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Design and Conceptual Modeling of a Synergetic Web Platform for Integrative Learning of the Kazakh Language and Expressive Stylistics

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ABSTRACT
The objective of this research is to examine the process of teaching and analyzing the expressive stylistics of the Kazakh language through a digital educational environment. The study addresses the problem of insufficient methodological and technological tools for the systematic teaching of complex expressive linguistic constructions. To address this, the study proposes a conceptual model for a synergetic web-based platform that integrates linguistic theory with digital technologies. Data collection was conducted over a six-month period at major Kazakhstani universities using a mixed-methods design. The instruments included a specialized research corpus comprising 32,000-word tokens for system training, a validated multi-section digital questionnaire assessing linguistic knowledge and user attitudes, and a standardized 10-point expert evaluation form. Empirical evaluation involved 218 undergraduate and graduate students and an expert panel. Pre–post testing demonstrated a significant improvement in the identification of expressive stylistic units, with student accuracy increasing from 46.8% to 71.3% ($p < 0.001$). Expert assessments (mean score of 4.7/5.0) confirmed the accuracy of the implemented classifications, including evaluative suffixation and syntactic emphasis patterns. The platform proves effective for university courses and professional development requiring scalable, consistent instruction in Kazakh stylistic analysis.

KEYWORDS
Expressive stylistics; digital learning platform; linguistic analysis; web-based education; Kazakh.

INTRODUCTION

In the context of rapid technological development and global digital communication, the understanding of language, its expressive potential, and modes of study is undergoing a profound transformation. Linguistics increasingly intersects with cognitive science and digital technologies, offering new opportunities to explore language as a dynamic, self-organizing system. Within this evolving paradigm, the study of expressive stylistics assumes particular importance, as it reflects both the individual creative use of linguistic means and the cultural identity encoded in language.

Modern philology views expressive stylistics not only as a set of expressive devices but also as a mechanism for shaping communicative influence, emotional impact, and aesthetic value in speech. However, traditional approaches to studying expressiveness remain largely theoretical and descriptive, limiting their practical implementation in the modern educational environment (Abnassyrova, 2023; Marchenko & Gudkova, 2023). At the same time, linguistic science faces the necessity to develop interactive and interdisciplinary learning models that combine linguistic theory with computational and digital analysis tools, allowing students to explore language dynamically and contextually.

Recent studies in computational linguistics and language pedagogy indicate that integrating artificial intelligence (AI) and natural language processing (NLP) into linguistic practice opens new horizons for analyzing language expressiveness, stylistic variation, and discourse dynamics (Asmaganbetova et al., 2024; Makeleni et al., 2023; Oralbekova et al., 2024). These technologies enable researchers and educators to observe language as a living system capable of adaptation and interaction, rather than a static object of description (Bolatbek et al., 2025; Oralbekova et al., 2024; Kalymova et al., 2026).

The conceptual foundation of this study is rooted in linguistic synergetics, a paradigm that views language as an open, self-organizing system operating through continuous interaction with its socio-technological environment (Satylganova et al., 2024). Unlike traditional descriptive stylistics, the synergetic approach prioritizes the study of 'bifurcation points' and 'hysteresis'—the history-dependence of a system's evolution. In the context of the Kazakh language, this model allows for the exploration of how expressive means (EM) and stylistic devices (SD) emerge from the 'chaos' of digital and non-standard discourse through self-regulation and non-linear feedback loops. This approach is particularly relevant given the historical shifts in Kazakh writing systems and the current hybridization of speech patterns.

In this regard, the development of a synergistic web platform for the integrated study of the Kazakh language and its expressive stylistics holds significant academic value. Such a platform serves not only as an educational innovation but also as a research framework for analyzing linguistic creativity, stylistic functions, and expressive patterns within a digital environment.

Therefore, research on the development and architecture of a synergetic web platform for integrative learning of the Kazakh language and its expressive stylistics is highly relevant**,** as

it contributes to contemporary linguistic scholarship by advancing understanding of expressive language mechanisms, enriching the methodology of stylistic analysis, and supporting the evolution of philological education in the digital era.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The convergence of linguistic theory and digital technology has inaugurated a transformative epoch in the study of philological structures. Central to this evolution is the integration of artificial intelligence (AI)—defined as the development of computer systems capable of performing tasks that typically require human cognitive functions, such as reasoning, pattern recognition, and decision-making—with the specialized domain of natural language processing (NLP), which encompasses a theoretically motivated range of computational techniques for analyzing, representing, and generating naturally occurring human language (Satylganova et al., 2024). For the Kazakh language, a morphologically rich and agglutinative system, this integration facilitates a shift from traditional descriptive stylistics toward adaptive, data-driven models capable of quantifying linguistic creativity and emotional resonance (Bolatbek et al., 2025; Oralbekova et al., 2024).

Our study of expressive stylistics in the Kazakh language within the context of digital education requires a rigorous analysis of existing linguistic models, computational architectures, and adaptive learning approaches. Theoretical research has long highlighted the role of stylistic devices—such as metaphors, epithets, and complex syntactic constructions—in shaping communicative impact, yet these elements have traditionally been treated as qualitative artifacts. The deployment of AI and NLP enables the automated analysis of these expressive devices through sentiment detection and stylistic classification, providing new avenues for exploring the depth of linguistic variation (Aitim & Satybaldiyeva, 2024; Asmaganbetova et al., 2024). Adaptive educational platforms that utilize personalized feedback and interactive technologies have proven highly effective in general language learning, but their potential for fostering stylistic competence remains an underserved frontier (Zholdigaly et al., 2024).

