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AN INTERACTIVE E-DICTIONARY AS AN EDUCATIONAL TOOL FOR PROFESSIONAL LANGUAGE LEARNING

UN DICCIONARIO ELECTRÓNICO INTERACTIVO COMO HERRAMIENTA EDUCATIVA PARA EL APRENDIZAJE PROFESIONAL DE IDIOMAS

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ABSTRACT

This study focuses on developing a conceptual framework and evaluating the pedagogical efficacy of a pilot version of an interactive electronic dictionary integrated into specialized texts for teaching Russian as a Foreign Language (RFL) in a higher education context. The dictionary's design is grounded in five key instructional principles: text-centricity, integration, multilingualism, informational redundancy, and practice-oriented interactivity. A quasi-experimental study involving 58 university students (28 in the experimental group, 30 in the control group) demonstrated the dictionary's statistically significant advantage over AI translation tools ($p < 0.0001$). Findings revealed a 50.1% improvement in test scores among students using the e-dictionary, compared to only 27.8% for the control group. These results underscore the dictionary's potential as an effective educational technology for enhancing domain-specific vocabulary acquisition. Students also rated it highly for its didactic features, such as detailed lexical information, translation precision, and autonomy of use. The study contributes to educational innovation by validating that interactive e-dictionaries can support deeper cognitive processing and foster independent language learning in professional education settings.

Keywords:

Interactive e-dictionary, Professionally-oriented language learning, Vocabulary acquisition, Russian as a Foreign Language (RFL), Educational technology.

RESUMEN

Este estudio se centra en el desarrollo de un marco conceptual y la evaluación de la eficacia pedagógica de una versión piloto de un diccionario electrónico interactivo integrado en textos especializados para la enseñanza del ruso como lengua extranjera (RFL) en la educación superior. El diseño del diccionario se basa en cinco principios instruccionales clave: centralidad textual, integración, multilingüismo, redundancia informativa e interactividad práctica. Un estudio cuasiexperimental con 58 estudiantes universitarios (28 en el grupo experimental y 30 en el grupo de control) demostró la ventaja estadísticamente significativa del diccionario sobre las herramientas de traducción con IA ($p < 0,0001$). Los resultados revelaron una mejora del 50,1 % en las puntuaciones de los estudiantes que utilizaron el diccionario electrónico, en comparación con tan solo el 27,8 % del grupo de control. Estos resultados subrayan el potencial del diccionario como una tecnología educativa eficaz para mejorar la adquisición de vocabulario específico del dominio. Los estudiantes

también lo valoraron positivamente por sus características didácticas, como la información léxica detallada, la precisión de la traducción y la autonomía de uso. El estudio contribuye a la innovación educativa al validar que los diccionarios electrónicos interactivos pueden favorecer un procesamiento cognitivo más profundo y fomentar el aprendizaje independiente de idiomas en entornos educativos profesionales.

Palabras clave:

Diccionario electrónico interactivo, Aprendizaje de idiomas con orientación profesional, Adquisición de vocabulario, Ruso como lengua extranjera (RFL), Tecnología educativa.

INTRODUCTION

Over the past decade, the rapid evolution of AI technologies has dramatically transformed digital education, particularly in foreign language teaching. Just 7–10 years ago, electronic dictionaries (e-dictionaries) were considered promising educational tools. Today, amid the widespread adoption of neural machine translators and AI assistants, they risk becoming obsolete teaching relics.

Numerous studies confirm AI's effectiveness in vocabulary acquisition, translation automation, and even overcoming language barriers (Chang & Sun, 2024; Lavado et al., 2025; Wu, 2024). AI tools are also very useful when working with specialized texts (Altakhaineh et al., 2025; Kembaren et al., 2023; Wen et al., 2025). However, at the same time, data and concerns from scientists are accumulating the negative consequences of over-reliance on AI tools, as captured in the following poignant question:

"What might genuinely encourage students to prioritize their own learning, through their own efforts, in a context where, more and more, they may ask AI chatbots to do the work for them?" (Graves, 2023, p. 3)

Over time, this dependence develops into "intellectual laziness": modern students accustomed to instant AI solutions, demonstrating a reduced ability for deep textual analysis. Rather than examining contextual meanings, collocations, or grammatical nuances, students settle for superficial comprehension, delegating analytical work to algorithms (Zunaidah et al., 2023). The risks are particularly acute when working with professional texts. Overuse of AI translators creates an illusion of competence—students believe they've mastered professional language yet struggle to communicate without "digital crutches".

While traditional electronic dictionaries retain methodological value for professional language learning (offering detailed entries, grammatical notes, and collocation guidance), their linear-search interface architecture fails to engage today's learners, who expect interactive, context-integrated experiences.

This study proposes a next-generation interactive e-dictionary model that addresses these gaps by combining: (a) text-centric design (e-dictionary is embedded in professional texts with one-click access to entries) and (b) multimodal interactive content (audio support, grammar tips, collocations, idioms, and quizzes). Such resources can also provide more accessible and technology-driven solutions for content adaptation to meet the needs of individuals with disabilities (e.g., visually impaired users).

