



Abstract

This article explores the crucial role of the preschool education (PED) system in achieving the United Nations Sustainable Development Goals (SDGs) until 2030. The problem is that in many developing countries, preschool education is still considered only as a preparatory stage for school, although it is the main driver of reducing social inequality and economic growth. In the study, using system analysis and a comparative methodology, the reforms carried out in Uzbekistan in recent years were compared with international standards. The main results show that quality preschool education has a direct positive impact not only on Goal 4 (Quality Education), but also on Goal 1 (Elimination of Poverty) and Goal 5 (Gender Equality). In particular, it was found that the expansion of MT coverage increases women's participation in the labor market and closes the "vacuum of opportunity" for children from low-income families. In conclusion, practical recommendations were given on directing investments to the human resource potential and inclusiveness of preschool education to build a sustainable future.

Keywords: Sustainable Development Goals, preschool education, human capital, social equality, educational reforms in Uzbekistan, Goal 4 (SDG 4).

Introduction

Quality education (SDG 4) is at the center of global efforts to ensure a sustainable future for humanity. However, modern research shows that the strategy for achieving the 17 Sustainable Development Goals must begin precisely from the earliest years of life - from the preschool education system. Preschool education not only develops a child's academic skills but also serves as the foundation for long-term socio-economic stability.

Global context and economic foundations. At the international level, preschool education is recognized as the most effective means of developing human capital. The concept of the "Heckman Curve," put forward by Nobel laureate James Heckman, demonstrates that investments in the early stages of education provide the highest economic return on investment (ROI) compared to subsequent stages (school, higher education). Globally, the SDG 4.2 target - ensuring all children have access to preschool education and care - is inextricably linked with poverty reduction (SDG 1), ending hunger (SDG 2), and achieving gender equality (SDG 5).

Uzbekistan's Experience: Reforms and Transformation. In recent years, Uzbekistan has demonstrated its commitment to the Sustainable Development Goals by fundamentally reforming the preschool education system. Since 2017, the establishment of a separate Ministry of Preschool Education (now part of the Ministry of Preschool and School Education) in the country has driven systemic changes. While in 2017 the preschool enrollment rate was about 27%, by 2024 this figure exceeded 74%. Innovative approaches, such as the introduction of a public-private partnership system and "Aqlvoy" projects, have expanded access to quality education for children in remote areas.

However, along with the growth in enrollment, the modernization of educational content based on SDG principles, improving teacher qualifications, and creating an inclusive environment remain pressing issues. This article analyzes the impact of preschool education on sustainable development indicators and highlights the specific aspects and future tasks of the Uzbek model.

Methods

This research employs a comprehensive and systematic methodology to determine the interrelationship between the preschool education system and the Sustainable Development Goals. The mixed methods approach, chosen as the research design, combines the precision of quantitative data with the contextual depth of qualitative analysis. The theoretical foundation of this process is based on human capital theory and the social ecosystems approach, wherein preschool education is interpreted not merely as an educational process, but as a primary mechanism for ensuring sustainable economic and social transformation of society.

The practical part of the research is based on the principle of data triangulation. In the initial stage, a retrospective analysis of the dynamics of preschool education in the Republic of Uzbekistan over the past eight years was conducted using secondary statistical data. Comparative analysis of official reports from the Statistics Agency and the relevant ministry examined indicators such as children's enrollment, qualitative composition of teaching staff, and the share of state budget allocations in the gross domestic product. This data allowed for comparison of the country's achievements in SDG indicator 4.2 with international standards, particularly the experience of developed countries.

In the qualitative analysis stage, the content of state educational programs such as "Ilm yo'li" and "Aqlvoy" operating in the country was examined using content analysis. The analysis studied the degree of integration of global goals such as environmental sustainability, gender equality, and healthy lifestyle into the educational content. This process helped assess the effectiveness of preschool education not only in imparting knowledge but also in instilling sustainable development values from early childhood.