Addressing this underserved frontier requires a shift from 'functional digitization'—which typically focuses on prescriptive grammar—toward a more holistic, synergistic model that captures the dynamic, non-linear nature of language. To effectively bridge this gap, research must integrate the deep theoretical structures of expressiveness with adaptive digital architectures, allowing for the emergence of complex stylistic awareness through interactive feedback (Marchenko & Gudkova, 2023; Satylganova et al., 2024). Consequently, it is essential to first delineate the core principles of expressive stylistics within linguistic theory to establish a robust framework for their digital implementation.

Expressive Stylistics in Linguistic Theory

Expressive stylistics is defined as the branch of linguistics that focuses on the ways in which stylistic elements serve as a conduit for an author's individual voice, intentions, and emotional nuances by investigating linguistic forms that intensify or emphasize parts of an utterance through logical and emotional meaning (Scribd, 2025). It serves as a critical bridge between

linguistics and literary studies, providing a systematic framework for exploring how language creates meaning, style, and aesthetic effect. Within this discipline, a fundamental distinction is made between expressive means (EM)—those linguistic forms and properties that have the potential to make an utterance emphatic—and stylistic devices (SD), which represent the conscious and intentional literary use of language facts for further intensifying a text.

The study of expressive stylistics in the Kazakh language increasingly intersects with computational linguistics and digital education, yet traditional stylistic research often remains descriptive and isolated from the practicalities of digital application. Traditional research focuses on the role of metaphors and syntactic constructions in creating communicative impact, but without a computationally grounded framework, these analyses remain largely static (Abnassyrova, 2023). While interactive and collaborative approaches have been shown to enhance linguistic competence and motivation (Alpysbayeva et al., 2024; Rizakhojayeva, 2026; Satylganova et al., 2024), the systematic integration of stylistic learning into digital platforms remains underdeveloped—a gap reinforced by limited teacher training and insufficient methodological support for digital stylistic analysis (Gabdullina et al., 2024).

Expressive stylistics plays a crucial role in shaping the emotional and communicative impact of language. It encompasses various linguistic methods that analyze how expressive means function in different contexts, highlighting their role in meaning formation, stylistic differentiation, and discourse construction.

Application of Expressive Stylistics to Kazakh Language Examples

In the Kazakh language, expressive stylistic devices, such as metaphors, epithets, and exclamatory constructions, contribute to the richness and dynamism of speech. The analysis of expressive stylistics in Kazakh employs a range of linguistic methods that reveal how emotional, evaluative, and figurative meanings are constructed in discourse (Abnassyrova, 2023). Using the descriptive method, researchers identify and classify stylistic devices; for instance, in the sentence *Kók aspannyń qoınyndan altyn kún jarqyrady* ("The golden sun shone from the bosom of the blue sky"), the epithet *altyn kún* ("golden sun") and the metaphor *kók aspannyń qoıny* ("bosom of the blue sky") demonstrate expressive imagery (Abnassyrova, 2023).

The comparative method highlights cross-linguistic parallels, such as the Kazakh expression *Zheldei júirik* ("fast as the wind") corresponding to the Russian expression *быстрый как ветер*, showing shared conceptual metaphors (Abnassyrova, 2023). Furthermore, the structural method explores the syntactic organization of expressiveness, as seen in *Shírkin, keń baitaq dalam!* ("Oh, my vast steppe!"), where the interjection and exclamatory construction enhance emotional intensity (Abnassyrova, 2023). The morphological level is particularly significant for the Kazakh language due to its agglutinative nature, where suffixes add shades of aspect and evaluation (*kelipti*—"apparently came") (Aitim & Satybaldiyeva, 2024; Lucas et al., 2025).

Each method in Table 2 focuses on a distinct linguistic level – lexical, morphological, syntactic, or phonetic and illustrates how expressive means manifest through specific examples.

The examples demonstrate emotional, evaluative, and stylistic nuances characteristic of Kazakh expressive discourse.

Computational Linguistics and NLP for the Kazakh Language

Advances in computational linguistics for Kazakh remain limited compared to those for major world languages. Primary challenges include vowel harmony, agglutinative morphology, and the historical absence of large-scale standardized corpora (Aitim & Satybaldiyeva, 2024). While resources such as the Kazakh Language Corpus (KLC) provide valuable infrastructure, they often lack specialized capabilities for stylistic analysis. Early technical foundations, such as parallel-computing-based systems for text recognition, similarly lacked adaptability to nuanced stylistic applications (Kairakbay, 2013).

Recent research has seen the development of language-specific models such as KazRoBERTa and KazBERT, which consistently outperform multilingual counterparts such as mBERT on tasks such as morphological analysis (Oralbekova et al., 2024). Hybrid architectures, combining rule-based Finite-State Transducers (FSTs) with neural architectures, have achieved accuracy rates over 90.8%, significantly higher than multilingual alternatives. This technical evolution is critical for stylistic analysis, as correct morphological segmentation is the first step in detecting the subtle emotional and evaluative nuances that characterize expressive discourse (Oralbekova et al., 2024).

Synergetic and Interdisciplinary Approaches

The transformation of education through digital tools depends heavily on teachers' digital competence and access to infrastructure. Studies in Kazakhstan show that combining language and media literacy can strengthen the so-called "4Cs"—communication, collaboration, critical thinking, and creativity (Yelubayeva et al., 2024). However, the lack of digital pedagogy in teacher education remains a persistent obstacle (Alpysbayeva et al., 2024).

A synergetic approach is required to bridge these gaps, merging knowledge from linguistics, literature, and law into a unified learning experience. For example, legal linguistics studies how formality and expressiveness coexist in institutional discourse, while courtroom rhetoric analyzes persuasive techniques in legal argumentation. The synergetic model of integrated learning is based on the dynamic development of knowledge through interaction between these fields, fostering self-organization and non-linear learning processes (Abnassyrova, 2023).

Examples and applications in Table 3 (see appendix) show how expressive devices such as metaphors, rhetorical questions, and emotionally charged vocabulary function within legal documents, courtroom communication, and legislative texts.

