade, theoretical and technological innovations originating from the digital education ecosystem have far exceeded those in the field of education theory. Therefore, the digital education ecosystem embodies the fundamental characteristics of ecotones: boundaryless, ever-changing, open threshold areas.

2.2. Higher Species Exchange Rate and Diversity in Digital Education Ecosystem

On one hand, compared to educational and digital ecosystems, the digital education ecosystem exhibits a higher rate of species exchange. Species within the digital education ecosystem encompass all participants reliant on various platforms, technologies, and educational domains. For instance, platforms like Apex, Aventa, and E2020 predominantly offer K-12 full-course online learning, whereas MOOC platforms like Coursera, Udacity, and edX focus on online education for university students. Due to the finite lifespans of these platforms - for example, the previously popular World University City (www.worlduc.com) in China now has very few active users - populations dependent on these platforms experience rapid growth and decline. Unlike conventional school education with stable population numbers, or relatively "persistent" digital technology participants and resource providers within the digital ecosystem, the digital education ecosystem experiences higher rates of species exchange.

On the other hand, the digital education ecosystem also boasts greater species diversity. This diversity arises from different technologies, platforms, and even distinct disciplinary fields, resulting in diverse species. For instance, students in the same grade studying English and physics might belong to the same population within the educational ecosystem due to shared living areas and other similar characteristics that enable collective management. However, within the digital education ecosystem, these students might opt for entirely different platforms, technologies, and learning pathways. While credit recognition might be possible, at a data level, they belong to entirely different classes within the digital education ecosystem, representing distinct species categories. Therefore, the inherent complexity of the digital education ecosystem determines the diversity of its species.

2.3. The Digital Education Ecosystem: Driving Transformation through Interaction between Digital and Educational Ecosystems

The wave of educational informatization development is inseparable from the joint participation of IT enterprises and the education sector. In August 2010, at the Techonomy conference held in California, USA, then-Microsoft Chairman Bill Gates stated that the internet would become the best "classroom" for the public to acquire knowledge. Steve Jobs boldly

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predicted that electronic technology would dominate the future classroom and yield substantial profits. Driven by international IT giants like Microsoft, Google, and Apple, global internet education has seen unprecedented growth, with various digital education models like MOOCs, SPOCs, and flipped classrooms emerging. Simultaneously, governments worldwide place significant emphasis on educational informatization. For example, the United States initiated research and practice in computer-assisted instruction as early as the 1950s. Over the past 20 years, the country has successively issued five National Education Technology Plans (NETP), with the most recent released in 2017. The 2017 "National Education Technology Plan" for Higher Education proposed to "reshape technology's role in higher education" and explore technology's role in student-centered higher education ecosystems.

Domestic IT enterprises in China have also introduced digital education service platforms. For instance, Baidu launched Baidu Baike and Baidu Smart Classroom, Tencent introduced Tencent Classroom, and NetEase developed NetEase Cloud Classroom. Strong IT companies support some national-level MOOC platforms. For example, "Chinese University MOOC," jointly created by Higher Education Press and NetEase, offers over a thousand courses, including 322 nationally recognized excellent online open courses from 985 universities. Simultaneously, the Ministry of Education vigorously promotes educational informatization. Various documents, such as the "Ten-Year Development Plan for Educational Informatization (2011-2020)" in 2012, the "Guiding Opinions on Comprehensive Promotion of Educational Informatization during the 'Thirteenth Five-Year Plan'" in 2015, the "Education Informatization 2.0 Action Plan" in 2018, and the "Guiding Opinions on Strengthening the Construction and Application of Online Learning Spaces" in 2019, highlight the importance of educational informatization for modernizing China's education system, receiving high attention from governments at all levels and schools, from central to local.

As such, the formation and development of the digital education ecosystem are not solely influenced by one aspect of the digital or educational ecosystems but are the result of interactive transformation between the digital and educational ecosystems.

