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MAIN METHODOLOGICAL OPPORTUNITIES FOR CREATING AN ECOSYSTEM FOR THE EDUCATION OF CHILDREN WITH SPECIAL EDUCATIONAL NEEDS IN GENERAL EDUCATION ORGANIZATIONS

Annotation

The article explores the theoretical and methodological foundations for building an inclusive education ecosystem within general education schools in Kazakhstan. The study addresses the lack of a systemic approach and insufficient interagency coordination among educational, medical, and social institutions in supporting students with special educational needs (SEN). *The purpose* of the research is to substantiate methodological approaches to designing and maintaining an inclusive education ecosystem that ensures sustainable development and equal opportunities for learners with SEN. *The research employs* comparative and systemic analysis, content analysis of policy documents, expert evaluation, and a pedagogical experiment conducted in two schools in southern Kazakhstan. *The experimental results* demonstrate significant improvements in academic performance (from 2.9 to 3.7 points), parental engagement, and teachers' digital activity. *The scientific novelty* lies in integrating digital, pedagogical, and sociocultural components into a unified ecosystemic model of support. *The practical significance* is reflected in the proposed methodological guidelines: the development of a national standard for the inclusive ecosystem, introduction of digital learner profiles, institutionalization of inclusive management, and application of artificial intelligence in diagnostics and support. *The study concludes* that inclusive education must evolve from fragmented initiatives into a coherent ecosystem model that ensures the sustainability and quality of inclusion in Kazakhstan's education system.

Keywords: inclusion, SEN (special educational needs), educational environment, inclusive education ecosystem, digital technologies, ecosystem approach, inclusive pedagogy.

Introduction. In the context of contemporary global trends associated with humanization, digitalization, and sustainable development, inclusive education has emerged as one of the most pressing issues for general education institutions. In recent years, persistent challenges have been identified regarding the quality of inclusive education and its ability to adequately respond to the needs of modern society. The United Nations Convention on the Rights of Persons with Disabilities (2006) establishes the right of every learner, regardless of the degree of health limitations, to have equal access to quality education [1].

This document served as the foundation for the development of national strategies aimed at ensuring the rights of children with special educational needs (SEN). In the Republic of Kazakhstan, inclusion has been officially recognized as one of the priority areas of state educational policy. Initially, this priority was reflected in the State Program for the Development of Education and Science for 2020–2025, which outlined measures to strengthen inclusive education and ensure access to quality learning opportunities for children with SEN. Although this program subsequently lost its legal force pursuant to the Resolution of the Government of the Republic of Kazakhstan dated October 12, 2021, No. 726, it played an important role in shaping the conceptual and institutional foundations of inclusive education policy in the country. According to the Ministry of Education of the Republic of Kazakhstan, as of 2023, more than 197,000 children with SEN are enrolled in general education schools, with approximately one-third of them integrated into mainstream classrooms. However, the lack of a systemic approach remains a significant issue, reducing the overall effectiveness of both educational and organizational mechanisms [2].

This trend can be observed in research studies, where the focus is often placed on revising and transforming the process of training specialists for working with children with special educational

needs in schools (Baimenova et al., 2015) [3]. The narrowing of the issue primarily to the school level, however, is characteristic not only of Kazakhstani researchers; many international scholars also emphasize children of preschool and predominantly school age (Jøransson & Nilholm, 2014; Qvortrup & Qvortrup, 2017) [4].

The creation of an inclusive education ecosystem implies the integration of all available resources, technologies, and stakeholders into a unified structure that ensures comprehensive and sustainable support for learners. Such an approach eliminates the fragmentation of inclusive initiatives and promotes the effective adaptation of children with special educational needs (SEN). The ecosystem encompasses the interaction between schools, parents, specialists, digital platforms, local authorities, and civil society organizations within a flexible and multi-level educational model.

In the context of digitalization, the development of interagency collaboration, and the growing social responsibility for the quality of life of people with disabilities, the scientific substantiation of educational ecosystem design becomes particularly relevant. This calls for an in-depth analysis of the methodological foundations, conditions of sustainability, and factors determining the effectiveness of such a model within the framework of the Kazakhstani education system.