Our research aims to present this innovative dictionary framework and evaluate its pilot version's efficacy compared to AI tools in teaching language for specific purposes.

The origins of dictionary compilation trace their roots to ancient civilizations, with extant evidence indicating that the earliest lexical compendiums emerged in Mesopotamia over four millennia ago. The ErYa 《爾雅》, an ancient Chinese explanatory dictionary dating back to the 3rd-2nd century BCE, represents the oldest surviving lexicographic work, while European traditions recognize early Greek glossaries – systematic collections of difficult terms found in specific authors' works with definitions – as pioneering efforts in Western lexicography.

Modern lexicography as a discipline developed considerably later, taking shape during the 18th and 19th centuries with the publication of prescriptive dictionaries. Samuel Johnson's seminal "A Dictionary of the English Language" (1755) established foundational standards for dictionary entry organization that would influence generations of lexicographers (Lynch, 2020). However, the field experienced its most transformative revolution in the late 20th century through the advent of digital formats, evolving from early CD-ROM dictionaries (e.g., Longman Interactive, 1993) to contemporary web-based platforms. Despite significantly improved information accessibility (Sarmila et al., 2023), these electronic resources largely maintained the static structure of their print predecessors: isolated entries requiring manual lookup and offering limited contextual or interactive functionality.

The current evolutionary stage of language technologies coincides with remarkable advancements in artificial intelligence and machine translation (MT) systems during the 2010s (Chávez et al., 2025; Rama et al., 2024). Neural machine translation platforms such as Google Translate and DeepL, leveraging vast datasets, now deliver near-instantaneous translations of texts across complexity levels, reducing reliance on both traditional and electronic dictionaries. This technological progress, however, has raised substantial concerns among scholars regarding overreliance on AI and MT tools in language education

(Zunaidah et al., 2023). Such dependence may foster learner autonomy erosion and create inaccurate self-assessments of linguistic competence (He et al., 2023), with particularly detrimental consequences for developing professional communicative competence. Current MT systems prioritize speed over accuracy, frequently disregarding lexical polysemy, collocational patterns, and appropriate stylistic register selection, as Zhao et al. (2011) critically observe in the following quote.

A lot of electronic dictionaries [meaning MT tools] have been brought out to the market nowadays <…> such as the Kingsoft, Google Translation <…>.

But almost all of these dictionaries are only able to explain the common meaning of the vocabularies instead of detailed professional meaning explanations and related professional knowledge instructions about the vocabularies (Zhao et al., 2011, p. 277).

This limitation compounds with users' frequent inability to critically evaluate MT output quality, as Clifford et al. (2013) note: *"Learners rarely possess the knowledge necessary to judge the output of an MT and so cannot reject it when it is wrong or learn from it when it is right".* (p. 114).

Furthermore, research indicates that MT usage promotes cognitive offloading (Zunaidah et al., 2023), whereby learners bypass deep lexical processing in favor of accelerated translation and superficial content comprehension.

These documented shortcomings underscore the necessity to reconceptualize electronic dictionaries not as AI competitors, but as complementary methodological tools for profession-oriented language teaching and learning. Qulmamatova (2025) emphasizes in the following quote:

Ultimately, the effective use of electronic dictionaries in language teaching not only enhances vocabulary acquisition and comprehension but also prepares learners for success in an interconnected world where linguistic agility is essential. As we continue to embrace technological advancements in education, it is imperative to remain committed to fostering meaningful learning experiences that resonate with students' needs and aspirations. (Qulmamatova, 2025, p. 271)

While a handful contemporary studies show renewed interest in traditional electronic dictionaries' potential (Qulmamatova, 2025; Samsuri et al., 2024; Vyshkin et al., 2021), fundamental questions regarding their optimal design architecture for professional language learning remain. The present study addresses this research gap through developing and testing an interactive e-dictionary embedded within specialized texts.

MATERIALS AND METHODS

The designed e-dictionary constitutes a digital resource specifically developed for profession-oriented teaching of Russian as a foreign language, targeting English- and Chinese-speaking learners. The core innovation of this tool lies in its text-centric architecture: the dictionary operates as an embedded extension within electronic specialized texts, delivering context-sensitive explanations upon user request.

The architectural framework of the electronic dictionary incorporates the following key features:

multimodal dictionary entries, comprising: audio for terms, translations into English and Chinese, grammatical annotations with lists of morphological variants (word forms) and collocational patterns;

hypertext content organization, enabling instant access to lexical entries through single-click activation of terms within texts and seamless integration with host documents through dynamic pop-up displays.

The dictionary's design philosophy rests upon five foundational principles:

Text-centricity – emphasizing vocabulary acquisition through sustained engagement with specialized texts, where lexical items are learned within authentic professional contexts rather than as isolated elements.

Integration – implementing the dictionary as an organic component of digital texts rather than a separate reference tool, allowing for uninterrupted workflow during reading comprehension tasks.

