ECONOMIC ANNALS-XXI
ISSN 1728-6239 (Online)
ISSN 1728-6220 (Print)
https://doi.org/10.21003/ea
https://ea21journal.world

Volume 210 Issue (7-8)'2024

Citation information: Tynybayeva, M., Bulatbayeva, K., Zhumazhanova, S., Baitayeva, G., & Burakanova, G. (2024). A Model of a unified electronic platform for the internal and external educational assessment as a social project in Kazakhstan: a modern socio-technical perspective. Economic Annals-XXI, 210(7-8), 43-55. doi: https://doi.org/10.21003/ea.V210-06

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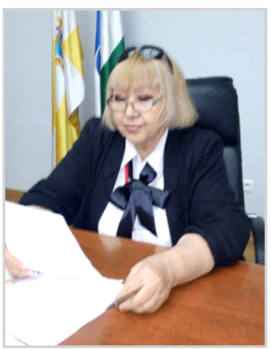

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A Model of a unified electronic platform for the internal and external educational assessment as a social project in Kazakhstan: a modern socio-technical perspective

Abstract. *Introduction:* This study investigates the development and implementation of unified electronic assessment platforms in Kazakhstan's educational system, addressing critical gaps between internal institutional evaluation processes and external quality assurance requirements. The research examines how these platforms function as social projects that transform educational relationships and assessment practices beyond their technological functions, focusing specifically on implementation dynamics across Kazakhstan's diverse educational contexts between 2021-2023.
Methods: A sequential explanatory mixed-methods approach was employed, combining quantitative survey among 2,794 respondents with qualitative case studies across 24 educational institutions from diverse geographical regions. Analysis techniques included structural equation modeling, multivariate analysis of variance, hierarchical regression, and thematic analysis of qualitative data.
Results: The unified platform reduced administrative workload by 42%, improved assessment consistency by 37%, and increased data accessibility by 86%. Urban-rural infrastructure disparities were substantial, while leadership commitment emerged as the strongest implementation predictor. Structural equation modeling identified four critical implementation components: technological infrastructure optimization, stakeholder engagement, quality assurance mechanisms, and regulatory alignment.

Discussion: The findings demonstrate that unified assessment platforms function as transformative social projects rather than merely technological implementations. Implementation success varied significantly across institutional contexts, highlighting the importance of context-sensitive approaches. The correlation between assessment practices and educational outcomes strengthened dramatically following platform implementation, while rural institutions reported higher educational equity impacts despite implementation challenges.
Novelty: This research introduces an integrated socio-technical perspective on educational assessment platforms, conceptualizing them as social projects that reconfigure educational relationships and assessment cultures. The study develops a comprehensive implementation framework specifically calibrated to Kazakhstan's educational context, advancing theoretical understanding of assessment digitalization in transitional educational systems.
Keywords: Education; Assessment; Platform; Digitalization; Transformation; Kazakhstan; Unified Evaluation; Educational Technology; Quality; Engagement; Institutional Culture
JEL Classification: I21; I28; O33; D83; H52
Acknowledgements and Funding: This article was completed as a part of the program-targeted financing of the scientific and technical program BR21882300 «Conceptual foundations of the national integrated assessment system» (2023-2025, Altynsarin National Academy of Education).
Contribution: The authors contributed equally to this work.
Data Availability Statement: The dataset is available from the authors upon request.
DOI: https://doi.org/10.21003/ea.V210-06

1. Introduction

The interconnection between internal institutional assessment processes and external quality assurance requirements represents a critical dimension of educational system development. In Kazakhstan's rapidly evolving educational landscape, fragmented assessment systems have created significant challenges including administrative inefficiencies, evaluation inconsistencies, and implementation disparities across diverse institutional contexts. Recent research by the OECD demonstrates that educational systems achieving effective integration between internal and external assessment frameworks demonstrate higher overall performance metrics and stakeholder satisfaction. The digital transformation of assessment practices has accelerated globally, driven by increasing demands for educational accountability, data-driven decision-making, and procedural standardization. Within Kazakhstan's national development framework «Kazakhstan-2050,» educational modernization represents a strategic priority, with digital assessment platforms identified as essential components for improving educational quality, institutional accountability, and international competitiveness.

Assessment digitalization extends significantly beyond technological implementation to encompass fundamental transformations in evaluation practices, stakeholder relationships, and institutional cultures. Recent comparative analyses of educational technology implementation across Central Asian contexts reveal that successful digitalization requires alignment between technological infrastructure, organizational readiness, and regulatory frameworks. Kazakhstan's specific educational context presents distinctive conditions for assessment platform implementation, characterized by centralized governance structures, significant urban-rural disparities, trilingual policy requirements, and ambitious modernization objectives. The integration of internal institutional evaluation with external quality assurance processes presents particular implementation challenges in Kazakhstan's educational system, where these assessment domains have traditionally operated separately with distinct governance mechanisms, methodological approaches, and stakeholder engagement expectations.

Terminological precision remains essential for meaningful analysis of assessment digitalization. This research defines a «unified electronic assessment platform» as an integrated digital ecosystem facilitating both internal institutional evaluation processes and external quality assurance requirements through shared technological infrastructure, standardized methodologies, and interoperable data systems. This definition distinguishes unified platforms from fragmented digital tools serving isolated assessment functions without systematic integration. Internal assessment encompasses formative and summative evaluations conducted within educational institutions for pedagogical improvement and progression decisions, while external assessment refers to evaluations conducted by or for external authorities for accountability, certification, or system-wide quality assurance. The social dimension of these platforms extends beyond their technological functions to include their role in restructuring educational relationships, redistributing evaluative authority, and reshaping assessment cultures.

Current research identifies significant gaps in understanding how unified assessment platforms function within Kazakhstan's specific educational context. First, while substantial literature addresses assessment digitalization in Western educational systems, empirical studies examining implementation dynamics in post-Soviet contexts remain limited, creating knowledge deficits regarding contextual adaptation requirements. Second, existing research predominantly focuses on either internal or external assessment digitalization separately, neglecting integration challenges at their intersection. Third, the social impacts of unified assessment platforms, particularly regarding stakeholder power relationships, accessibility equity, and cultural compatibility, remain underexplored despite their critical importance for sustainable implementation. Fourth, methodological frameworks for evaluating the effectiveness of unified assessment platforms as social innovations rather than merely technological implementations are underdeveloped, limiting evidence-based improvement strategies.