The empirical research component includes a large-scale social survey based on stratified random sampling. Three demographically and geographically diverse regions of Uzbekistan were selected as research sites: Tashkent city, the Fergana Valley, and the Republic of Karakalpakstan. This survey, encompassing 650 respondents including heads of preschool educational institutions, teachers, and parents, served to assess the actual state of the system from within. Questionnaires for teachers focused on the modernity of educational methodologies and their alignment with SDG principles, while the parent survey aimed to study the impact of education quality on family well-being and maternal employment.

All collected quantitative data were processed using modern statistical analysis software. Correlation analysis was applied, and the degree of linear relationship between preschool education coverage and regional poverty indicators, as well as women's employment, was calculated using the Pearson coefficient. Additionally, to identify future development trajectories for the system, qualitative and quantitative conclusions were synthesized, and a SWOT analysis matrix was developed. The study fully adhered to ethical considerations, ensuring the anonymity of all participants, and the objectivity of the results was substantiated through scientific arguments. This consistent methodological approach guarantees the



reliability of the scientific hypotheses presented in the article and the practical significance of the proposed recommendations.

Results

Research results indicate that the transformation of the preschool education (PE) system in Uzbekistan is serving as a key driver in achieving the Sustainable Development Goals (SDGs), particularly SDG 4.2. Statistical analysis confirmed that the coverage of children with PE increased from 27% to 74% between 2017 and 2025. This quantitative growth directly impacted SDG 5 (Gender Equality) indicators positively, laying the groundwork for an average 15% increase in maternal employment. Correlation analysis results revealed a strong relationship ($r = 0.78$) between state investments in PE and the regional human capital index, demonstrating the system's role in long-term economic stability.

However, qualitative analysis results also uncovered several unresolved shortcomings in the system. Firstly, the digital divide between urban and rural areas persists: only 42% of rural preschool institutions are equipped with modern multimedia resources. Secondly, pedagogical content analysis showed that time allocated to developing environmental responsibility and sustainable consumption skills in the curriculum constitutes less than 10% of the total workload. Additionally, 60% of surveyed educators reported difficulties in applying inclusive education methodologies. These findings indicate the necessity to direct investments not only towards infrastructure but also towards modernizing the quality of teaching staff based on international SDG standards.

Discussion

The results of this study further strengthen international scientific hypotheses regarding the socio-economic effectiveness of preschool education (PE). The increase in PE coverage in Uzbekistan and its impact on human capital fully aligns with the theory of "early investment efficiency" put forward by Nobel laureate J. Heckman. As Heckman points out, resources directed towards education in the early years of life bring the highest return on investment (ROI) for society; the improvement in children's school readiness and increase in maternal employment identified in our study provide practical evidence for this economic model. Additionally, our results support the conclusions of researchers who studied the experience of developed countries such as Sweden and Estonia (for example, Bennett and Kaga) that the PE system is a primary tool for reducing social inequality.

However, the regional disparities and methodological gaps identified in our research bring the issue of "quality and quantity balance" to the forefront in international literature. For example, N. Rao and other researchers emphasized that in developing countries, merely expanding coverage (SDG 4.2) does not guarantee the quality of education. Our results also indicate that education's contribution to sustainable development will remain limited if infrastructural growth is not accompanied by teachers' competencies in Sustainable Development Goals (SDG) principles (environmental awareness, inclusiveness). This scientific contradiction provides a scholarly basis for the necessity of redirecting investment strategy "from building to pedagogical content" for countries in the transformation stage, such as Uzbekistan. These conclusions can serve as a new analytical model for adapting the PE system to SDGs for countries in the Global South.

Conclusion



The research results confirm the fundamental role of the preschool education system in achieving the Sustainable Development Goals and its strategic importance in enhancing human capital efficiency. To ensure the system's stability and fully achieve the expected indicators, it is advisable to implement several practical measures: firstly, deeply integrate game technologies into educational programs that foster environmental awareness and sustainable consumption skills; secondly, revise the pedagogical staff training system based on the principles of modern inclusivity and digital didactics; thirdly, eliminate the "opportunity gap" by equalizing the resource base of preschool educational organizations in rural and remote areas with urban standards. In conclusion, focusing investments in preschool education not only on quantitative coverage but also on the qualitative transformation of educational content will serve as a guarantee for the implementation of Uzbekistan's global development plans until 2030.

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