The "Ecological Niche-Carrying Capacity" Crisis and Symbiotic Pathways of Primary Education Programs in Higher Vocational Colleges under the Context of Population Decline: A Structural Reflection from the Perspective of Educational Ecology

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Abstract

Against the backdrop of China's unprecedented population decline, this paper employs educational-ecology theory to examine the "niche–carrying-capacity" crisis confronting primary-education programmes in higher-vocational colleges (HVCs). Using literature review and conceptual analysis, the study finds that falling birth rates have shrunk the social niche for these programmes while simultaneously over-loading their institutional carrying capacity, resulting in enrolment shortages, resource waste and curricular mismatch. To restore ecosystem balance, the paper proposes three symbiotic pathways: (1) re-niching through interdisciplinary curriculum expansion (early-childhood, educational-technology and psychology tracks); (2) optimising carrying capacity via resource-sharing, blended learning and flexible class-size policies; and (3) enhancing adaptive fitness by deepening school–enterprise cooperation, practice-based training and localized graduate-output agreements. The ecological lens reveals that sustainable survival depends on continuous co-evolution with demographic, labour-market and policy sub-systems. Limitations and directions for empirical, interdisciplinary and regional longitudinal studies are discussed.

Keywords: population decline; primary-education programme; higher-vocational college; educational ecology; ecological niche; carrying capacity; symbiotic pathway

1. Introduction

As China enters a period of population decline, profound changes in the social structure are gradually affecting various sectors, with the education sector being particularly evident. According to data released by the National Bureau of Statistics of China, the number of births in 2024 decreased to 9.54 million, marking the lowest level since 1978 (National Bureau of Statistics, 2024). The decline in birth rates and the intensification of population aging present significant challenges to the supply of educational resources, particularly in the field of primary and secondary education. The demand for primary school teachers is gradually decreasing, and the enrollment situation for primary education programs in higher vocational colleges is becoming increasingly severe. Population decline not only impacts the demand for primary education but also exerts substantial pressure on the development of primary education programs in vocational institutions. In this context, ensuring the sustainable development of primary education programs in higher vocational colleges and addressing the challenges posed by changes in the educational ecosystem have become urgent issues that need to be addressed.

Nevertheless, primary education programs in higher vocational colleges still possess unique practical advantages, having trained a large number of teachers who meet societal needs. These colleges emphasize the cultivation of students' practical abilities, with a curriculum that highlights "learning by doing." This practice-oriented approach has allowed these programs to maintain an important position in the education system. However, as the demand for teachers declines due to population decrease, the primary education programs in vocational colleges are facing the dual challenges of declining enrollment numbers and insufficient student recruitment. According to the China Higher Vocational Education Development Report (2024), in regions with smaller populations, the enrollment numbers in education-related programs have significantly decreased, especially in primary education programs, which are experiencing a severe shortage of applicants.

Therefore, identifying a symbiotic path for primary education programs in higher vocational colleges that adapts to social changes under the current context of population decline has become a key issue in this field of research. Educational ecology offers a new perspective for analyzing this phenomenon. Educational ecology emphasizes the interaction and adaptation mechanisms among various educational elements within an educational system. From an ecological perspective, each educational program has its unique "ecological niche," referring to its position and role within the social and educational system. At the same time, the educational ecosystem has its "carrying capacity," which refers to the maximum sustainable capacity that the system can support without losing balance. For primary education programs in higher vocational colleges, their "ecological niche" is not only about the social function and demand of the program within the educational system but also involves whether the program can adapt to the challenges posed by population changes and whether it can produce graduates who meet market demands.

This study will explore the "ecological niche—carrying capacity" crisis and its adjustment pathways faced by primary education programs in higher vocational colleges under the background of population decline in China, from the perspective of educational ecology. By analyzing the interactions among the various elements of the educational ecosystem, this paper aims to propose adjustment strategies for primary education programs in higher vocational colleges, in order to achieve balanced and sustainable development of the educational system.

2. Literature Review

2.1 The Impact of Population Decline on the Education Sector

China's entry into a period of population decline has become one of the significant characteristics of social development, especially with the continuous decline in birth rates and the intensification of population aging. This trend has had a profound impact on the education sector. According to data from the National Bureau of Statistics (2024), the number of births in 2024 reached a historical low, and the growth of the total population has slowed. This directly affects the demand for the basic education system. Wang Xiaobo (2025) suggests that the impact of population decline on education is primarily reflected in the decrease in student enrollment and the oversupply of educational resources. Specifically, as the number of students decreases, the demand for primary school teachers gradually reduces, and in some areas, an issue of "oversupply of primary school teachers" has emerged.