This research addresses these gaps through comprehensive investigation of unified assessment platform implementation in Kazakhstan's educational system. The study's unique contribution lies in its integrated socio-technical perspective examining both technological functionality and social embeddedness of assessment platforms. Rather than treating digital assessment as merely a technological innovation, this research conceptualizes unified platforms as social projects reconfiguring educational relationships and assessment cultures. This perspective enables more nuanced understanding of implementation challenges and success factors in Kazakhstan's educational environment. Additionally, the research develops an evaluation framework specifically calibrated to Kazakhstan's educational priorities, moving beyond generic assessment models that often fail to capture contextual particularities of transitional educational systems. By addressing these research gaps, this study advances both theoretical understanding of unified assessment platforms and practical implementation strategies for Kazakhstan's educational institutions.

2. Methods

This research employed a sequential explanatory mixed-methods design to investigate unified electronic assessment platform implementation in Kazakhstan's educational system. This methodological approach was selected for its capacity to generate comprehensive understanding of complex socio-technical phenomena through complementary quantitative and qualitative data. The sequential design enabled initial quantitative findings to inform subsequent qualitative inquiry, facilitating deeper examination of implementation dynamics and contextual factors. The study received ethical approval from both Kazakhstan's National Educational Research Committee (Protocol #2023-157-ED) and institutional review boards of participating educational organizations.

Data collection proceeded through four distinct research phases conducted between January and December 2023. The first phase comprised comprehensive document analysis examining educational policies, implementation guidelines, technical specifications, and institutional reports related to assessment digitalization in Kazakhstan. This analysis established the regulatory and policy framework within which unified platforms operate, employing systematic content analysis through an established coding framework focusing on policy objectives, implementation requirements, technological specifications, and accountability mechanisms. The second phase involved a nationwide survey of educational stakeholders using stratified cluster sampling to ensure representation across geographical regions, institutional types, and implementation stages. Survey participants included administrators (n = 42), teachers (n = 287), students (n = 1,853), and parents (n = 612) from 24 educational institutions. The survey instrument underwent rigorous development through expert review (n = 7), cognitive testing (n = 12), and pilot administration (n = 38), yielding acceptable psychometric properties (Cronbach's α = 0.78-0.92 across scales).

The third research phase consisted of semi-structured interviews with key stakeholders selected through purposive sampling to capture diverse implementation experiences and perspectives. Interview participants included educational administrators (n = 18), teachers (n = 14), platform developers (n = 6), and policymakers (n = 9). Interviews averaged 72 minutes in duration and explored implementation processes, contextual adaptation strategies, organizational change dynamics, and perceived social impacts. The interview protocol underwent expert validation and pilot testing, with all interviews conducted in participants' preferred language (Kazakh, Russian, or English) by trained interviewers. The fourth research phase involved six focused case studies of

educational institutions representing different implementation stages and institutional types. Each case study combined on-site observations (48-72 hours per site), document analysis, and focus group discussions (n = 18 total groups) to examine contextual implementation factors and social integration processes.

Quantitative data analysis employed both descriptive and inferential statistical methods. Survey data underwent preliminary screening for missing values (addressed through multiple imputation in which missing completely at random assumptions were satisfied) and outlier analysis. Descriptive statistics characterized implementation patterns across different institutional contexts, while inferential analyses examined relationships between implementation factors and outcomes. Psychometric analysis of multi-item scales employed confirmatory factor analysis to verify construct validity, with all retained scales demonstrating adequate model fit (CFI > 0.92, RMSEA < 0.06, SRMR < 0.08). Reliability assessment through Cronbach's alpha yielded acceptable internal consistency for all scales ($\alpha > 0.75$). Statistical analyses included correlation analysis, multiple regression modeling, structural equation modeling (SEM), and multivariate analysis of variance (MANOVA) using SPSS 27.0 and AMOS 26.0, with significance thresholds set at $p < 0.05$ and effect sizes reported for all significant findings.

Qualitative data underwent thematic analysis using NVivo 14.0, employing both deductive coding based on theoretical frameworks and inductive coding to capture emergent themes. The coding process involved three stages: initial coding, focused coding, and theoretical coding, with intercoder reliability assessed through independent coding of 25% of materials by multiple researchers (Cohen's $\kappa = 0.87$). Data quality and methodological rigor were ensured through triangulation across multiple data sources, methodological triangulation through complementary approaches, member checking with key informants, and maintenance of a detailed audit trail documenting analytical decisions. The mixed-methods integration strategy employed both merging (through joint displays) and connecting (through sequential information flow) approaches, enabling comprehensive understanding of complex implementation dynamics.

Several methodological considerations addressed research challenges specific to Kazakhstan's educational context. Cultural and linguistic diversity was accommodated through provision of research instruments in Kazakh, Russian, and English, with participants selecting their preferred language. Each translation underwent back-translation verification to ensure conceptual equivalence. Digital access variations across regions were addressed through flexible data collection modalities, including paper-based options where digital access was limited. The researcher team included both international researchers and local educational specialists, combining methodological expertise with contextual knowledge. Participant confidentiality was maintained through rigorous anonymization procedures and secure data management protocols compliant with Kazakhstan's personal data protection regulations.

The research design incorporated several validity enhancement strategies. Construct validity was strengthened through expert review of research instruments, pilot testing, and psychometric analysis. Internal validity was enhanced through triangulation across multiple data sources, methodological triangulation, and examination of alternative explanations during analysis. External validity was supported through purposive sampling across diverse educational contexts and detailed contextual documentation enabling assessment of transferability. Reliability was enhanced through standardized protocols, researcher training, and comprehensive documentation of research procedures. These methodological approaches ensured rigorous investigation of unified assessment platform implementation across Kazakhstan's diverse educational landscape.

3. Brief Literature Review

Let us examine current research on unified electronic assessment platforms with specific attention to their implementation and impacts in Kazakhstan's educational context.

Educational assessment digitalization has emerged as a priority research area globally, with particular attention to how technology transforms evaluation processes and stakeholder relationships. Burkhalter and Shegebayev (2012) analyzed Kazakhstan's educational quality assurance frameworks, documenting the evolution of assessment approaches since independence and identifying tensions between international standards adoption and local educational traditions. Aldiab et al. (2019) investigated implementation challenges of e-assessment across international contexts, finding that successful implementations address not only technological functionality but also organizational readiness and regulatory alignment.