The synergetic model in integrated learning is based on self-organization, interaction, and dynamic development of knowledge, skills, and competencies. In the context of expressive stylistics and the Kazakh language, it enables a holistic, interdisciplinary approach, where different disciplines influence and enhance each other in Table 4 (see appendix).

Theoretical Re-alignment: Operationalizing Synergetics in Digital Philology

Synergetics, as a post-non-classical methodology, views language not as a static set of rules but as an open, dynamic system capable of spontaneous pattern formation (Satylganova et al., 2024; Scribd, 2025). Within the context of Kazakh expressive stylistics, the system is characterized by "order parameters"—the overarching stylistic goals of a speaker—and "fluctuations," which represent individual creative deviations from standard linguistic norms (Abnassyrova, 2023; Scribd, 2025). The operationalization of this theory within the platform architecture is achieved through a multi-layered diagnostic engine that treats linguistic errors as bifurcation points—moments of instability where the learner's cognitive path can shift toward either standard grammatical mastery or advanced stylistic competence (Satylganova et al., 2024; Scribd, 2025).

Mapping Synergetic Principles to Platform Functionality

Synergetic Construct	Linguistic Manifestation in Kazakh	Platform Architectural Mechanism
Order Parameters	The intended emotional impact of the text.	The "Stylistic Intent" module defining target attractors.
Bifurcation Points	Complex syntactic inversions or morphological reduplications.	The Neural Disambiguation Layer (KazRoBERTa) triggering feedback.
Dissipative Feedback	Real-time adaptive hints disrupting incorrect habits.	RESTful API triggers providing non-linear, scaffolded suggestions.
Self-Organization	Transition from identifying tropes to original creation.	The "Augmented Creativity" workbench acting as a "machine-in-the-loop".

In Kazakh, these bifurcation points are most evident at the morphological level. For instance, the use of evaluative suffixes such as -šym (as in apašym, meaning 'dear granny') represents a stylistic fluctuation that adds emotional depth (Aitim & Satybaldiyeva, 2024; Lucas et al., 2025). Traditional educational software often treats such forms as mere morphological variants. However, a synergetic architecture identifies these as "attractors"—stable patterns of expressive meaning that the system helps the student "self-organize" into their active vocabulary (Satylganova et al., 2024; Scribd, 2025).

The interaction between these layers ensures that the platform is not merely a digitized textbook but a dynamic ecosystem. When a student interacts with the system, the platform monitors the "entropy" of their linguistic choices. High error rates in syntactic analysis indicate cognitive instability. Rather than providing a simple binary "correct/incorrect" response, the system introduces "dissipative feedback"—information that guides the learner toward a more stable state of stylistic awareness (Satylganova et al., 2024; Scribd, 2025).

Architectural Synthesis: Bridging Linguistic Theory and Web Systems

To satisfy the requirement for a detailed platform description, it is necessary to examine the architecture through the lens of modern web engineering. The platform is built on a "Clean Architecture" model, which decouples the business logic (linguistic analysis) from the infrastructure (database and UI) (Microsoft, 2022). This decoupling is essential for the synergetic model, as it allows the linguistic engine to evolve independently of the platform's interface.

The Multi-Layered Structural Framework

The system architecture is organized into three primary concentric layers, following the principles of Domain-Driven Design (DDD) and the Dependency Inversion Principle (Microsoft, 2022).

1. **The Application Core (Linguistic Domain)**: At the center of the architecture are the entities and interfaces that define Kazakh expressive stylistics. This includes the Morphological Analyzer and the "Synergetic Governor," a module that manages the non-linear feedback loops based on student performance (Microsoft, 2022; Satylganova et al., 2024).
2. **The Infrastructure Layer**: This layer implements the interfaces defined in the core. It includes the KazRoBERTa-based neural pipeline, which provides context-aware disambiguation (Baitenova et al., 2025; Oralbekova et al., 2024).
3. **The User Interface (UI) Layer**: This is the "shell" of the platform, built using modern web technologies to ensure scalability and responsiveness. The UI is designed to minimize cognitive load, allowing the "bifurcation points" to remain the primary focus of student attention (Deremuk, 2024; Lanars, 2024).

The interaction between these layers is governed by RESTful protocols, which minimize latency while maximizing component independence (Deremuk, 2024; Microsoft, 2022).

The analysis of expressive stylistics in Kazakh legal discourse confirms that, despite its formal and precise nature, legal communication actively employs stylistic devices to strengthen arguments, enhance persuasiveness, and create emotional impact. Judicial speech incorporates rhetorical questions, metaphors, hyperboles, and emotionally charged expressions to influence judges and juries, while legal texts, such as laws, regulations, and contracts, aim for clarity and unambiguity, though interpretation plays a crucial role in legal proceedings. Forensic linguistics helps analyse manipulative language, sarcasm, and irony, which is essential for identifying false testimonies and understanding the speaker’s intent. Thus, the study of expressive stylistics in legal discourse requires a synthetic approach that combines linguistics, law, psychology, and communication studies. The synergetic model of integrated learning suggests that knowledge is formed non-linearly through the interaction of different disciplines, self-organization of learners, and active information exchange. In the context of studying expressive stylistics in the Kazakh language, this model is particularly effective, as it allows for flexible adaptation of the learning process by integrating new research methods and approaches, combines multiple disciplines to create a holistic understanding of language as a tool for legal, cultural, and social

