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# Inclusion Made Practical: How Full-Cycle Artificial Intelligence Solutions Transform Special Educational Needs and Disabilities Support at Scale

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***Abstract*—Supporting learners with Special Educational Needs and Disabilities is a critical global challenge exacerbated by a systemic shortage of specialists. This paper introduces the MIKKO framework — an integrated ecosystem for inclusive education and the world's first patented, full-cycle inclusive education solution. Built on 10 years of research and development and over 100,000 hours of clinical practice, MIKKO integrates a three-pillar model: Spaces, Knowledge, and Innovation [1]. By utilizing Artificial Intelligence-driven screening and automated Individual Education Plan generation based on the "6 Spheres of Development" methodology, the framework enables national-scale educational reforms. Evidence from large-scale implementations in Kazakhstan demonstrates significant improvements in specialist training and student support standards [4].**

***Keywords—Artificial Intelligence (AI) in Education, Special Educational Needs and Disabilities (SEND) Support, Inclusive Education, MIKKO Framework, Universal Design for Learning (UDL), Educational Reform, Individual Education Plan (IEP).***

## I. INTRODUCTION

The modern education system is facing a systemic challenge in providing high-quality support for learners with special educational needs and disabilities (SEND). Despite the development of inclusive education policies, a gap persists in practice between the early identification of difficulties and the implementation of effective educational interventions. This study is based on the assumption that the key scientific and practical problem lies not only in limited resources, but also in the lack of alignment between assessment, planning, and implementation processes. This is manifested in several critical bottlenecks:

- The duration of developing Individual Education Plans (IEPs), which in some systems can reach up to six months, as well as their limited adaptability to the dynamic nature of a child's development.
- The insufficient level of teacher preparedness in modern inclusive education practices and the lack of tools for obtaining immediate expert support in a 24/7 format.
- The limited systemic involvement of parents and the absence of tools to extend developmental practices into the home environment.

These constraints significantly reduce the effectiveness of early intervention, which is a critical factor for learners with neurodiversity [4], [5].

In response to these challenges, this paper proposes the MIKKO model - an integrated digital-physical ecosystem aimed at synchronizing the processes of assessment, planning, and implementation in inclusive education. The approach is based on screening across six key developmental domains, enabling the rapid formation of individualized support pathways and their continuous adjustment. Unlike fragmented solutions, the MIKKO model establishes a continuous cycle of "assessment - intervention - outcome monitoring," ensuring alignment between teachers, specialists, and parents, as well as reducing the time from the identification of difficulties to the initiation of targeted educational interventions.

This study addresses the following research questions: (1) how the integration of digital tools and methodological approaches can reduce the time from identification of difficulties to IEP implementation; (2) how to provide teachers with access to real-time, context-specific support; and (3) how parental involvement influences the sustainability of educational outcomes. The aim of this paper is to develop and validate an applied model for organizing inclusive educational processes that reduces delays, improves the quality of pedagogical decision-making, and strengthens the interaction between school and home environments. At the same time, the limitations of the proposed approach should be considered, including the need for institutional adaptation, the level of digital readiness of educational institutions, and the variability of national education systems. The paper is structured as follows: Section II describes the MIKKO full-cycle model and its core pillars (Spaces, Knowledge, and Innovation); Section III presents the results of national-level implementation (case of Kazakhstan); Section IV analyzes measurable outcomes and results; Section V concludes the paper and outlines directions for future research.

## II. THE MIKKO ECOSYSTEM: SPACES, KNOWLEDGE, INNOVATION

The MIKKO framework is a patented hybrid model designed to cover every aspect of the inclusive process through three interconnected pillars [2]:

### *A. Spaces (Infrastructure and UDL)*

This pillar focuses on creating a physical environment conducive to learning. It involves the establishment of specialized inclusion support classrooms based on Universal Design for Learning (UDL) principles [6]. These spaces are equipped with 100+ specialized didactic kits that provide the sensory and cognitive input necessary for students with diverse needs.

*B. Knowledge (Pedagogical Excellence)*

Inclusion is impossible without qualified human intervention. This pillar includes comprehensive training programs, "Training of Trainers" (ToT) modules, and digital courses. It ensures that specialists are not only familiar with the technology but also mastered international best practices in ABA and modern diagnostics [1].