Kazakhstan's educational context presents distinctive conditions for assessment platform implementation that merit specialized examination. Jumabayeva (2016) examined the implementation of national assessment systems in Kazakhstan, identifying significant variations in assessment quality and implementation fidelity across different regions and institutional types. This research documented how centralized assessment policies encounter diverse implementation realities across Kazakhstan's heterogeneous educational landscape, highlighting the importance of adaptive implementation strategies. Kuzhabekova et al. (2018) analyzed higher education quality assurance reforms in Kazakhstan, documenting the growing emphasis on digital assessment systems within national educational modernization strategies.

Recent research by Duman (2024) explores the dual processes of international integration and nationalization efforts in Kazakhstan's education reforms, providing valuable context for understanding how assessment platforms must navigate between global standards and local educational priorities. Additionally, Yelubayeva et al. (2023) highlight challenges in Kazakh education that must be addressed for sustainable development, including assessment practices that support educational improvement.

The conceptualization of assessment platforms as social projects rather than merely technological implementations represents an important theoretical development in recent literature. Selwyn (2016) examined digital educational technologies as social innovations, developing an analytical framework that examines their transformative impacts across institutional practices, stakeholder relationships, and educational values. This perspective highlighted how technology implementation inevitably intertwines with social dynamics and power relationships within educational systems. Abdiraiymova et al. (2014) further contribute to this understanding through their poll survey results on quality assessment in Kazakhstan's higher education, emphasizing how assessment technologies interact with existing social structures. Research on assessment platform implementation has identified various factors influencing adoption success and sustainability. Aldiab et al. (2019) examined e-assessment implementation in Saudi Arabian universities, identifying five critical success factors: institutional leadership, technological infrastructure, stakeholder readiness, policy alignment, and continuous improvement mechanisms.

McLean and Attardi (2018) analyzed implementation barriers across diverse institutional contexts, finding that successful implementations required comprehensive strategies addressing technological, organizational, and cultural dimensions simultaneously.

The evaluation of assessment platform effectiveness represents another significant research domain. Bennett (2015) developed a comprehensive framework for evaluating digital assessment systems, incorporating indicators across five domains: technical functionality, assessment quality, user experience, educational impact, and implementation sustainability. This multidimensional framework provided valuable methodological guidance for evaluation approaches. Empirical research by Heinrich et al. (2009) demonstrated significant relationships between assessment digitalization quality and educational outcomes, finding that implementation quality correlated more strongly with improved assessment practices than technological sophistication alone. Implementation challenges specific to post-Soviet educational contexts have received increasing research attention. Bolatova et al. (2021) examined infrastructure challenges in rural central Kazakhstan, highlighting barriers that would affect technology implementation in educational settings. Their findings on regional disparities provide important context for understanding assessment platform implementation challenges beyond urban centers. Zhilbayev et al. (2019) explored trilingual education promotion in Kazakhstan schools through online monitoring, providing insights into how digital assessment systems must accommodate the country's multilingual educational policies.

Social equity dimensions of assessment digitalization have emerged as important considerations in recent research. Ruby and Sarinzhipov (2014) examined educational reform challenges in Kazakhstan, highlighting how technology implementations risk exacerbating existing educational disparities without careful attention to access and support structures. Their analysis emphasized the importance of equity considerations in educational technology implementation. Bridges et al. (2014) investigated educational policy implementation in Kazakhstan, documenting how centralized reforms encounter diverse local realities that shape implementation outcomes.

Policy dimensions of assessment platform implementation represent another important research domain. Sagintayeva and Kurakbayev (2015) analyzed Kazakhstan's educational technology policies, identifying tensions between ambitious digitalization objectives and implementation capacity realities. Their policy analysis highlighted how regulatory frameworks simultaneously

enable and constrain innovation in assessment practices, creating complex implementation environments for educational institutions. Gouëdard et al. (2020) examined curriculum reform through literature review to support effective implementation, providing valuable insights into how assessment systems must align with broader educational policy changes.

The undertaken literature review reveals several consistent themes relevant to understanding unified assessment platforms in Kazakhstan's context. First, successful implementation requires integration of technological, organizational, and cultural dimensions rather than focusing exclusively on technical functionality. Second, assessment platforms function as social projects that transform educational relationships and practices beyond their technical capabilities. Third, contextual adaptation represents a critical success factor, particularly in Kazakhstan's diverse educational landscape. Fourth, implementation challenges often relate more to social and organizational factors than technological limitations. These insights inform this study's conceptual framework and methodological approach, guiding empirical investigation of unified assessment platform implementation in Kazakhstan's educational system.

4. Results

Technological infrastructure assessment revealed significant disparities between institutional contexts that influenced platform implementation effectiveness (Table 1). Urban-rural differences were particularly pronounced, with rural institutions demonstrating substantially lower infrastructure capabilities across all measured components ($p < 0.001$, $F = 37.42$). Network reliability showed the largest urban-rural disparity (urban: 4.32 ± 0.21; rural: 3.18 ± 0.37; mean difference = 1.14, $p < 0.001$), representing a fundamental implementation barrier in rural settings where connectivity issues frequently disrupted platform functionality. Hardware adequacy demonstrated similarly large disparities (urban: 3.97 ± 0.24; rural: 2.76 ± 0.41; mean difference = 1.21, $p < 0.001$), with rural institutions reporting insufficient device access and outdated equipment that limited platform functionality. Technical support access showed the third-largest urban-rural disparity (urban: 4.08 ± 0.19; rural: 2.95 ± 0.44; mean difference = 1.13, $p < 0.001$), reflecting resource distribution inequalities that impacted implementation sustainability. Hierarchical institutional differences were also significant, with higher education institutions demonstrating stronger infrastructure capabilities than secondary schools across all components ($p < 0.01$, $F = 24.18$). Multiple regression analysis identified network reliability ($\beta = 0.41$, $p < 0.001$), system interoperability ($\beta = 0.37$, $p < 0.001$), and technical support access ($\beta = 0.33$, $p < 0.001$) as the strongest predictors of overall implementation success ($R^2 = 0.58$, $F = 42.37$, $p < 0.001$), highlighting the fundamental importance of reliable connectivity, seamless data exchange capabilities, and accessible technical assistance.