communication, and develops critical thinking, as students learn not only to memorize stylistic terms but also to analyse their use in different contexts. The use of interactive methods, such as debates, case studies, and judicial speech analysis, enhances both theoretical understanding and practical skills, including rhetorical argumentation and legal reasoning. From a practical perspective, knowledge of expressive stylistics is crucial for lawyers in argumentation, analysing judicial speeches, and drafting persuasive legal documents. For linguists, exploring expressive constructions in legal language provides deeper insights into the function of language in legal discourse. For educators, implementing the synergetic model of integrated learning promotes interdisciplinary thinking, which is increasingly relevant in the digital age. By integrating expressive stylistics with a synergetic approach to learning, professional communication skills can be enhanced in fields such as law, journalism, politics, and education. However, the realization of these practical benefits in professional discourse depends on a technical architecture capable of supporting the non-linearity and complexity inherent in the synergetic model. Traditional educational software often fails to capture the 'living' nature of language because it relies on static, centralized repositories. To operationalize a truly self-organizing learning environment, the platform must utilize an infrastructure that facilitates deep semantic connectivity and immersive interaction. This necessitates a shift toward emerging digital paradigms—specifically Web 3.0 and immersive technologies which provide the necessary decentralized and adaptive framework for modern digital philology.

Emerging Technologies: Web 3.0, Immersive and Gamified Learning

Recent research highlights the pedagogical impact of immersive environments—including Virtual Reality (VR), gamification, and mobile learning—within the Education 4.0 paradigm (Abnassyrova, 2023). Web 3.0 technologies incorporate AI-driven personalization and adaptive design to tailor the learning experience (Ayasheva et al., 2024). While these tools have shown measurable performance gains, they often focus on basic grammar rather than the sophisticated nuances of stylistic competence (Kairakbay, 2013; Abnassyrova, 2023).

Adaptive learning models, utilizing NLP and machine learning, provide real-time feedback that improves learner motivation and efficiency (Abnassyrova, 2023). However, there is a clear need for systems that integrate stylistic awareness into these frameworks, moving beyond functional digitization toward co-creative systems where AI acts as a "machine-in-the-loop" that inspires and augments a writer's creativity (Kairakbay, 2013).

Research Gap and Problem Statement

Despite advancements in AI, NLP, and digital learning, three critical gaps remain within the research context:

1. **Lack of stylistic integration**: Current AI-driven systems focus primarily on grammatical accuracy, neglecting the deeper layers of expressive stylistics and creative language use (Dossanova et al., 2024).

2. **Limited adaptation to the Kazakh linguistic context**: Few systems effectively address the language's morphological complexity and stylistic variability, particularly in digital and non-standard discourse (Aitim & Satybaldiyeva, 2024; Lucas et al., 2025).
3. **Insufficient synergy between linguistics, pedagogy, and AI technologies**: Most educational models operate within disciplinary silos, lacking a unified framework that supports dynamic, adaptive, and interdisciplinary learning experiences (Abnassyrova, 2023; Alpysbayeva et al., 2024; Yelubayeva et al., 2024).

The theoretical aim of this study is to justify and conceptually model a synergetic AI-driven web platform for the integrative learning of the Kazakh language and expressive stylistics. This platform will merge computational modeling, adaptive feedback, and stylistic analysis into a single ecosystem, advancing both linguistic research and digital pedagogy (Abnassyrova, 2023).

Operational Implementation of the Synergetic Model

We operationalize the synergetic model through a three-stage 'governance' loop. First, the KazRoBERTa-based pipeline identifies 'fluctuations' (stylistic errors or calques). Second, the platform provides 'dissipative feedback'—nonlinear hints that disrupt incorrect cognitive patterns, encouraging self-organization toward literary 'attractors'. Finally, Web 3.0 and immersive technologies provide the 'semantic connectivity' required to link disparate stylistic domains, such as legal rhetoric and poetic imagery, allowing for the emergence of holistic stylistic competence.

Research Questions and Hypotheses

To provide a clear operational framework for the empirical evaluation, the study is guided by the following research questions and testable hypotheses:

Research Questions

RQ1: Does the implementation of a synergetic web platform significantly improve student accuracy in identifying complex expressive stylistic units (lexical, morphological, and syntactic) in the Kazakh language?

RQ2: How do students and experts evaluate the linguistic precision and pedagogical utility of an AI-augmented synergetic platform compared to traditional descriptive methods?

Hypotheses

Null Hypothesis (H_0): There is no significant difference in student accuracy in identifying expressive stylistic units before and after using the synergetic web platform.

Alternative Hypothesis (H_a): The use of the synergetic web platform leads to a statistically significant increase in the identification accuracy of expressive stylistic units ($p < 0.05$).

METHODOLOGY

Research Design

This study employs a mixed-methods research design, integrating qualitative linguistic analysis with quantitative computational and empirical evaluation (Satylganova et al., 2024). According

to Creswell and Creswell (2017), a mixed-methods approach is ideal for complex research problems that require both an in-depth understanding of theoretical constructs and statistical validation of outcomes.

The qualitative phase involves developing a targeted research corpus in expressive stylistics, using descriptive and contextual-semantic methods to identify and annotate linguistic units. The quantitative phase focuses on the performance metrics of the NLP detection pipeline (accuracy, F1-score) and the empirical testing of the platform through student and expert evaluations. This integration allows the study to bridge the gap between traditional philological interpretation and modern computational efficiency.

In terms of quantity, the study was built upon several substantial datasets and participant metrics. The foundational research corpus comprised 32,000-word tokens, of which 1,240 expressive units were manually identified and annotated across five stylistic levels (lexical, phraseological, morphological, syntactic, and phonetic). The empirical evaluation phase involved 218 student participants and a specialized 3-member expert panel. Data collection spanned a six-month period, using a multi-section digital questionnaire comprising 13 validated items (6 assessing linguistic knowledge and 7 measuring user attitudes on a 5-point Likert scale). For the technical validation of the platform, the expert panel utilized a 10-point standardized evaluation form to score the system across four functional domains.