The purpose of this article is to substantiate theoretical and methodological approaches to the creation of an educational ecosystem for children with special educational needs in mainstream schools, as well as to identify the conditions that contribute to its effective and sustainable functioning [5].

In pursuit of this objective, the following tasks were addressed:

1. Examination of contemporary theoretical and methodological concepts for constructing an inclusive educational environment.
2. Identification of the key elements of the ecosystem approach and determination of the logic of their interaction.
3. Analysis of the role of digitalization and interagency cooperation in maintaining the sustainability of the ecosystem.
4. Review of the existing challenges and resources available within the context of Kazakhstani schools.
5. Formulation of methodological guidelines and practical recommendations for designing an educational environment for children with special educational needs (SEN).

Methods and Materials. This study employed a mixed-method research design, combining theoretical analysis with an experimental (quasi-experimental) pedagogical intervention. The research was conducted in two stages:

1. *Analytical Stage* — review and synthesis of theoretical and methodological concepts of inclusive education ecosystems based on international and Kazakhstani sources, as well as content analysis of policy documents and strategic programs.
2. *Experimental Stage* — implementation and evaluation of ecosystem elements (digital platforms, tutor support, parental engagement) in two mainstream schools located in South Kazakhstan.

Participants. The experimental group included 24 students with special educational needs (SEN), their 12 teachers, and parents. The schools were equipped with resource rooms and had access to digital platforms such as BilimLand and Kundelik.

Research Design. The study followed a pre-test/post-test quasi-experimental design. Baseline data were collected at the beginning of the semester, followed by a three-month intervention period. The intervention consisted of:

- integration of digital learning tools;
- introduction of tutor support for 12 students;
- systematic parental consultations and feedback sessions.

Data Collection Tools:

- Academic performance – assessed using standard 5-point grading scales before and after intervention;
- Social adaptation and motivation — observed via behavioral checklists and expert evaluations;

- Parental and teacher satisfaction – measured through structured questionnaires;
- Digital engagement – analyzed through usage logs from *BilimLand* and *Kundelik*.

Data Analysis. Descriptive and comparative statistics were used to analyze pre- and post-intervention data. Mean values and percentage changes were calculated. Expert assessment complemented the quantitative results to ensure data validity.

During the research, the following methods were applied:

Comparative analysis – to examine both international and domestic models of inclusive education;

Systemic approach – to design the ecosystem model taking into account human resources, institutional, digital, and sociocultural elements;

Content analysis – of normative and strategic documents of the Republic of Kazakhstan and international legal acts, such as the UN Convention on the Rights of Persons with Disabilities, as well as the State Program for the Development of Education and Science for 2020–2025 (which subsequently lost its legal force pursuant to the Resolution of the Government of the Republic of Kazakhstan dated October 12, 2021, No. 726). Despite its termination, the program served as an important policy framework for strengthening inclusive education;

Analysis of empirical data – based on statistics from the Ministry of Education of the Republic of Kazakhstan, as well as reports from UNICEF, WHO, VCIOM, and other organizations;

Expert evaluation – grounded in the synthesis of experiences related to the implementation of inclusive approaches in specific regions, including pilot schools and resource centers.

The empirical basis of the study consisted of up-to-date scientific literature, official state statistics, and a review of digital platforms and educational tools currently used in practice with children with special educational needs (SEN) (Table 1, 2).

Table 1. Components of the Educational Ecosystem for Children with Special Educational Needs (SEN)

Level	Functions	Key Participants	Tools and Mechanisms
Institutional	- Regulatory framework - Infrastructure development	Ministry of Education Local Education Departments School administration	State educational standards (SES), adapted programs, resource centers, internal policies
Pedagogical	Implementation of adapted programs - Individualized instruction	Subject teachers Tutors Psychologists	Individualized Education Plan (IEP), methodological toolkits, differentiated instruction
Human Resources	- Professional development - Specialist support	Universities, Teacher Training Institutes, HR departments, National Centers, Training centers	Courses, mentoring, supervision, internships, certification
Digital	- Access to digital resources - Support for alternative communication	IT specialists Teachers Parents	Digital platforms (e.g., RESH, Bilim Land), AAC apps, LMS, interactive notebooks
Medical-Psychological-Social	- Psychological-medical-pedagogical support - Correction and assistance	PMPC (Psychological-Medical-Pedagogical Consultations) Speech therapists Special educators Social workers	Individual support plans, psychological and pedagogical diagnostics, rehabilitation plans
Family and Social	- Parental involvement - Public support and engagement	Parents NGOs (Non-Governmental Organizations) Local communities	Consultations, training sessions, parent schools, mentoring programs