From the aforementioned points, it is evident that the digital education ecosystem embodies the basic characteristics of natural ecological ecotones. It serves as an ecological intersection between the digital and educational ecosystems, acting as a bridge between digital technology and education. The species within the digital education ecosystem maintain close, frequent, extensive, and in-depth connections and interactions with the species in the digital and educational ecosystems. Studying and formulating policies for the digital education ecosystem can draw inspiration from natural ecological ecotones.

The diagram below provides a basic description of the digital education ecosystem. Although it may not adhere strictly to a typical digital or educational ecosystem, it shares fundamental characteristics of ecosystems, described metaphorically using an ecosystem model. The digital education ecosystem consists of numerous subsystems, each comprised of communities and habitats. Communities represent the collective of digital education participants, including students, teachers, parents, administrators, and service personnel, constituting various population types. Habitats can be further divided into several smaller habitats, such as various online classrooms and virtual offices. Specific populations and smaller habitats constitute ecological niches, representing the minimum threshold for various digital education activities, including online educational, learning, and management activities.

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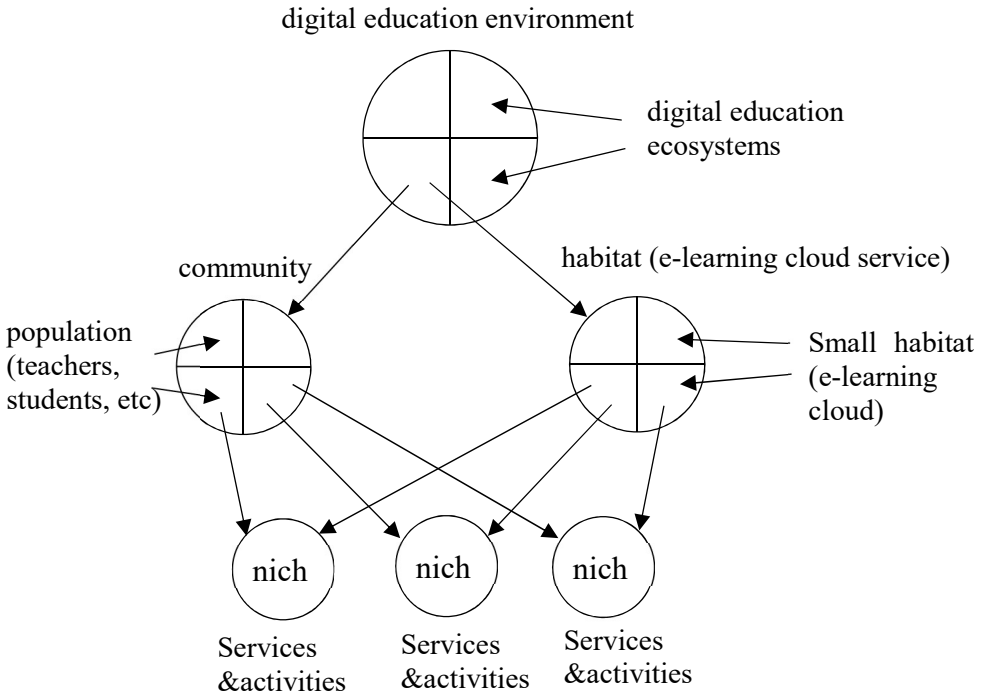


Fig. 1 Conceptual Model of Digital Education Ecosystem

3. Understanding Current Issues in Educational Informatization Through the Lens of Ecotone Theory

When we convert the research object of information technology and education integration into the ecological ecotone of digital ecosystem and educational ecosystem, some existing problems can be explained. The following figure is drawn with reference to the grassland desert ecological ecotone in Figure 1, where A, B and C represent teachers and the numbers 1, 2 and 3 represent students. C is located in the ecological ecotone. It is a long-term participant and builder in the digital education ecosystem, and an active population in the digital education ecosystem. It is different from ordinary school teachers, but also an online teacher or virtual teacher. B is closer to the ecotone and interacts closely with it. It continuously obtains resources from the ecotone and provides some resources to the ecotone, but its main activity area is still in schools, that is, in a typical educational ecosystem. A is far away from the ecotone and has no direct connection with it. All his teaching activities and scope of activities are in a typical educational ecosystem, as shown in Figure 2 (see the next page).