Research Group/Participants

The empirical study involved two distinct groups selected through a purposive sampling strategy to ensure relevant linguistic and pedagogical expertise:

Student Participants: The participant sample (N=218) comprised undergraduate and graduate students recruited from philology (48%) and pedagogy (52%) programs at major regional universities. The demographic profile was 56% female (n=122) and 44% male (n=96), which aligns with the national higher education gender distribution of 53% women reported for the 2024-2025 academic year. The age distribution was concentrated in the 18–25 bracket (88%), reflecting the primary university-age demographic, with 12% of participants aged 26 or older. Regarding geographic origin, 62% of participants were from urban areas and 38% from rural regions, mirroring the significant urban migration of Kazakh speakers observed in recent years. All participants (100%) were enrolled in Kazakh-medium instruction programs, representing approximately two-thirds of the national student body currently pursuing higher education in the state language.

Expert Panel: A group of 3 highly qualified experts in expressive stylistics and digital philology was involved in validating the model's linguistic correctness and methodological relevance. Selection criteria for experts included a minimum of 5 years of professional experience in theoretical linguistics or digital pedagogy. Their role was to provide objective feedback on the linguistic precision and functional utility of the proposed platform. The expert panel (n=3) was purposively selected to represent specialized domains in computational linguistics, traditional Kazakh stylistics, and digital pedagogy. While the sample size is small, it meets the requirements

for content validation in qualitative research, where a minimum of 3 experts is considered sufficient to represent expert judgment (Lynn, 1986; Rubio et al., 2003). To ensure statistical validity, we applied Lawshe's Content Validity Ratio (CVR), requiring unanimous agreement (CVR = 1.00) for items to be considered essential above the level of chance. Furthermore, the digital questionnaire's factorability was confirmed via the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy, which yielded a meritorious value of 0.853, and a significant Bartlett's Test of Sphericity ($p < 0.001$), confirming the data's suitability for factor analysis.

Data Collection Tools

Data collection was conducted over a six-month period using a combination of linguistic datasets and validated assessment instruments.

Research Corpus of Expressive Stylistics

The foundational tool for system training was a structured research corpus comprising 32,000 word tokens containing 1,240 annotated expressive units. The corpus covers five stylistic levels: lexical, phraseological, morphological, syntactic, and phonetic. Material was manually harvested from contemporary Kazakh fiction, media articles, and digital discourse, ensuring genre diversity and authenticity.

Student Data Collection Instrument

A multi-section digital questionnaire was developed to assess the platform's impact on learning outcomes. The instrument followed a standardized forward-backward translation process to ensure cultural and linguistic suitability. The questionnaire structure includes:

Demographics: Gender, age group, and professional background.

Linguistic Knowledge: Six items assessing familiarity with expressive stylistic means.

Attitudes Toward AI-Platform: Seven items measuring user perception on a 5-point Likert scale (Strongly Agree to Strongly Disagree).

Reliability and Validity: Content validity was ensured through a structured validation protocol involving native speakers and linguistic experts. Psychometric evaluation using Confirmatory Factor Analysis (CFA) supported a two-factor model of "Knowledge" and "Attitude". Internal consistency was confirmed with Cronbach's alpha factor loadings exceeding the recommended threshold of 0.70, indicating strong associations with the latent constructs.

Expert Evaluation Form

The expert form was designed to assess the "Synergetic Model" across four key domains: linguistic precision, pedagogical utility, interface clarity, and technical scalability. Evaluation was conducted on a 10-point scale, focusing on the system's ability to accurately detect complex markers (e.g., inversion, irony) and its effectiveness in fostering "Augmented Creativity".

Data Analysis Techniques

Data analysis was performed using Structural Equation Modeling (SEM) and CFA to validate the internal structure of the research instruments (Hair et al., 2010). Quantitative results were analyzed using the Jamovi software module to assess model fit and factor loadings.

Performance differences between student groups were assessed using Covariance Analysis (ANCOVA) to determine the statistical significance of the digital intervention while controlling for pre-existing proficiency. Qualitative data from experts were processed using Thematic Analysis to identify recurring patterns of success and areas for future optimization in low-resource language environments. To determine the statistical significance of the digital intervention while controlling for pre-existing proficiency, a One-Way Analysis of Covariance (ANCOVA) was performed. This approach statistically removes the 'noise' caused by baseline differences, allowing for a more accurate assessment of the platform's unique contribution to learning—the experimental effect.

Ethical Considerations

The study was conducted in strict adherence to the National AI Standards for Education (2025–2029) of the Republic of Kazakhstan, which prioritize personal data protection, transparency, and academic integrity. Ethical approval was secured through institutional review, and all 218 participants provided informed consent via a digital agreement before accessing the pilot platform. Data collection was performed anonymously to ensure confidentiality, with no personal identifiers stored in the research database. To maintain academic integrity, the platform was framed as an 'augmentative' tool rather than a replacement for creative effort, aligning with the ethical use guidelines established by international bodies such as UNESCO and the OECD.

RESULTS

To measure the platform's effect, a paired-samples t-test was conducted on pre- and post-test results (N=218). The analysis revealed a significant improvement in total accuracy ($t(217) = 12.84$, $p < 0.001$), with mean scores increasing from 46.8% to 71.3%. The most significant gains occurred in Morphological Identification (+27.4%) and Syntactic Analysis (+26.6%), addressing the primary areas of linguistic hybridization. Qualitatively, thematic analysis of expert feedback highlighted the platform's success in 'Sozsaptam Recovery,' with experts noting the system's ability to detect nuanced evaluative suffixes that are often lost in direct translations (Expert #2). They emphasized that the platform fosters 'Pedagogical Non-Linearity,' allowing students to self-organize their learning paths based on disciplinary interests (Expert #1).

Hypothesis Testing of Learning Gains

To move beyond a superficial analysis of mean scores, a paired-samples t-test was conducted on the pre- and post-test results of the N=218 student participants to measure the experimental effect of the digital intervention.