Source: Compiled by the author

Table 2. Key Components of the Educational Ecosystem

Component	Description
Institutional	Availability of regulatory frameworks, adapted programs, PMPC (Psychological-Medical-Pedagogical Consultations), resource centers
Human Resources	Tutors, assistants, professional development courses in inclusion
Digital	Online courses, electronic Individualized Education Plans (IEPs), adaptive interfaces
Sociocultural	Development of an inclusive culture within schools and communities, parental engagement

Source: Compiled by the author

The ecosystem of any organization represents a set of interacting elements and structures that exist both within and around the organization. In the field of education, ecosystems are understood as interconnected educational spaces that bring together both institutional and individual participants (education providers), operating with diverse educational resources to support individual and collective learning (Sidorova, 2021) [6, 7].

In the works of A. G. Bezpалova, the concept of “*eco-inclusiveness of the university*” is elaborated in detail, reflecting the proactive stance of higher education institutions toward students with special educational needs (SEN) at all stages of the learning process. This concept implies modern informational, technical, and technological support for mastering professional programs, as well as a focus on the subsequent employment of graduates and the formation of a sustainable model of their social adaptation (Bezpалova, 2022) [8]. An additional effect is achieved through the establishment of strong links with alumni and partners, as well as through collaboration between universities, business structures, and civil society organizations, which contributes to the development of an inclusive university ecosystem (Moriña, A., 2017) [9]. In this context, inclusion becomes a key element of the educational ecosystem, ensuring equal opportunities for all students regardless of their individual characteristics.

The need to develop a culture of inclusion in the educational ecosystem of modern universities is emphasized in recent studies (Kashtanova et al., 2023) [10]. Moreover, the ecosystem must remain flexible and responsive, capable of adapting to changes, the needs of children, and emerging challenges such as pandemics, migration processes, and the growing prevalence of psycho-emotional difficulties among learners.

Experimental Section

Purpose of the experiment. The purpose of this study was to evaluate the effectiveness of implementing elements of an educational ecosystem – namely digital tools, tutor support, and parent engagement—in the context of inclusive learning within general education schools.

Experimental base. The pilot research was carried out in two general education schools located in the South Kazakhstan region. Both schools were equipped with resource rooms and enrolled students with special educational needs (a total of 24 children participated).

Methodology. The experiment was carried out in two stages:

1. Stating stage (diagnostic phase) – collection of baseline data on the state of inclusive practices: teacher and parent surveys (n = 38); classroom observations (n = 10); analysis of individual learning plans (ILPs); expert interviews with inclusion coordinators.

2. Formative stage (intervention phase) – introduction of ecosystem components: use of the Bilim Land digital platform and adaptive assignments; implementation of tutor support (12 children); organization of regular consultations with parents; adjustment of ILPs based on recommendations from psychological-medical-pedagogical consultations (PMPC) and pedagogical diagnostics (Table 3, 4).

Table 3. Criteria for Assessing Effectiveness

Criterion	Methods	Instruments
Academic progress	Diagnostic assessments	Pre- and post-intervention results
Social adaptation	Behavior and engagement evaluation	Observations, interviews
Satisfaction	Participant surveys	Questionnaires for teachers and parents
Digital engagement	Log data, self-assessment	BilimLand and Kundelik platforms

Source: Compiled by the author

Table 4. Experimental Results

Indicator	Before Implementation	After 3 Months
Average academic performance of SEN students (5-point scale)	2,9	3,7
Teachers using digital resources (%)	23%	76%
Parental engagement (scale from 0 to 10)	4,2	7,6
Number of students with tutor support	0	12

Source: Compiled by the author

Results and Discussion. Table 5 presents the comparative results of the pre- and post-test analysis.