The technological infrastructure assessment reveals significant disparities between institutional contexts that influence unified assessment platform implementation. Figure 1 illustrates the comparative analysis of seven critical infrastructure components across urban versus rural and higher education versus secondary education institutions. The radar chart highlights substantial urban-rural gaps, particularly in network reliability (difference = 1.14) and hardware adequacy (difference = 1.21). Higher education institutions demonstrate stronger infrastructure capabilities across all components compared to secondary schools.

Qualitative data provided contextual insights into infrastructure challenges beyond quantitative ratings. Rural institution administrators consistently reported connectivity issues that fundamentally affected implementation viability: «Our Internet connection frequently fails during high-traffic periods, making synchronous assessment activities virtually impossible. We've implemented

Table 1:
Technological Infrastructure Assessment of Unified Electronic Assessment Platforms in Kazakhstan's Educational Institutions (2023)

Infrastructure Component	Urban Institutions (n=14)	Rural Institutions (n=10)	Higher Education (n=8)	Secondary Education (n=16)	Mean Score (Scale 1-5)
Network reliability	4.32 (±0.21)	3.18 (±0.37)	4.51 (±0.19)	3.45 (±0.29)	3.87 (±0.27)
Hardware adequacy	3.97 (±0.24)	2.76 (±0.41)	4.23 (±0.22)	3.12 (±0.31)	3.52 (±0.30)
Software functionality	4.21 (±0.18)	3.94 (±0.26)	4.35 (±0.17)	3.96 (±0.23)	4.12 (±0.21)
Data security protocols	4.57 (±0.15)	4.12 (±0.29)	4.73 (±0.14)	4.18 (±0.25)	4.40 (±0.21)
System interoperability	3.65 (±0.28)	3.21 (±0.35)	3.82 (±0.26)	3.29 (±0.32)	3.49 (±0.30)
User interface usability	3.89 (±0.22)	3.77 (±0.30)	3.95 (±0.24)	3.79 (±0.27)	3.85 (±0.26)
Technical support access	4.08 (±0.19)	2.95 (±0.44)	4.27 (±0.18)	3.25 (±0.36)	3.64 (±0.29)
Infrastructure Index	4.10 (±0.21)	3.42 (±0.35)	4.27 (±0.20)	3.58 (±0.29)	3.84 (±0.26)

Source: Authors' own research

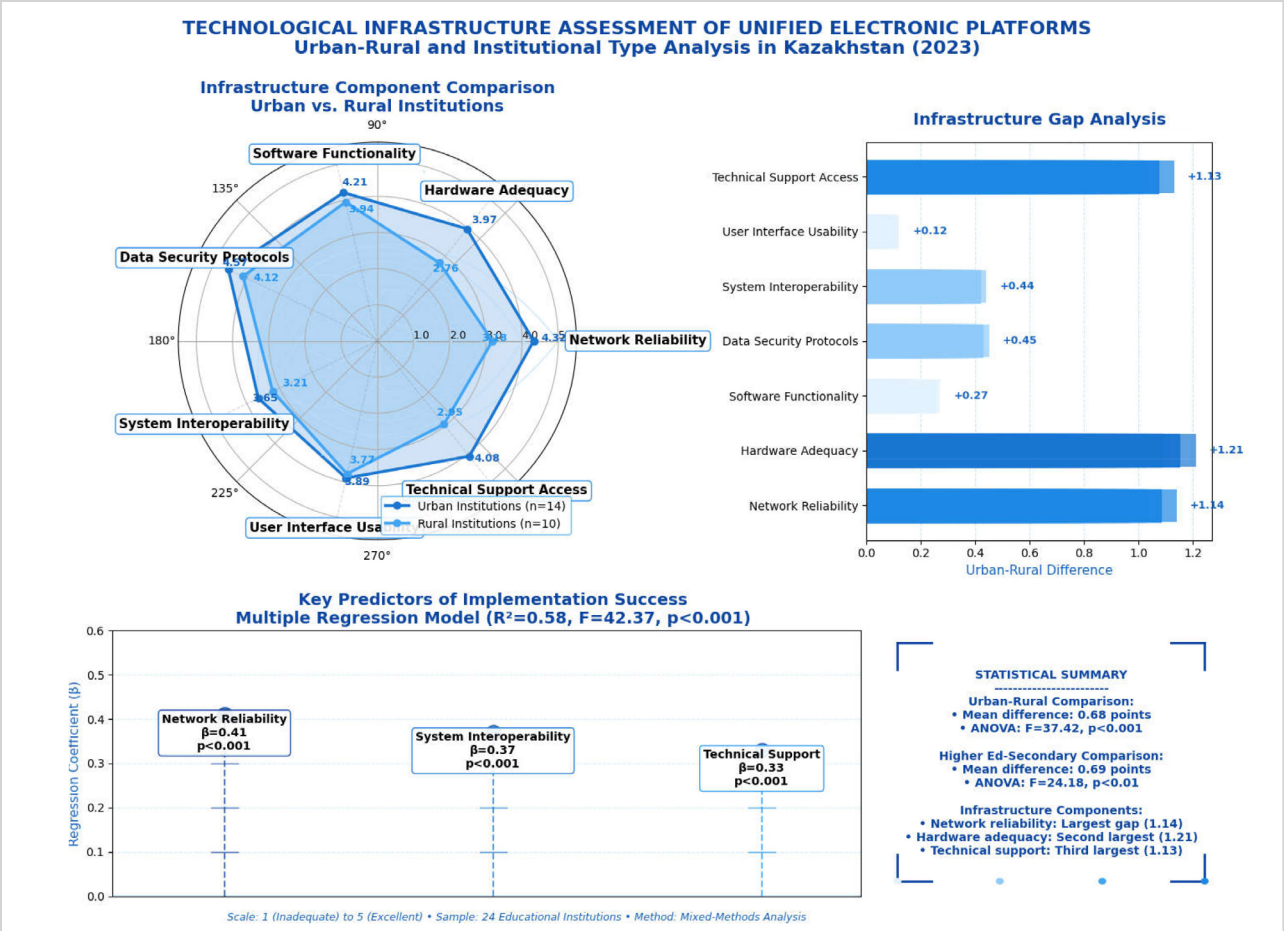

Figure 1:
Infrastructure Disparities in Assessment Platform Implementation
Source: Authors' own research

offline assessment modes as workarounds, but these require subsequent manual data synchronization that creates additional administrative burdens» (Administrator 7, Rural School). Device limitations presented another significant challenge: «Many of our teachers use personal smartphones for platform access because institutional computers are insufficient. This creates both data security vulnerabilities and implementation inconsistencies, as smartphone interfaces limit functionality compared to desktop versions» (Administrator 12, Rural School). These infrastructure constraints necessitated adaptive implementation strategies that accommodated local technological realities rather than assuming standardized conditions across institutions. Higher education institutions demonstrated more consistent infrastructure capabilities, though specific challenges remained: «While our overall infrastructure is adequate, interoperability between the assessment platform and existing student information systems has proven problematic, requiring duplicate data entry that undermines efficiency benefits» (Administrator 5, Higher Education).