Population decline has triggered a structural adjustment in educational resources, especially at the primary education level. Some schools are facing the dilemma of declining student numbers, with an imbalance in the teacher workforce and educational resources. Moreover, the impact of population changes on higher vocational colleges has become increasingly prominent, especially in terms of enrollment in primary education programs. As the population declines, the recruitment of students has gradually decreased, and the enrollment pressure on higher vocational colleges has increased. This change requires adjustments in educational policies to promote the rational allocation and optimization of educational resources.

2.2 The Current Situation of Primary Education Programs in Higher Vocational Colleges

Since its establishment, primary education programs in higher vocational colleges have played a vital role in training teachers for basic education. Li Jiayan (2024) pointed out that primary education programs are among the best choices for higher vocational colleges to pilot professional accreditation. This program, with its strong practical and applied focus, has attracted a large number of students. However, with

population decline and changes in the demand for basic education, primary education programs in higher vocational colleges are facing challenges related to enrollment difficulties and curriculum mismatches. According to the China Higher Vocational Education Development Report (Ministry of Education, 2024), enrollment numbers in some higher vocational colleges for primary education programs have significantly decreased in recent years. In regions with more abundant educational resources, the increasing variety of student choices has led to a more pronounced loss of applicants for these programs.

Hou Yingchao (2025) pointed out that primary education programs in higher vocational colleges emphasize the cultivation of practical skills, aiming to enhance students' teaching abilities and practical operational capabilities. However, the lack of updates and diversification in curriculum content has been insufficient to meet the changing demands of the market. Some higher vocational colleges have taken positive measures in professional settings and teaching reforms, such as collaborating with primary education schools to develop "school-enterprise cooperation" projects to enhance students' employability (Li Jiayan, 2024). However, overall, there is still considerable room for improvement in the alignment of curricula with market demands.

2.3 The Application and Development of Educational Ecology

Educational ecology is a discipline that studies the interactions and adaptability of various elements within an educational system. As educational reforms have deepened, educational ecology has gradually become an important theoretical tool for addressing structural issues in education. Educational ecology emphasizes the dynamic balance and mutual adaptation of elements within an educational system, particularly how to adjust the system in response to changes in the external environment (Li Wenjuan & Yue Wei, 2025). Within this framework, the concepts of "ecological niche" and "carrying capacity" have become crucial for analyzing the educational system. The "ecological niche" in educational ecology refers to the function and role of an educational program within a specific educational environment, while "carrying capacity" refers to the maximum teaching scale and talent cultivation capacity that the program can support within the current social, economic, and cultural context.

In recent years, these concepts have been widely applied in the educational reforms of higher vocational colleges. Li Jiayan and Song Lihua (2025) propose that, under the backdrop of population changes, the "ecological niche" of primary education programs in higher vocational colleges needs to be redefined, and their "carrying capacity" must align with educational demands to ensure the sustainable development of the program. In this context, higher vocational colleges need to adjust their professional settings by redefining their ecological niches to ensure that they can find new positions in the increasingly competitive educational market.

2.4 Research Gaps and Contributions of This Study

Although some scholars have explored the changes in the educational system under the context of population decline, systematic research specifically addressing the "ecological niche—carrying capacity" crisis of primary education programs in higher vocational colleges remains scarce. Existing studies mainly focus on the changes in primary education market demand and enrollment trends, but there is a lack of research from the perspective of educational ecology, particularly in exploring how adjustments to the internal elements of the educational ecosystem can lead to the sustainable development of the educational system.

Therefore, this study will adopt the theoretical framework of educational ecology to explore the "ecological niche—carrying capacity" crisis faced by primary education programs in higher vocational colleges under the context of population decline and propose corresponding adjustment pathways and symbiotic strategies.

3. Theoretical Framework and Analysis

3.1 Theoretical Framework of Educational Ecology

Educational ecology is an interdisciplinary theoretical framework aimed at studying the interrelationships and adaptation mechanisms among various elements within the educational system. This theory, derived from the ecological concepts of "ecological niche" and "carrying capacity," provides a powerful tool for analyzing the changes and development of educational systems (Bronfenbrenner, 1979). In the field of education, ecology emphasizes the interactions and balance between various educational elements, focusing on the adaptability of the educational system in a constantly changing social environment.

Ecological Niche

The concept of ecological niche originally comes from ecology, referring to the functional positioning and role of a species within its ecosystem (Hutchinson, 1957). In the educational system, the "ecological niche" refers to the role and function of an educational program within a specific environment. For primary education programs in higher vocational colleges, the ecological niche reflects factors such as the program's social demand, labor market needs, and the allocation of educational resources. As population decline progresses, changes in society’s demand for primary education have altered the ecological niche of the program. The reduction in population has led to a shrinking demand in basic education, necessitating a redefinition of the program's role and function in this new context.