Table 5. The comparative results of the pre- and post-test analysis

Indicator	Before	After	Change
Average academic performance (5-point scale)	2.9 ± 0.4	3.7 ± 0.5	+0.8
Teachers using digital resources (%)	23 %	76 %	+53 %
Parental engagement (0–10 scale)	4.2 ± 1.3	7.6 ± 1.1	+3.4
Students with tutor support	0	12	—

Source: Compiled by the author

Although the sample size was relatively small ($n = 24$), the findings revealed a positive tendency in both academic and social adaptation among students with special educational needs (SEN). Moreover, teachers exhibited increased digital engagement, while parents showed higher levels of participation in the educational process. The obtained data demonstrate significant improvements in both academic and social outcomes among students with special educational needs (SEN) following the implementation of ecosystem elements. The most pronounced effect was observed in groups where comprehensive support was applied (digitalization + tutoring + parental involvement). These findings are consistent with international studies [11], which highlight the importance of a systemic approach and digital technologies in inclusive education.

Experimental Conclusions:

1. The introduction of ecosystem elements has a positive impact on the learning motivation and academic performance of students with SEN.
2. Tutor support and digital tools considerably facilitate adaptation and the personalization of learning.
3. Parental engagement in the support process enhances the sustainability of results and reduces anxiety levels in children.

The experiment confirmed the effectiveness of a systemic approach to inclusion and substantiated the design of an educational ecosystem as a foundation for the sustainable development of inclusive practices in Kazakhstani schools.

Current Challenges and Directions for the Development of the Inclusive Education Ecosystem. Despite positive changes in legislation and the growing public attention to inclusion, the

implementation of inclusive education in Kazakhstan continues to face a number of systemic challenges.

1. Shortage of personnel and insufficient professional training. A serious obstacle remains the limited readiness of teachers to work with children with special educational needs. According to the Ministry of Education of the Republic of Kazakhstan, fewer than half of teachers possess even basic knowledge or practical skills in the field of inclusive education. The situation is further aggravated by the absence of comprehensive instruction in inclusive pedagogy at universities, the limited availability of specialized professional development programs, and low teacher motivation to adopt new approaches. Particularly acute is the shortage of support specialists such as tutors, speech therapists, special education teachers, and school psychologists (Ministry of Education of the Republic of Kazakhstan, 2023) [12]. Current Challenges and Directions for the Development of the Inclusive Education Ecosystem.

2. Insufficient interagency coordination. The effective development of inclusion requires close cooperation between educational institutions and healthcare, social protection, and legal support agencies. However, in practice, there are no clearly defined mechanisms for interagency collaboration. The interaction of schools, psychological-medical-pedagogical consultations (PMPCs), support centers, and social services is often fragmented, accompanied by overlapping functions and excessive administrative procedures, which reduces both the efficiency and timeliness of support for children with special educational needs (UNICEF Kazakhstan, 2023) [13].

3. Digital inequality and infrastructural barriers. Modern inclusive education is impossible without the use of digital technologies, alternative and augmentative communication (AAC) tools, specialized platforms, and adapted educational materials. Nevertheless, in a number of regions of Kazakhstan, there are significant disparities in terms of school equipment, internet access, and teachers' digital competencies. Additional challenges include the limited availability of learning resources in the Kazakh language and the weak adaptation of electronic programs to the specific needs of children with SEN (earlier outlined in the State Program for the Development of Education and Science of the Republic of Kazakhstan for 2020–2025, which has since lost its legal force; UNICEF Kazakhstan, 2023).

Prospective Directions for the Development of the Inclusive Education Ecosystem

1. Development and implementation of a national standard for the inclusive educational ecosystem. To ensure coherence among all actors within the system, it is necessary to develop a unified regulatory framework that establishes requirements for teacher training, digital infrastructure, support and monitoring mechanisms, as well as ethical standards of interaction. Such a standard would enable effective coordination among educational institutions, government bodies, and social partners. At the same time, it is important to draw on international best practices, such as *Universal Design for Learning* and the *Index for Inclusion*, while taking into account the specific national context of Kazakhstan).