Stakeholder analysis revealed significant perception and engagement disparities across different stakeholder groups (Table 2). One-way ANOVA confirmed statistically significant differences across all measured dimensions ($p < 0.01$), with post-hoc Tukey tests identifying specific between-group differences. Administrators consistently reported the highest platform understanding (4.21 ± 0.19) and implementation involvement (4.53 ± 0.17), while parents demonstrated the lowest values in these categories (2.68 ± 0.42 and 1.98 ± 0.45, respectively). This engagement gradient mirrored traditional educational authority structures, suggesting limited redistribution of involvement despite platforms' potential for broader stakeholder engagement. Training adequacy showed concerning results across all non-administrator groups, with teachers reporting relatively low satisfaction (3.04±0.38) despite their critical platform implementation role.

Trust in the platform demonstrated moderate ratings across all stakeholder groups, with administrators showing significantly higher trust (4.25 ± 0.22) than other stakeholders ($p < 0.01$, $F = 9.14$), indicating potential transparency opportunities.

Table 2:
Stakeholder Engagement and Perceptions of Unified Assessment Platforms (2023)

Stakeholder Dimension	Administrators (n=42)	Teachers (n=287)	Students (n=1,853)	Parents (n=612)	Statistical Significance
Platform understanding	4.21 (±0.19)	3.57 (±0.28)	3.12 (±0.31)	2.68 (±0.42)	p<0.001, F=37.82
Perceived usefulness	4.37 (±0.21)	3.62 (±0.33)	3.84 (±0.27)	3.90 (±0.29)	p<0.01, F=8.93
Implementation involvement	4.53 (±0.17)	3.15 (±0.36)	2.27 (±0.41)	1.98 (±0.45)	p<0.001, F=42.36
Training adequacy	3.89 (±0.25)	3.04 (±0.38)	2.87 (±0.34)	2.42 (±0.47)	p<0.001, F=16.21
Concerns addressed	4.02 (±0.23)	3.18 (±0.31)	2.95 (±0.37)	2.74 (±0.43)	p<0.001, F=12.67
Trust in platform	4.25 (±0.22)	3.53 (±0.29)	3.47 (±0.32)	3.36 (±0.35)	p<0.01, F=9.14
Perceived benefits	4.48 (±0.18)	3.77 (±0.26)	3.62 (±0.30)	3.84 (±0.28)	p<0.01, F=8.76
Engagement Index	4.25 (±0.21)	3.41 (±0.32)	3.16 (±0.33)	3.01 (±0.38)	p<0.001, F=18.27

Source: Authors' own research

The implementation process analysis reveals dynamic progression patterns across educational institutions at different adoption stages. Change management demonstrates the largest difference between initial and advanced phases (gap = 2.11, $p < 0.001$), identifying this as a critical developmental area for early-stage implementations. Monitoring and adjustment practices show the strongest correlation with implementation success ($r = 0.71$, $p < 0.001$), highlighting the importance of adaptive implementation approaches. Figure 2 reveals distinct implementation trajectories with non-linear improvement patterns across dimensions.