3.1. Question 1: Why are Some Teachers and Students not Deeply Involved in Education Informatization?

In Fig. 2, A represents a group of teachers who do not actively participate in education informatization. They are far away from the interlaced zone and have no direct interaction with the interlaced zone. According to the understanding of natural ecological ecotone, the area far away from the ecotone usually has a more stable ecological factor structure, less competition between populations, and much less survival pressure than the species in the ecotone. At the same time, if these species are forcibly moved to the ecotone, it will not bring good results. They may not be able to adapt to the environment of the ecotone. This is called "selective penetrability" in ecology, that is, the ecotone hinders the distribution of species like a fence. Only creatures adapted to the environment of the ecotone can penetrate the fence.

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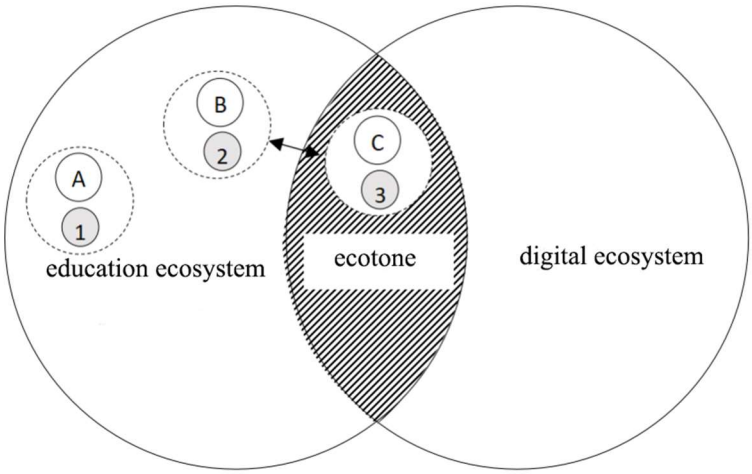


Fig. 2 Digital education ecological ecotone

From the perspective of the ecological ecotone theory, it is not difficult to understand that some of our teachers and managers have become less adaptable to environmental changes due to the lack of competition and survival pressure due to their long-term stable living environment. When we need to be close to the ecological ecotone, that is, we need to change our ideas and deeply participate in the education informatization, we will become unable to interact with the technical population in the ecological ecotone (such as various digital education equipment, APP, etc.), and can not adapt to the changes in the entire teaching environment brought about by digitalization. In the absence of mandatory external force, this group will be in a stable and relatively closed living area for a long time, and students taught by this type of teachers will naturally be unable to meet the basic quality requirements for students in the digital learning environment. To solve this problem, we will try to design the model later, such as increasing the exchange frequency of A and B, and indirectly realizing the interaction between A and the interlaced band.

3.2. Question 2: Will Traditional School Education Disappear in the Future?

Since the rise of computer assisted education in the 1950s, some scholars have discussed whether digital technologies such as multimedia will replace school education. Until recent years, with the rapid development of Mukden, some scholars even proposed that in future education, only a few good online teachers are needed for each course to teach all students in a region, and most teachers will change from teaching dominance to teaching assistance. We understand this problem according to the theory of ecological ecotone. The educational ecosystem is a relatively stable and independent system, which has its own operation and development laws. Even if the entire educational ecosystem has completed the digital transformation one day in the future, digitalization will be only the infrastructure of the whole society at that time. Like our current multimedia equipment, it will not affect the basic structure Functions and laws. With the progress of human beings, technology is also developing constantly. At that time, the education ecosystem may also face the problem of integration with the new technology ecosystem. In 2017, the article the future of employment.

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