Hypothesis: The use of the synergetic web platform leads to a statistically significant increase in identification accuracy.

The statistical comparison of students' performance before and after the intervention is summarized in Table 5. The analysis demonstrates that the 24.5% absolute gain in identification

accuracy is statistically significant ($p < 0.001$), supporting the effectiveness of the synergetic platform in fostering stylistic awareness.

The analysis revealed a significant improvement in student performance, with accuracy increasing from a pre-test mean of 46.8% to a post-test mean of 71.3%. The calculated *p*- value ($p < 0.001$) indicates that the null hypothesis can be rejected with high confidence. This absolute gain of 24.5 percentage points confirms that the system effectively supports the development of essential skills in stylistic analysis. These findings are consistent with Satylganova et al. (2024), who emphasize the transformative potential of computer-supported collaborative learning in the Kazakhstani educational context.

Table 5.

Comparative Learning Gains by Category (N=218)

Linguistic Category	Pre-test M (%)	Post-test M (%)	Absolute Gain	t(217)	p	Cohen's d
Morphological Identification	42.1	69.5	+27.4%	14.32	< 0.001	0.97
Syntactic Analysis	45.3	71.9	+26.6%	12.86	< 0.001	0.87
Lexical-Semantic Analysis	48.2	70.4	+22.2%	10.15	< 0.001	0.69
Phonetic-Stylistic Detection	51.6	73.4	+21.8%	9.42	< 0.001	0.64
Total Stylistic Accuracy	46.8	71.3	+24.5%	12.84	< 0.001	0.84

Construct Validity and User Perception

To ensure the internal structure of the research instruments, Confirmatory Factor Analysis (CFA) was utilized, with Cronbach's alpha factor loadings exceeding 0.70, indicating strong internal consistency.

Linguistic Competence: The significant performance leap suggests the platform's systematic structuring of expressive categories helps illustrate how meanings are formed in context.

Student Satisfaction: 84% of students reported improved understanding and high satisfaction with the interface. This positive reception aligns with Ayasheva et al. (2024) regarding the pedagogical impact of Web 3.0 technologies and adaptive design in language platform development.

Expert Linguistic Validation

Expert assessment confirmed that the platform accurately reflects core theoretical categories and provides a methodologically consistent learning environment. The mean score of 4.7/5.0 suggests the system is highly suitable for integration into academic courses. This validation supports the technical evolution described by Oralbekova et al. (2024), where correct morphological segmentation is recognized as a critical first step in detecting the subtle emotional and evaluative nuances of the Kazakh language.

Table 6.

Linguistic precision was measured through an expert panel (n=3) using a standardized evaluation form.

№	Evaluation Parameter	Data Source	Value
1	Pre-test mean score	Students ($n=218$)	46.8%
2	Post-test mean score	Students ($n=218$)	71.3%
3	Learning improvement	Students ($n=218$)	+24.5%
4	Expert evaluation score	Experts ($n=3$)	4.7 / 5.0

Consistency with the Synergetic Framework

The results demonstrate that even the platform's beta version successfully reflects the foundational elements of the proposed synergetic architecture. The interaction between learning materials, the glossary, and the testing module confirms the feasibility of a "self-organizing" learning process. These outcomes are consistent with the synergy paradigm proposed by Marchenko and Gudkova (2023), which highlights the potential of information technology to create non-linear, dynamic paths for knowledge acquisition in university language education.

DISCUSSION

The empirical results of this study provide a robust foundation for evaluating the pedagogical and linguistic impact of the synergetic web platform. By moving beyond descriptive statistics to inferential analysis, we can more precisely measure the platform’s contribution to developing stylistic competence in the Kazakh language. The practical implications of these findings extend to the 'State Program for the Development of Education and Science 2020-2025,' providing a scalable model for inclusive digital instruction. Our results suggest that hybrid AI architectures—integrating rule-based FSTs with models like KazRoBERTa—are necessary for the 'synergetic governance' of low-resource languages like Kazakh. This shift from 'functional digitization' to 'co-creative systems' supports teachers' professional development under the 'acquire to deepen to create' model mandated by national AI standards.

Our findings regarding morphological identification gains (+27.4%) resonate with recent advancements in hybrid AI architectures for Kazakh (Oralbekova et al., 2024). Furthermore, our identification of 'bol' as a marker of hybridization aligns with studies on Kazakh speech production from 2025 (Kuderinova et al., 2025). This aligns the platform with the 'National AI Standards for Education 2025-2029,' shifting focus from 'functional digitization' to 'co-creative systems.'

Interpretation of Experimental Effects

The transition from a pre-test accuracy of 46.8% to a post-test accuracy of 71.3% represents a statistically significant learning gain ($p < 0.001$), which directly addresses the "insufficient methodological and technological tools" identified in the problem statement. This 24.5-percentage-point increase suggests that the platform's systematic structuring of expressive categories enables students to move from theoretical understanding to functional application of stylistic analysis.

These findings align with the work of Satylganova et al. (2024), who argue that computer-supported collaborative environments possess a transformative potential for language learning in Kazakhstan. Furthermore, the significant improvement in identifying complex markers, such as evaluative morphology and syntactic emphasis patterns, validates the necessity of the "scaffolded learning" approach discussed by Abnassyrova (2023).

Theoretical Consistency and Synergetic Modeling

The expert evaluation score of 4.7/5.0 confirms that the platform's architecture aligns with the Synergetic Model of integrated learning. This model emphasizes self-organization and interdisciplinary interaction. The results indicate that the platform successfully bridges the gap between traditional philology and digital pedagogy, a persistent obstacle noted by Alpysbayeva et al. (2024).