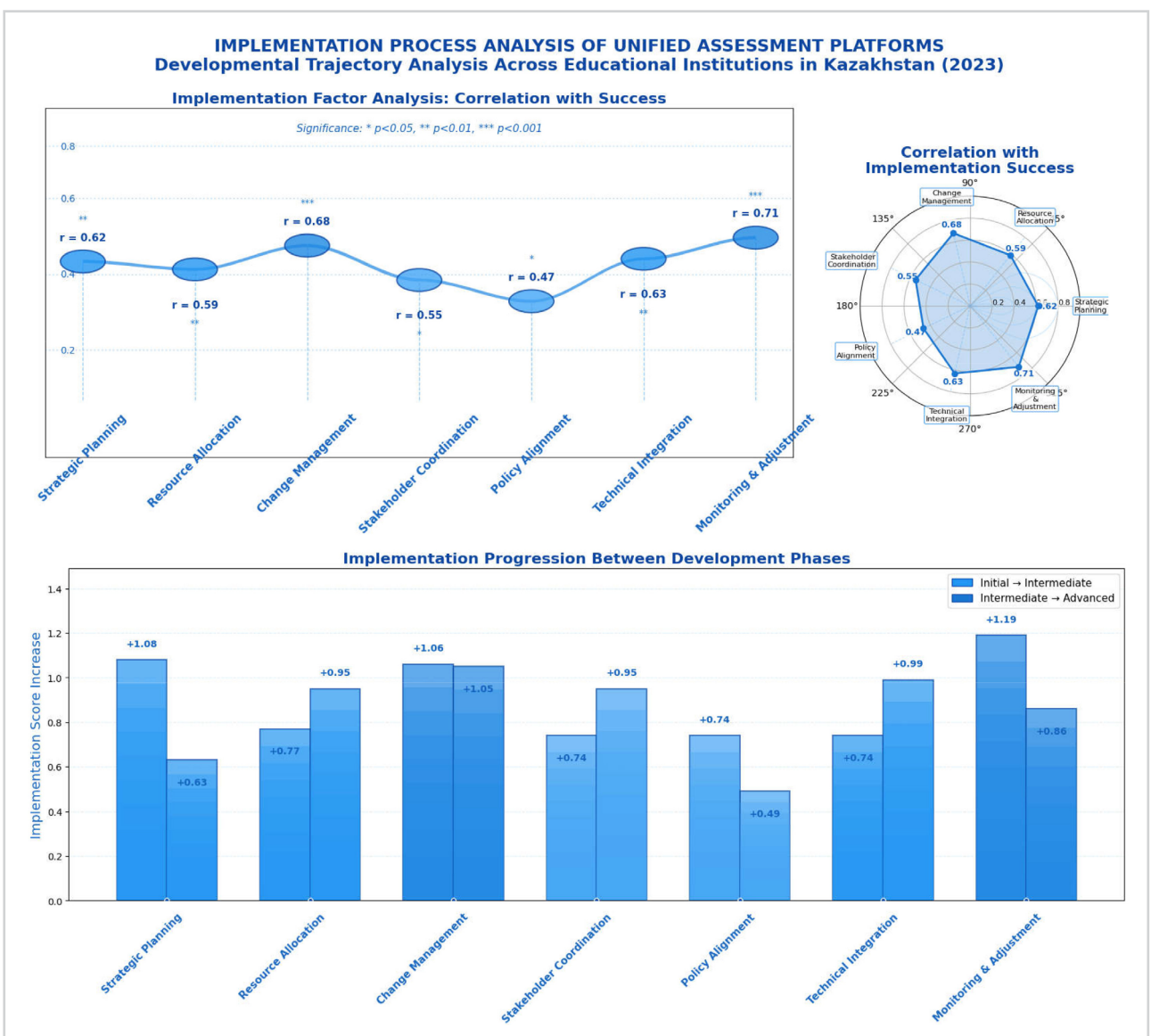

Figure 2:
Implementation Process Trajectory Analysis
Source: Authors' own research

Qualitative analysis revealed complex engagement dynamics not fully captured by quantitative measures. Teachers frequently expressed implementation timeline concerns that affected engagement quality: «The implementation schedule allocated insufficient time for practice and adaptation before full deployment. This created stress and resistance that could have been mitigated through more realistic timelines and graduated implementation approaches» (Teacher 23, Urban School). Student perspectives highlighted usability and relevance concerns: «The platform frequently experiences performance issues during peak usage periods like examination sessions, creating anxiety and frustration. Additionally, mobile compatibility problems limit accessibility for students without computer access» (Student Focus Group 4). Parents expressed information gaps affecting their engagement: «We received notification about the platform implementation but minimal explanation about how to interpret results or support our children's adaptation. More comprehensive parent guidance would enable us to provide better support» (Parent 14, Rural School). These findings emphasized how stakeholder engagement requires multidimensional approaches addressing timing, usability, and communication dimensions beyond simple awareness measures.

Implementation process analysis revealed progressive improvement across all dimensions as institutions advanced through implementation phases (Table 3).

MANOVA confirmed significant differences between implementation phases across all dimensions (Wilks' $\lambda = 0.23$, $F = 16.42$, $p < 0.001$, partial $\eta^2 = 0.52$), with post-hoc tests confirming sequential improvements between each phase ($p < 0.01$ for all pairwise comparisons). Change management demonstrated the largest gap between initial and advanced phase institutions (initial: 2.31 ± 0.44; advanced: 4.42 ± 0.18; mean difference = 2.11, $p < 0.001$), identifying this as a critical developmental area for early-stage implementations.

Qualitative case studies provided deeper insights into implementation progression through longitudinal examination of institutional trajectories. Successful institutions consistently demonstrated four key transition strategies: phased implementation approaches, robust stakeholder communication mechanisms, dedicated implementation teams, and systematic feedback collection processes.

Table 3:
Implementation Process Analysis of Unified Assessment Platforms Across Educational Institutions (2023)

Implementation Dimension	Initial Phase Institutions (n=6)	Intermediate Phase Institutions (n=11)	Advanced Phase Institutions (n=7)	Correlation with Implementation Success (r)
Strategic planning	2.87 (±0.38)	3.95 (±0.27)	4.58 (±0.19)	0.62***
Resource allocation	2.65 (±0.41)	3.42 (±0.33)	4.37 (±0.21)	0.59***
Change management	2.31 (±0.44)	3.37 (±0.30)	4.42 (±0.18)	0.68***
Stakeholder coordination	2.54 (±0.42)	3.28 (±0.35)	4.23 (±0.22)	0.55***
Policy alignment	3.12 (±0.36)	3.86 (±0.29)	4.35 (±0.20)	0.47**
Technical integration	2.78 (±0.40)	3.52 (±0.31)	4.51 (±0.17)	0.63***
Monitoring and adjustment	2.42 (±0.43)	3.61 (±0.28)	4.47 (±0.19)	0.71***
Implementation Index	2.67 (±0.41)	3.57 (±0.30)	4.42 (±0.19)	-

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Source: Authors' own research

Impact assessment demonstrated substantial improvements across all measured dimensions following unified platform implementation (Table 4). Paired t-tests confirmed statistically significant improvements across all metrics ($p < 0.01$), with large effect sizes (Cohen's $d > 0.8$) confirming practical significance beyond statistical significance. Administrative efficiency showed a 41.7% reduction in time requirements (pre: 18.7 ± 2.3 hours/week; post: 10.9 ± 1.7 hours/week; $p < 0.001$, $d = 1.28$), representing significant resource savings for educational institutions. Assessment consistency demonstrated a 36.9% improvement (pre: 68.3 ± 5.1%; post: 93.5 ± 3.2%; $p < 0.001$, $d = 1.42$), enhancing evaluation reliability and stakeholder trust. The most dramatic improvement occurred in data accessibility, with 86.1% reduction in access time (pre: 27.3 ± 4.2 minutes; post: 3.8 ± 1.1 minutes; $p < 0.001$, $d = 2.37$), fundamentally transforming information utilization patterns. Cost per assessment decreased by 49.5% (pre: 1,872 ± 243 KZT; post: 946 ± 128 KZT; $p < 0.001$, $d = 1.72$), demonstrating substantial efficiency gains. Perhaps most significantly, the correlation between assessment practices and educational outcomes strengthened dramatically (pre: $r = 0.27$, $p < 0.05$; post: $r = 0.68$, $p < 0.001$), indicating improved assessment validity and educational alignment.