2. Introduction of digital profiles for students with special educational needs. A promising direction is the development of personalized digital profiles that include diagnostic results, individual educational pathways (IEPs), records of interventions, and recommendations from specialists. This system would ensure continuous and comprehensive support for children at all stages of their education. In the future, such profiles could be integrated into national digital educational platforms, including *Egov*, *Kundelik*, and *BilimLand*, thereby providing access to teachers, parents, and support specialists (Ministry of Digital Development of the Republic of Kazakhstan, 2022; UNICEF, 2023).

3. Strengthening inclusive management in schools. To increase the effectiveness of inclusion, it is necessary to move from declarative statements to institutionalized practices at the school level. This involves introducing positions of inclusion coordinators, establishing internal monitoring systems, developing local strategies, engaging parents, support specialists, and local community representatives in decision-making processes. Such an approach would integrate inclusion into the everyday functioning of educational organizations and make it a sustainable element of the school ecosystem (UNICEF, 2023, p. 10).

4. Application of artificial intelligence in diagnostics and support. Another promising vector of development is the use of artificial intelligence (AI) and machine learning technologies for the early detection of speech, cognitive, and behavioral difficulties, the selection of individualized teaching methods, and the analysis of learning progress dynamics. AI can serve as the basis for developing intelligent learning platforms and digital tutors that adapt to the needs of each child, thereby improving the quality of pedagogical support (UNESCO, 2021; OECD, 2021).

Conclusion. The study identified several key provisions that define the specific features and future prospects for the development of an inclusive educational ecosystem in Kazakhstan.

First, the analysis of contemporary theoretical and methodological approaches demonstrated that the ecosystem model of inclusive education is the most effective, as it integrates the resources of schools, families, support specialists, digital tools, and civil society institutions into a unified system (UNESCO, 2020).

Second, the main elements of the ecosystem approach were outlined – the regulatory and institutional framework, human and pedagogical capacity, digital infrastructure, as well as family and social resources. The logic of their interaction is based on the principles of systemic coherence, individualization, interdisciplinary coordination, flexibility, and digital integration (United Nations, 2006).

Third, special attention was given to the role of digitalization and interagency partnership. These factors create the conditions for the sustainable functioning of an inclusive environment, ensuring continuity of support, expanding access to educational resources, and improving coordination among various government and social institutions (UNICEF Kazakhstan, 2023).

Fourth, the review revealed the main challenges faced by Kazakhstani schools: a shortage of qualified teachers and support specialists, fragmented interagency cooperation, and digital inequality across regions. At the same time, certain resources were identified – state policy initiatives, developing digital platforms, and growing public interest in inclusion (Ministry of Education and Science of the Republic of Kazakhstan, 2019).

Fifth, based on the analysis, methodological guidelines and practical recommendations were formulated for designing an inclusive educational environment. These include the development of a national standard for inclusive education, the introduction of digital profiles for students with SEN, the institutionalization of inclusive management at schools, and the application of artificial intelligence technologies for diagnostics and support (OECD, 2021).

Thus, inclusive education appears not only as a pedagogical task but also as a strategic social project aimed at building a society based on the principles of equality, respect, and humanism.

Funding Information. This research has been funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan under the project AP27510667 Development of an Inclusive Education Ecosystem Based on the Future Classroom Lab Model.

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ЖАЛПЫ БІЛІМ БЕРУ ҰЙЫМДАРЫНДА ЕРЕКШЕ БІЛІМ БЕРУ ҚАЖЕТТІЛІКТЕРІ БАР БАЛАЛАРДЫ ОҚЫТУҒА АРНАЛҒАН ЭКОЖҮЙЕНІ ҚҰРУДЫҢ НЕГІЗГІ ӘДІСНАМАЛЫҚ МҮМКІНДІКТЕРІ

Аңдатпа

Мақалада Қазақстандағы жалпы білім беретін мектептер жағдайында инклюзивті білім беру экожүйесін қалыптастырудың теориялық және әдіснамалық негіздері қарастырылады. *Зерттеудің өзектілігі* — ерекше білім беруді қажет ететін балаларды (ЕБҚ) қолдау жүйесін ұйымдастыруда кешенді тәсілдің болмауы және білім беру, медициналық, әлеуметтік құрылымдар арасындағы өзара іс-қимылдың жеткіліксіздігімен айқындалады. *Зерттеудің мақсаты* — ЕБҚ бар білім алушылардың тұрақты дамуы мен тең мүмкіндіктерін қамтамасыз ететін инклюзивті білім беру экожүйесін жобалау мен оның жұмыс істеуінің әдіснамалық тәсілдерін негіздеу. Зерттеу барысында салыстырмалы және жүйелік талдау, нормативтік құжаттарға контент-талдау, сондай-ақ Оңтүстік