The platform's ability to model the multilevel structure of expressive stylistics—from phonetic-stylistic alliteration to contextual-pragmatic irony —supports the theoretical proposition that language should be explored as a dynamic, self-organizing system. As highlighted by Oralbekova et al. (2024), the success of such digital tools in agglutinative languages like Kazakh depends heavily on correct morphological segmentation, which our experts confirmed was accurately implemented in the system's classifications.

Implications for Digital Philology

The high student satisfaction rate of 84% suggests that integrating Web 3.0 principles, such as adaptive design and interactive feedback, enhances learner engagement. This supports the "Education 4.0" paradigm where AI acts as a "machine-in-the-loop" to augment human creativity rather than just providing functional digitization.

However, as noted by Aitim and Satybaldiyeva (2024), the historical absence of large-scale standardized corpora for Kazakh remains a challenge. While our research corpus of **32,000 tokens** provided a solid foundation for this pilot, the discussion of the results underscores the need to continue expanding corpus-based resources to move beyond the beta phase.

Comparison with Prior Research

Unlike traditional descriptive approaches that remain largely theoretical, this study demonstrates measurable performance gains through digital intervention. While previous studies in Kazakhstan focused primarily on basic grammar, our findings show that digital platforms can effectively address sophisticated stylistic nuances. This shifts the focus from "functional digitization" to "co-creative systems".

Practical Implementation Challenges

The scaling of the synergetic platform faces several distinct technical and pedagogical barriers. From a linguistic perspective, the agglutinative nature of Kazakh produces complex morphotactic structures and context-dependent homonymy (e.g., *jazğan*), which require high levels of computational disambiguation. While the rule-based Finite-State Transducer (FST) modules are highly resource-efficient, the neural KazRoBERTa pipeline requires 4–6 GB of RAM for optimal performance, which may exceed the capacity of some rural institutions' infrastructure. Furthermore, a significant pedagogical challenge lies in teacher readiness; current data indicates that while 59% of Kazakhstani teachers use AI, 51% feel they lack the specific knowledge to teach effectively with these tools. Successful implementation will require a national shift toward a three-level professional development model—' acquire > deepen > create'—to transition educators from being passive users to active co-creators of digital stylistic content.

CONCLUSION

The study successfully established and evaluated a conceptual model for a synergetic web-based platform designed for the integrative learning of the Kazakh language and expressive stylistics. Through rigorous mixed-methods testing, we have demonstrated that the platform is not only linguistically accurate but also pedagogically effective.

Theoretical Contributions:

- Validated the synergetic approach as a viable framework for teaching complex linguistic structures in a digital environment.
- Demonstrated that interdisciplinary integration (linguistics, law, and pedagogy) creates a more holistic understanding of language as a tool for social and professional communication.
- *Practical Contributions:*
- Provided empirical evidence, through significant t-test results ($p < 0.001$), that scaffolded digital tools significantly improve student recognition of expressive stylistic units.
- Developed a specialized research corpus of 32,000 tokens for Kazakh expressive stylistics, filling a critical gap in low-resource language infrastructure.

The beta version's structural alignment with the conceptual architecture confirms the feasibility of developing a comprehensive, scalable system for university-level instruction. Future research should focus on implementing advanced Natural Language Processing (NLP) modules for automated stylistic detection and exploring the platform’s impact in broader professional contexts, such as legal and journalistic education. Ultimately, this research contributes to the modernization of philological education by aligning it with the technological demands of the digital era.

Study Limitations

Constraints of the Quasi-Experimental Design:

The most significant limitation is the lack of a randomized control group. Due to institutional constraints at the participating universities, it was not possible to withhold the platform from a portion of the student body for a long-term control study. While ANCOVA was used to statistically mitigate this by controlling for pre-test scores, the design cannot fully account for the "Hawthorne Effect"—the tendency for participants to perform better simply because they know they are part of a novel technological intervention.

Generalizab*ility and Sampling Bias.*

The study utilized a purposive sampling strategy, recruiting 218 students specifically from philology and pedagogy programs. While these participants are the primary target for a stylistic analysis tool, the results may not generalize to students in technical or scientific fields who use Kazakh in a purely functional manner. Furthermore, the participants were primarily from major regional universities; the platform's effectiveness in rural or less-resourced educational settings remains to be tested, especially given the hardware requirements of the KazRoBERTa model.

Technical and Data Constraints

While the 32,000-word corpus is a significant contribution to Kazakh NLP, it remains relatively small in the context of deep learning. The platform's ability to "self-organize" is currently limited by the breadth of the available "attractors" in the dataset. Expanding the corpus to 150,000 sentences, as seen in newer hybrid models, would likely improve the system's performance in resolving rare stylistic ambiguities.

Methodological Limitations:

The expert panel was limited to three individuals. Although their qualifications were high and their agreement was quantified using Lawshe's Content Validity Ratio (CVR = 1.00), a larger panel would provide a more diverse range of perspectives on the platform's linguistic precision. Additionally, the study focused on immediate learning gains over a six-month period; it does not yet provide data on the long-term retention of stylistic skills once the student stops using the platform.

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APPENDIX

Table 1.

The key linguistic methods.

Method	Description	Application
Descriptive Method	Systematic description of expressive language units, their functions, and structures.	Classification of tropes and stylistic figures (metaphor, metonymy, hyperbole, etc.); development of expressive vocabulary dictionaries.
Comparative Method	Identifies differences and similarities in the use of expressive means across languages, genres, or historical periods.	Comparative analysis of expressive stylistics in different languages; study of the evolution of expressive constructions in literature.
Contextual Analysis	Examines expressive means within their textual and situational contexts.	Analysis of stylistic function in artistic and journalistic texts; study of the impact of context on interpretation.
Structural Method	Investigates expressive means as elements of a language system, identifying structural connections.	Research on the construction patterns of expressive statements; identification of syntactic features of expressive constructions.
Semasiological Method (Semantic Analysis)	Studies word meanings and their expressive nuances.	Examination of lexical expressiveness; identification of emotional and evaluative word connotations.
Stylistic-Functional Analysis	Analyses expressive language features in different functional styles (journalistic, literary, scientific, etc.).	Identification of stylistic characteristics across genres; study of individual authorial style.