Carrying Capacity

Carrying capacity is a concept in ecology used to describe the number of species and population density an ecosystem can support (Odum, 1971). In educational ecology, carrying capacity refers to the ability of the educational system to sustain a certain number of students and match educational resources without causing imbalance. For primary education programs in higher vocational colleges, carrying capacity is reflected in how many students can be trained to meet market demands while ensuring that educational quality is not compromised. As population decline leads to fewer students, and educational resources remain limited, the carrying capacity of the program faces significant challenges. In this context, optimizing resource allocation and adjusting the educational system to adapt to demographic changes becomes a crucial task for higher vocational colleges.

3.2 The "Ecological Niche—Carrying Capacity" Crisis from the Educational Ecology Perspective

Primary education programs in higher vocational colleges are facing the "ecological niche—carrying capacity" crisis triggered by population decline. This crisis manifests in several ways:

Shrinking Ecological Niche

Against the backdrop of population decline, the demand for primary school teachers is gradually decreasing, particularly in areas with low population density where the demand for basic education has reached saturation. As a vital pathway for training primary education teachers, the ecological niche of primary education programs in higher vocational colleges is inevitably challenged. With the contraction of the primary education market, the social demand for these programs has declined, resulting in difficulties in enrollment. In this situation, higher vocational colleges need to redefine the ecological niche of their primary education programs by adjusting curriculum design, teaching modes, and collaborating with local governments and educational authorities to enhance their market appeal.

Overload of Carrying Capacity

Due to the decline in birth rates, the overall demand for primary school teachers has decreased, directly resulting in fewer applicants for primary education programs in higher vocational colleges. According to the theory of educational ecology, this shift leads to the risk of an overloaded carrying capacity. The overload of carrying capacity is characterized by the excessive use of educational resources and a mismatch between student numbers and available resources. Higher vocational colleges continue to maintain excessive enrollment quotas and resource allocations, while the insufficient number of students results in these resources not being fully utilized, leading to "resource waste." Moreover, the reduction in student numbers, coupled with an oversupply of teaching staff and curriculum resources, has made it difficult to

maintain the quality of education, exacerbating the problem of carrying capacity overload.

Adaptability Issues in the Educational System

A core concept in educational ecology is adaptability, which refers to the capacity of the educational system to adjust according to changes in the external environment, maintaining system stability and development (Bronfenbrenner, 1979). However, in the context of population decline, many primary education programs in higher vocational colleges have not effectively adjusted their teaching models and curricula, resulting in insufficient adaptability. This is manifested in several ways: overly rigid curricula that fail to meet the evolving needs of basic education; unequal distribution of teaching resources, which cannot support the personalized development of diverse student needs; and inadequate career guidance and professional development support, leading to difficulties for students in securing suitable employment after graduation. To address these issues, higher vocational colleges must strengthen cooperation with industry, local governments, and basic education sectors to enhance the adaptability of their programs and restore balance to the educational ecosystem.

3.3 Adjustment Strategies: Pathways from the Educational Ecology Perspective

To address the "ecological niche—carrying capacity" crisis faced by primary education programs in higher vocational colleges, educational ecology provides several feasible adjustment strategies. The following pathways are potential solutions derived through the theoretical framework:

Redefining the Ecological Niche: Diversified Development

Higher vocational colleges can redefine the ecological niche of primary education programs through curriculum innovation and interdisciplinary development. For example, in addition to traditional primary education courses, interdisciplinary courses such as early childhood education, educational technology, and psychology can be added to meet the societal demand for versatile talent. This transformation would not only expand the market space for the program but also attract more students to apply.

Optimizing Carrying Capacity: Improving Resource Allocation Efficiency

To mitigate the issue of carrying capacity overload, higher vocational colleges need to optimize resource allocation and improve the efficiency of educational resource usage. For instance, measures such as streamlining program settings, increasing class sizes, and incorporating online education can reduce the waste of educational resources and enhance their utilization. At the same time, strengthening the alignment with societal

needs ensures that students are able to find suitable employment after graduation, avoiding the issue of oversaturation.

Enhancing Adaptability: Strengthening School-Enterprise Cooperation and Practical Education

To enhance the adaptability of primary education programs, higher vocational colleges can strengthen school-enterprise cooperation and increase the emphasis on practical education. For example, establishing deep partnerships with local primary schools and educational institutions can provide more internship opportunities and employment pathways for students. Additionally, offering social practice courses, career development planning, and other initiatives can help students better adapt to the future education market.