*C. Innovation (AI-Driven Support)*

The innovation component of the MIKKO model is based on the use of algorithms that automate key stages of expert assessment and the design of individualized educational pathways. In contrast to traditional approaches, where assessment and planning require significant time and expert involvement, the proposed model implements a continuous digital support cycle. The AI-driven process begins with a digital screening based on six key developmental domains: sensory, cognitive, speech, social-emotional, motor, and daily living. Input data are generated through teacher observations, standardized checklists, and structured tasks performed by the child [3]. At the next stage, the system analyzes the collected data using pattern-matching algorithms to identify specific developmental gaps at the level of functional skills. This enables a transition from broad categorical assessment to targeted pedagogical decision-making.

A key element of the architecture is the proprietary RAG-based knowledge system, HUMAN AI, integrated into the platform. HUMAN AI is built on aggregated experience from early intervention centers, best educational practices from more than 15 countries, and a dataset of over 200,000 real-world specialist cases [7]. This enables the system to deliver recommendations with a quality comparable (up to 90%, based on internal validation and expert benchmarking) to that of leading international experts, available 24/7 [2]. Within the educational support framework, HUMAN AI performs two primary functions. First, within the knowledge layer, it provides teachers and parents with context-aware responses and recommendations grounded in validated methodologies and practices. Second, within the IEP generation layer, it produces individualized recommendations by incorporating real-time data about the child obtained through screening and ongoing monitoring.

Identified developmental gaps are automatically mapped to a structured database of validated pedagogical goals, organized by levels of complexity and time horizons [3], [8]. Based on this mapping, an Individual Education Plan (IEP) is generated, including:

- specific developmental objectives aligned with identified needs.
- sets of didactic exercises and activities (including those based on MIKKO solution).
- measurable performance indicators (KPIs) for a defined period.
- implementation guidelines for both educational and home environments.

For example, when a deficit is identified in the cognitive domain, the system may generate a goal focused on developing the ability to classify objects based on two attributes (e.g., color and shape). To achieve this, the IEP includes a sequence of structured tasks such as sorting exercises, work with flashcards and physical objects from didactic kits, and game-based activities targeting generalization skills. Measurable targets are defined, for instance, achieving at least 80% accuracy in 4 out of 5 consecutive sessions, with a minimum frequency of three sessions per week. Thus, a process that traditionally requires months and the involvement of multiple specialists is transformed into a standardized and near-instant mechanism, significantly reducing the time from assessment to intervention. In addition, the system provides continuous feedback and updates recommendations based on performance dynamics, making the educational pathway adaptive and responsive. Teachers and parents have 24/7 access to actionable, context-specific recommendations and analytical insights.

## III. NATIONAL REFORM IN KAZAKHSTAN: A MULTI-PROJECT CASE STUDY

The scalability of the MIKKO model was rigorously tested and proven through a series of national projects in the Republic of Kazakhstan [9]:

*A. Unified Model of Inclusion*

Development and implementation of a national standard for inclusive support, aligning schools with global benchmarks.

*B. Inclusion Support Labs*

The establishment of specialized cabinets in 14 national pedagogical universities. These labs serve as practical training hubs where future educators gain hands-on experience with MIKKO technology and UDL-compliant environments before entering the workforce.

*C. Curriculum Modernization*

Following extensive ToT sessions, university curricula were formally adjusted to include MIKKO methodologies, ensuring long-term sustainability of the reform. Furthermore, a pilot scientific study was conducted in the East Kazakhstan region (VKO) to standardize testing protocols across the "6 Spheres of Development" [9]. This research marks a transition from pilot implementation to a standardized, evidence-based scientific framework for national inclusion.

## IV. MEASURABLE IMPACT AND VALIDATION

The MIKKO framework's impact is validated by several key metrics:

*A. Administrative Efficiency*

Reduction in IEP development time from 6 months to minutes, allowing specialists to focus on direct child interaction [7].

*B. Scientific Validation*

The system is protected by patents and supported by a pilot research study on developmental standardization [3], [9].

*C. Global Reach*

The practical applicability and effectiveness of the proposed model are supported by the results of large-scale implementation and empirical validation. To date, MIKKO-based solutions have been deployed across more than 545 educational institutions, with over 14,800 educators trained across diverse educational, cultural, and socioeconomic contexts, including Ukraine and Kazakhstan [7], [9].

A key component of the empirical validation was the pilot implementation of the six-domain developmental screening model within the early intervention system in Kazakhstan. The study involved **131 children aged between 18 and 72 months (M = 40.3, SD = 15.6)**.