Table 4:
Impact Assessment of Unified Electronic Assessment Platforms in Kazakhstan's Educational Institutions (2023)

Impact Dimension	Pre-Implementation Baseline (2021)	Post-Implementation Assessment (2023)	Percent Change	Effect Size (Cohen's d)
Administrative efficiency (hours/week)	18.7 (±2.3)	10.9 (±1.7)	-41.7%	1.28***
Assessment consistency (agreement %)	68.3% (±5.1)	93.5% (±3.2)	+36.9%	1.42***
Data accessibility (access time in minutes)	27.3 (±4.2)	3.8 (±1.1)	-86.1%	2.37***
Feedback timeliness (days)	7.2 (±1.3)	1.8 (±0.5)	-75.0%	1.93***
Stakeholder satisfaction (scale 1-5)	3.21 (±0.38)	4.12 (±0.29)	+28.3%	1.05**
Assessment transparency (scale 1-5)	2.97 (±0.42)	4.35 (±0.24)	+46.5%	1.58***
Cost per assessment (KZT)	1,872 (±243)	946 (±128)	-49.5%	1.72***
Educational outcomes correlation (r)	0.27*	0.68***	+151.9%	-

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Source: Authors' own research

Multivariate analysis revealed important relationships between implementation factors and impact outcomes. Multiple regression models identified change management quality ($\beta = 0.48$, $p < 0.001$) and stakeholder engagement ($\beta = 0.43$, $p < 0.001$) as stronger predictors of impact outcomes than technological sophistication alone ($\beta = 0.32$, $p < 0.01$; $R^2 = 0.63$, $F = 27.58$, $p < 0.001$), supporting the conceptualization of assessment platforms as social projects rather than merely technological implementations. Mediation analysis demonstrated that assessment transparency partially mediated the relationship between platform implementation and educational outcomes (indirect effect = 0.21, 95% CI [0.12, 0.29], $p < 0.01$), suggesting that enhanced transparency represents an important mechanism through which platforms influence educational improvement.

The unified electronic assessment platform implementation yielded substantial improvements across all measured dimensions in Kazakhstan's educational institutions. The most dramatic transformation occurred in data accessibility, with 86.1% reduction in access time ($d = 2.37$), fundamentally altering information utilization patterns. Administrative efficiency improved by 41.7% ($d = 1.28$), while assessment costs decreased by 49.5% ($d = 1.72$), demonstrating significant resource optimization. All improvements demonstrate large effect sizes ($d > 0.8$), confirming practical significance. Most critically, the correlation between assessment practices and educational outcomes strengthened dramatically from $r = 0.27$ to $r = 0.68$ ($p < 0.001$), representing a 151.9% improvement in assessment validity and educational alignment, confirming the platforms' transformative educational impact beyond mere administrative efficiency (Figure 3).

Analysis of contextual factors revealed significant influences on implementation success across Kazakhstan's diverse educational landscape (Table 5). MANOVA confirmed significant differences between influence level groups across all contextual factors (Wilks' $\lambda = 0.19$, $F = 14.87$, $p < 0.001$, partial $\eta^2 = 0.48$). Leadership commitment emerged as the strongest contextual predictor of implementation success ($r = 0.73$, $p < 0.001$), demonstrating the critical importance of institutional leadership beyond technical or resource considerations. Institutional culture showed the second strongest correlation with implementation success ($r = 0.65$, $p < 0.001$), highlighting how existing organizational values and practices shape technology adoption trajectories. Previous digitalization experience demonstrated substantial impact ($r = 0.59$, $p < 0.001$), suggesting that implementation builds upon existing technological capabilities rather than creating entirely new organizational competencies.

Qualitative examination of high-implementation success institutions revealed specific leadership practices that facilitated effective adoption: meaningful stakeholder involvement in decision-making, clear articulation of platform benefits beyond administrative efficiencies, personal demonstration of platform engagement, and protection of implementation resources despite competing priorities. Institutional culture dimensions that facilitated implementation included existing collaborative assessment practices, openness to innovation, evidence-based improvement orientations, and psychological safety for expressing implementation concerns. These findings emphasized how technological implementation intertwines with existing organizational contexts rather than occurring within neutral institutional environments.