3.4 Conclusion

Through the lens of educational ecology, this chapter has analyzed how primary education programs in higher vocational colleges can address the crisis and challenges posed by population decline and changes in educational demand from the perspective of "ecological niche" and "carrying capacity." Specifically, population decline has led to a shrinking ecological niche and an overloaded carrying capacity, which in turn affects enrollment and education quality. To tackle this crisis, higher vocational colleges need to adjust by redefining the ecological niche, optimizing resource allocation, and enhancing system adaptability. The theoretical framework of educational ecology provides strong theoretical support for this process and offers practical guidance for future educational reforms in higher vocational colleges.

4. Conclusion and Prospects

4.1 Research Summary

This study, through the perspective of educational ecology, explores the "ecological niche—carrying capacity" crisis and symbiotic pathways of primary education programs in higher vocational colleges under the context of population decline. Through a review of the literature and theoretical analysis, the following key conclusions have been drawn:

Impact of Population Decline on Primary Education Programs in Higher Vocational Colleges: Population decline has led to a contraction in the demand for primary education, which in turn affects enrollment in primary education programs in higher vocational colleges. As the number of students decreases, these programs face the challenge of a shrinking "ecological niche."

Manifestation of the "Ecological Niche—Carrying Capacity" Crisis: The "ecological niche" of primary education programs is gradually shrinking due to demographic changes, while the "carrying capacity" faces the risk of overload. The mismatch between educational resources and the number of students has resulted in difficulties in maintaining educational quality, and resource waste has become a prominent issue.

Applicability of Educational Ecology: By applying the concepts of "ecological niche" and "carrying capacity" from educational ecology to the analysis of primary education programs in higher vocational colleges, this study finds that the theoretical framework effectively explains the difficulties caused by population decline and provides pathways for addressing these issues. Educational ecology emphasizes the dynamic balance and adaptability of educational systems, offering a theoretical basis for educational reforms in higher vocational colleges in response to population changes.

Proposed Adjustment Strategies: Based on the theoretical analysis, this study proposes several strategies to address the "ecological niche—carrying capacity" crisis, including redefining the ecological niche of the program, optimizing resource allocation, enhancing school-enterprise cooperation, and improving adaptability. These strategies provide feasible solutions for higher vocational colleges to navigate the ongoing changes in the educational ecosystem.

4.2 Research Limitations

Although this study employs the theoretical framework of educational ecology and proposes adjustment strategies for primary education programs in higher vocational colleges, there are still several limitations:

Limitations of Literature: This study primarily relies on existing literature for analysis. While it covers a broad range of related fields, some of the latest research findings have not been included, as the field is still developing. Future studies could incorporate more recent literature to provide a more up-to-date analysis.

Theoretical Limitations: While educational ecology provides an effective analytical framework, the practical application of quantifying the "ecological niche" and "carrying capacity," as well as the interactions between these concepts, remains a complex issue. Future research can further validate the practical application of these theoretical concepts through more specific empirical data.

Regional Differences: This study mainly focuses on literature analysis and does not consider the specific regional differences in how higher vocational colleges address the "ecological niche—carrying capacity" crisis. Given the significant variations in educational resources, population structure, and economic development across different regions of China, future research could explore how colleges in different regions tailor their professional adjustments based on local characteristics.

4.3 Future Research Directions

Based on the limitations of this study, future research could expand on the following directions:

Empirical Research: Future studies can further explore the specific impact of population decline on primary education programs in higher vocational colleges through field research and data collection. Quantitative data analysis can provide more actionable recommendations for educational policymakers and validate the practical application of the concepts of "ecological niche" and "carrying capacity" in educational ecology.

Interdisciplinary Research: Educational ecology, as an interdisciplinary theoretical framework, offers significant potential for application in the adjustment of educational programs. Future research could combine perspectives from economics, sociology, and other disciplines to comprehensively examine the complex relationships between demographic changes, educational resource distribution, and market demand.

Regional Studies: Given the regional disparities across China, future studies could focus on the measures taken by different regions in response to population decline. Case studies can provide in-depth insights into how local policies, school-enterprise cooperation models, and curriculum settings align with regional characteristics, offering more tailored adjustment strategies for higher vocational colleges.

Longitudinal Research: Population decline and changes in educational demand are ongoing processes. Future studies could conduct long-term tracking to assess the effectiveness of various policies and adjustment pathways over time, providing more forward-looking policy recommendations.

4.4 Conclusion

This study analyzes the "ecological niche—carrying capacity" crisis faced by primary education programs in higher vocational colleges under the context of population decline through the lens of educational ecology. By reviewing the literature and conducting theoretical analysis, the study reveals the challenges faced by higher vocational colleges in response to declining student numbers and changing market demands. It also proposes diverse, innovative development paths. Despite certain limitations, this study offers valuable theoretical support and practical guidance for the educational reform and development of higher vocational colleges through a systematic theoretical framework and analysis of practical paths.

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