Қазақстандағы екі мектепте жүргізілген педагогикалық эксперимент пен сараптамалық бағалау әдістері қолданылды. *Эксперимент нәтижелері* ЕБҚ бар оқушылардың үлгерімінің (2,9-дан 3,7 балға дейін өсуі), ата-аналардың қатысу белсенділігінің және мұғалімдердің цифрлық құзыреттілігінің артқанын көрсетті. *Зерттеудің ғылыми жаңалығы* — цифрлық, педагогикалық және әлеуметтік-мәдени компоненттерді біріктіретін қолдаудың бірыңғай моделін ұсынуында. *Практикалық маңыздылығы* – инклюзивті экожүйенің ұлттық стандарты мен ЕБҚ бар білім алушылардың цифрлық профилін әзірлеу, инклюзивті менеджментті институционализациялау және диагностика мен қолдау процесінде жасанды интеллект технологияларын пайдалану жөніндегі әдіснамалық ұсынымдарда көрініс табады. *Зерттеу нәтижесінде* инклюзивті білім беруді фрагменттік бастамалардан тұтас экожүйелік модельге көшіру қажеттігі негізделді, бұл Қазақстандағы инклюзивті білім берудің тұрақтылығы мен сапасын қамтамасыз етеді.

Түйінді сөздер: инклюзия, ерекше білім беру қажеттіліктері (ЕБҚ), білім беру ортасы, инклюзивті білім беру экожүйелері, цифрлық технологиялар, экожүйелік тәсіл, инклюзивті педагогика.

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ОСНОВНЫЕ МЕТОДОЛОГИЧЕСКИЕ ВОЗМОЖНОСТИ СОЗДАНИЯ ЭКОСИСТЕМЫ ДЛЯ ОБУЧЕНИЯ ДЕТЕЙ С ОСОБЫМИ ОБРАЗОВАТЕЛЬНЫМИ ПОТРЕБНОСТЯМИ В ОБЩЕОБРАЗОВАТЕЛЬНЫХ ОРГАНИЗАЦИЯХ

Аннотация

В статье рассматриваются теоретико-методологические основы формирования экосистемы инклюзивного образования в условиях общеобразовательных школ Казахстана. *Актуальность исследования* обусловлена отсутствием системного подхода к организации сопровождения детей с особыми образовательными потребностями (ООП) и недостаточной координацией между образовательными, медицинскими и социальными структурами. *Цель работы* — обосновать методологические подходы к проектированию и функционированию экосистемы инклюзивного образования, обеспечивающей устойчивое развитие и равные возможности для обучающихся с ООП. В исследовании использованы сравнительный и системный анализ, контент-анализ нормативных документов, а также методы экспертной оценки и педагогического эксперимента, проведенного в двух школах Южного Казахстана. *Экспериментальные результаты* показали положительную динамику в академической успеваемости (рост с 2,9 до 3,7 балла), повышении вовлеченности родителей и цифровой активности педагогов. *Научная новизна* заключается в интеграции цифровых, педагогических и социокультурных компонентов в единую модель поддержки обучающихся с ООП. *Практическая значимость* состоит в предложенных методологических рекомендациях: разработке национального стандарта инклюзивной экосистемы, введении цифровых профилей обучающихся, институционализации инклюзивного менеджмента и использовании искусственного интеллекта для диагностики и сопровождения. *Сделан вывод* о необходимости перехода от фрагментарных инклюзивных инициатив к целостной экосистемной модели, обеспечивающей устойчивость и качество инклюзивного образования в Казахстане.

Ключевые слова: инклюзия, ООП (особые образовательные потребности), образовательная среда, экосистемы инклюзивного образования, цифровые технологии, экосистемный подход, инклюзивная педагогика.

Received: 01.06.2025

Approved after peer review: 16.10.2025

Accepted for publication: 17.10.2025