The sample was distributed across age groups as follows:

18–23 months — 20 children (15.3%)

24–29 months — 20 children (15.3%)

30–35 months — 20 children (15.3%)

36–47 months — 30 children (22.9%)

48–59 months — 20 children (15.3%)

60–71 months — 20 children (15.3%)

72+ months — 1 child (0.8%)

This distribution enabled the evaluation of the model across multiple stages of early childhood development and supported its assessment within real-world early identification and intervention contexts.

The results of the pilot study indicate that the use of standardized digital screening combined with an AI-driven recommendation system significantly improves both the speed and consistency of pedagogical decision-making, while enabling earlier initiation of targeted interventions. A comparative analysis demonstrates a systemic transformation of support processes for learners with special educational needs (Table I).

TABLE I. COMPARATIVE ANALYSIS OF SUPPORT PROCESS TRANSFORMATION (TRADITIONAL MODEL VS. MIKKO) [7], [8]

| Functional Domain | Traditional Model | MIKKO Model |
|---|---|---|
| Initial Screening | 7–14 days, fragmented observational practices | < 1 day, standardized digital screening across six developmental domains |
| IEP Development | up to 6 months, multi-specialist involvement required | 5–15 minutes, automated generation based on real-time data |
| Access to Expert Support | delays ranging from several days to weeks | immediate 24/7 access via HUMAN AI |
| Quality of Recommendations | dependent on individual specialist expertise | standardized, based on 200,000+ cases and international best practices |
| Parental Involvement | episodic and limited | continuous engagement with 24/7 access to tasks and guidance |
| Documentation | high administrative burden | up to 90% reduction through automation |
| IEP Adaptability | infrequent updates (monthly or less) | dynamic, continuously updated based on child progress |
| Time to Intervention | several weeks to months | reduced to days or near-immediate initiation |

In addition, implementation data indicate a substantial reduction in the overall time from the identification of developmental challenges to the initiation of intervention—from several months to a matter of days—which is a critical factor in early intervention effectiveness. From a technological maturity perspective, the MIKKO framework has progressed from pilot-stage development to full-scale operational deployment and can be classified at Technology Readiness Level 9 (TRL 9, Proven Technology). The system is currently functioning as a standardized solution integrated into institutional educational processes.

## V. CONCLUSION AND FUTURE WORK

The findings of this study indicate that effective inclusion requires a systemic transformation that integrates physical learning environments (“Spaces”), structured pedagogical expertise (“Knowledge”), and adaptive technological solutions (“Innovation”). The MIKKO framework demonstrates that a full-cycle, AI-supported approach can significantly improve the timeliness, consistency, and scalability of support for learners with special educational needs. At the same time, the implementation process has revealed several important limitations and practical lessons. First, the integration of digital solutions into existing educational systems requires substantial institutional adaptation, including changes in workflows, teacher training, and administrative practices. Second, the quality of AI-generated recommendations is inherently dependent on the completeness and representativeness of the underlying data, necessitating continuous validation and expert oversight. Third, variability across national educational systems and regulatory environments imposes constraints on full standardization and large-scale deployment. Alternative approaches, such as purely expert-driven models or isolated digital tools, remain relevant in certain contexts; however, they typically fail to ensure both scalability and consistency of support. The proposed hybrid model, combining human expertise with AI-supported decision-making, aims to address these trade-offs, although further comparative research is required to evaluate its effectiveness across different educational settings.

Future research will focus on several key directions. From a technical perspective, a primary priority is the deeper integration of the MIKKO digital platform with national Educational Management Information Systems (EMIS), enabling secure and interoperable data exchange between screening, intervention planning, and classroom-level implementation. This includes the development of standardized data models, API-based architectures, and compliance with data protection and privacy regulations. Another direction involves the further development of the HUMAN AI knowledge system, including the expansion and diversification of training datasets, as well as the refinement of retrieval-augmented generation (RAG) pipelines. Particular attention will be given to improving context awareness, personalization mechanisms, and the explainability of AI-generated recommendations, which is critical for trust and adoption in educational environments. In addition, future work will explore the application of adaptive and predictive models, including machine learning approaches for longitudinal progress tracking and early risk detection. In this context, multiple technological options are being considered, including hybrid systems (combining rule-based and machine learning approaches), domain-specific fine-tuned language models, and federated learning techniques that enable model improvement while preserving data privacy. Finally, the expansion of the "Knowledge" pillar remains a strategic priority, particularly through the development of cloud-based, scalable training modules for educators. These solutions are intended to support continuous professional development and ensure consistent access to high-quality pedagogical practices across diverse educational systems.

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