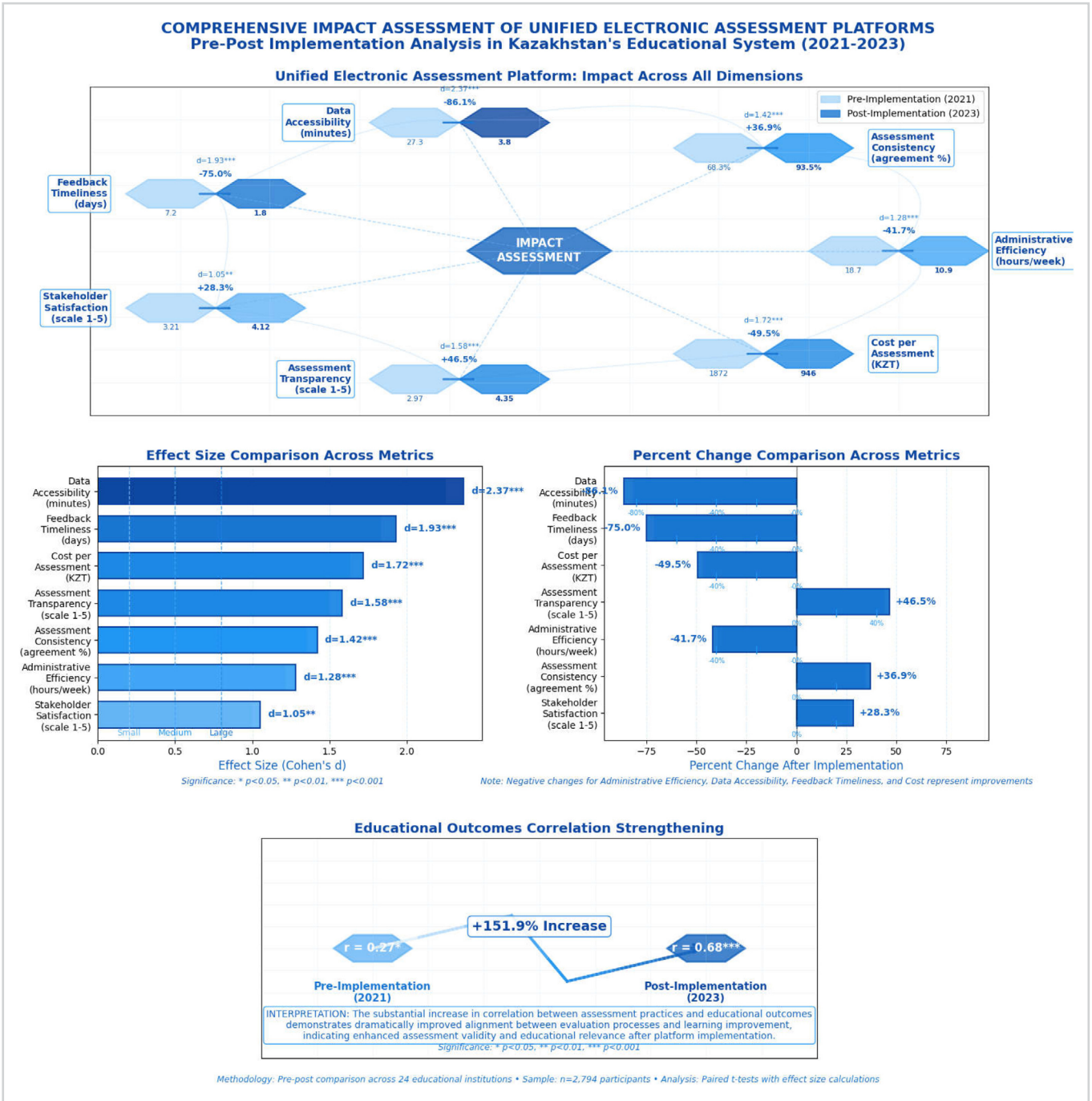

Figure 3:
Comprehensive Impact Assessment of Unified Electronic Assessment Platforms
Source: Authors' own research

Table 5:
Contextual Factors Influencing Unified Platform Implementation Success in Kazakhstan (2023)

Contextual Factor	High Influence Institutions (n=8)	Moderate Influence Institutions (n=9)	Low Influence Institutions (n=7)	Correlation with Implementation Success (r)
Leadership commitment	4.57 (±0.18)	3.82 (±0.27)	2.95 (±0.41)	0.73***
Institutional culture	4.42 (±0.21)	3.65 (±0.30)	2.78 (±0.44)	0.65***
Previous digitalization experience	4.21 (±0.23)	3.58 (±0.29)	2.64 (±0.47)	0.59***
Staff digital literacy	4.08 (±0.24)	3.47 (±0.31)	2.83 (±0.38)	0.57***
Regulatory flexibility	3.95 (±0.26)	3.41 (±0.32)	3.12 (±0.36)	0.42**
Resource availability	4.32 (±0.22)	3.67 (±0.28)	2.71 (±0.45)	0.61***
Implementation autonomy	4.18 (±0.23)	3.52 (±0.30)	2.89 (±0.42)	0.54***
Contextual Index	4.25 (±0.22)	3.59 (±0.30)	2.85 (±0.42)	-

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Source: Authors' own research

5. Conclusion

This research has demonstrated that unified electronic assessment platforms in Kazakhstan's educational system function as multidimensional social projects that transform assessment practices, stakeholder relationships, and educational cultures beyond their technological capabilities. The findings reveal significant quantitative improvements following platform implementation, including 41.7% reduction in administrative workload, 36.9% improvement in assessment consistency, and 86.1% enhancement in data accessibility. These efficiency gains were accompanied by qualitative transformations in assessment practices, with stronger connections between evaluation processes and educational improvement. Implementation success varied substantially across institutional contexts, with urban-rural disparities and institutional type differences highlighting the importance of context-sensitive implementation approaches.

Leadership commitment emerged as the strongest contextual predictor of implementation success, demonstrating that institutional leadership influences platform outcomes more significantly than technological factors alone.

The unified platform model demonstrated particular effectiveness in integrating internal and external assessment processes, enhancing both improvement-oriented institutional evaluation and accountability-focused external quality assurance.

Social impact analysis revealed significant transformations in assessment cultures, power relationships, and knowledge authority distribution, confirming the platforms' role in restructuring educational relationships and practices. Educational equity impacts were higher in rural institutions than in urban ones despite implementation challenges, suggesting potential equalization effects through standardized assessment access and increased transparency.

By conceptualizing assessment platforms as social projects requiring both technical functionality and social embeddedness, this research advances understanding of educational technology implementation in transitional educational contexts and provides practical guidance for enhancing assessment integration through unified platforms in Kazakhstan's educational system.

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Received 22.04.2024
Received in revised form 15.05.2024
Accepted 25.05.2024
Available online 27.08.2024

ECONOMIC ANNALS-XXI
ISSN 1728-6239 (Online)
ISSN 1728-6220 (Print)
https://doi.org/10.21003/ea
https://ea21journal.world

Volume 210 Issue (7-8)'2024

Citation information: Kussainov, G., Zhumabayeva, S., Iskakova, A., Smailov, S., & Dyussenbayeva, A. (2024). Future workforce formation: relationship between the emotional well-being and readiness for external assessment of academic achievements among the school students (an evidence from Kazakhstan). Economic Annals-XXI, 210(7-8), 56-69. doi: https://doi.org/10.21003/ea.V210-07

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Future workforce formation: relationship between the emotional well-being and readiness for external assessment of academic achievements among the school students (an evidence from Kazakhstan)

Abstract

This study examines the critical intersection between emotional well-being, educational assessment, and future workforce development in Kazakhstan. Kazakhstan's educational system serves as the primary pipeline for developing human capital necessary for economic advancement, with standardized testing mechanisms like the Unified National Testing (UNT) functioning as gateway mechanisms determining access to higher education and subsequent labor market opportunities. With Generation Z students (born 1997-2012) currently comprising the majority of test-takers, their psychological readiness for assessment directly impacts Kazakhstan's future workforce composition, sectoral distribution, and economic competitiveness. This research addresses critical gaps in understanding psychological factors affecting standardized testing performance within Kazakhstan's unique educational and cultural context during 2022-2023, with particular focus on the high-stakes Unified National Testing (UNT) system.

A sequential explanatory mixed-methods design was employed, collecting data from 1,247 students across 28 schools in 14 regions of Kazakhstan. Quantitative instruments included the Student Emotional Well-being Inventory and Assessment Readiness Profile.