Discourse Analysis	Investigates expressive language elements in broader discourse, considering communicative situations.	Study of expressiveness in media discourse and social networks; analysis of stylistic strategies in public speeches and political texts.

Table 2.

Levels and Methods of Expressive Stylistics Analysis in the Kazakh Language

Level of Analysis	**Method / Focus**	**Description and Examples**
Lexical-Semantic	Emotionally charged vocabulary	Expressive words convey affection, respect, or evaluation; for example, (7) *ainalayyn*(‘beloved’), *qasietti* (‘sacred’), which form the emotional tone of communication.
	Phraseologisms (idioms)	Fixed idiomatic expressions that enhance imagery and cultural specificity: (8) *it ölgen jer* (‘a very distant place’), *qoy auzynan šöp almas* (‘a very gentle person’).
	Archaisms and neologisms	The coexistence of old and new words reflects the bridge between tradition and modernity: (9) *abyz* (‘wise elder’) vs. *ğalamtör* (‘internet’).
Morphological	Diminutive forms	Convey affection or intimacy through suffixation: (10) *apašym* (‘dear granny’), *balaqay* (‘little child’).
	Reduplication (*qos sözder*)	Used for emphasis and emotional intensification: (11) *appa-q* (‘pure white’), *jap-jašyl*(‘bright green’).
	Verb forms and modality	Add shades of aspect and evaluation: (12) *kelipti* (‘apparently came’), *ayta berdi* (‘kept talking’).
Syntactic	Inversion	Alters word order for emphasis: (13) *Jalğız qaldy ol* (‘Alone remained he’) vs. *Ol jalğız qaldy* (‘He remained alone’).
	Parcellation	Fragmentation adds conversational expressiveness: (14) *Sen še? Ne oylaysyñ?* (‘And you? What do you think?’).

	Rhetorical constructions	Reinforce persuasion and emotion: (15) *Qazaq eli! Erkindik sağan layyq emes pe?!*(‘Kazakh nation! Isn’t freedom your right?!’).
Phonetic-Stylistic	Assonance and alliteration	Sound repetition creates musicality and rhythm: (16) *Qarañğı tüñde tau qalğyp* (‘In the dark night, the mountain slumbers’ – Abai).
	Vowel harmony	Ensures euphonic smoothness and resonance: (17) *kümbir-kümbir küy tögildi* (‘a deep resonating melody played’).
Contextual-Pragmatic	Evaluative modality	Expresses subjective judgment: (18) *Keremet körinis* (‘A magnificent view’), *sülu tabiğat* (‘beautiful nature’).
	Irony and sarcasm	Imply emotional contrast and critical tone: (19) *Mıqty ekensiñ!* (‘Oh, you’re so “great”!’).

Table 3.

Interdisciplinary Consolidation of Expressive Stylistics in the Kazakh Language.

№	Discipline	Contribution to Expressive Stylistics	Examples and Applications
1	**Legal Linguistics**	Studies stylistic features of legal texts and judicial speech, showing how formality and expressiveness coexist in institutional discourse.	(20) *zañ nama*, *quqyq*, *jauapkeršilik* – ‘law’, ‘rights’, ‘responsibility’; (21) *Bügin biz tarihtyñ betin ašyp otırmyz!* – ‘Today, we are opening a new page in history!’.
2	**Forensic Linguistics**	Examines linguistic style in legal communication, identifying markers of deception, irony, and emotional manipulation.	(22) *Balaqatap turğanday söylesedi!* – ‘Speaking as if an expert!’; (23) *Men eşteñe körgen joqpyn!* – ‘I didn’t see anything!’ (used with heightened emotional tone in testimony).
3	**Legislative Drafting**	Focuses on stylistic precision, clarity, and consistency in legal documentation.	(24) *Osi zañğa säykes…* – ‘According to this law…’; (25) *Zań qabıldandy* – ‘The law was adopted’.

4	**Courtroom Rhetoric**	Analyses persuasive and rhetorical techniques in legal argumentation and judicial speech.	(26) *Biz osyngerdi adal dep esepteuimiz kerek pe?* – 'Should we consider this fair?'; (27) *Zañ – halyq aynası*– 'The law is the mirror of the people'.
5	**Contract Law and Business Communication**	Examines stylistic norms in legal and corporate discourse, emphasizing neutrality and accuracy.	(28) *tarap* – 'party'; (29) *kelisim* – 'agreement'; (30) *mindette* – 'obligation'.

Table 4.

Core Components of the Synergetic Model in Integrated Learning

№	Component	Description	Example in Integrated Learning
1	Self-Organization	Learning emerges dynamically, adapting to linguistic and stylistic changes.	Students analyse modern vs. historical Kazakh expressive styles and how they evolve.
2	Interdisciplinary Interaction	Knowledge from different fields (linguistics, literature, psychology, law) merges to deepen understanding.	A law and linguistics course where students examine legal rhetoric and expressive speech in Kazakh court discourse.
3	Nonlinear Learning Process	Knowledge acquisition follows a dynamic, nonlinear path, influenced by learner interaction and experience.	A debate-based curriculum, where students practice rhetorical stylistic devices (metaphor, irony, hyperbole).
4	Emergent Knowledge Construction	New ideas emerge from student discussions, collaborative tasks, and interaction.	Collaborative writing projects, where students compare Kazakh poetic and legal language styles.
5	Feedback Loops	Continuous reflection, analysis, and refinement shape the learning experience.	Use of peer reviews for evaluating the expressiveness of spoken and written Kazakh texts.