Multilingual support – providing comprehensive translations (English and Chinese) for all terminological entries, accommodating learners' native language backgrounds.

Informational redundancy – incorporating multiple representation modes for each entry, including: audios, translations, grammatical paradigms, collocational frameworks, idiomatic expressions; this principle allows students to be provided with the most detailed information about the lexical unit being studied, in order to eliminate the need to refer to additional sources and provide adaptive content (both beginners and advanced students will find useful information in such entries).

Practice-oriented interactivity - embedding interactive elements such as hyperlinks, audio playback controls, embedded knowledge-check exercises (tests).

The dictionary's digital architecture was implemented via iSpring Suite 11 (Figure 1), an e-learning authoring toolkit that operates as a PowerPoint add-on. This

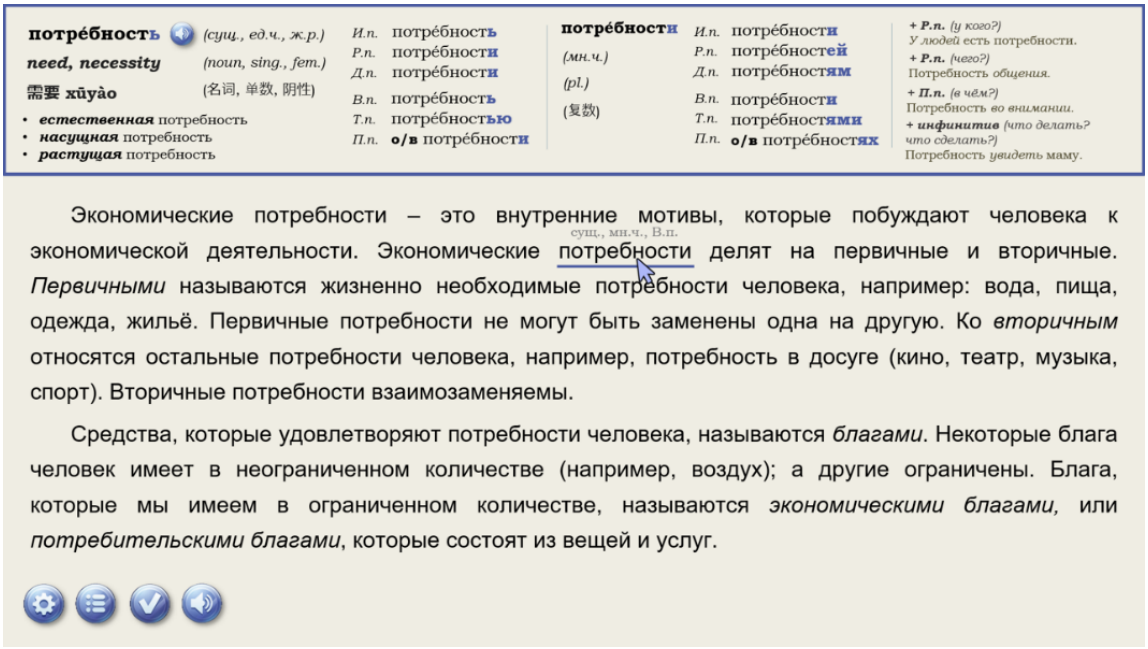
platform enables creation of SCORM-compliant interactive learning modules compatible with any standard Learning Management System (LMS).

The pilot version's linguistic database contains 320 selected economic and management terms accompanied by extended dictionary entries and included in 16 scientific texts (90-120 words) covering "Economics" and "Management" subject areas, designed for the level of proficiency in Russian from B1 to B2.

The interface architecture follows an intuitive design. Main menu displays thematic text selections in Russian. Text viewing screen includes: font size and background color customization ("Settings"), return navigation to main menu ("Menu"), topic-specific tests ("Quiz"), full-text audio narration ("Audio"). In addition, each word in the text is a hyperlink. Click activation triggers an information panel displaying all the necessary information on the selected lexeme: audio, translations, related grammatical information, contextual usage examples.

The pilot version of the resource successfully incorporated professionally recorded human narration for both complete texts and individual terms within dictionary entries. This non-synthetic audio component was meticulously produced by native Russian speakers and professional narrators, ensuring authentic pronunciation and appropriate intonation patterns for specialized terminology.

Fig. 1: Pilot version of the integrated e-dictionary.



Source: Prepared by authors

The e-dictionary entries follow a modular organizational structure, with each article containing systematically arranged components:

translation both into English and Chinese;

stress position markers;

grammatical annotation, that includes information on the part of speech, gender, number, aspect for verbal entries, as well as full morphological paradigms (case, number, tense declensions);

information on government and binding patterns (case requirements for verbs/prepositions);

contextualized examples demonstrating proper usage.

The university's learning management system (LMS) was configured to enable responsive interface adaptation across multiple device platforms: desktop/laptop computers (Windows/macOS); tablet devices (iOS/Android) and mobile smartphones. This cross-platform compatibility ensured seamless integration into classroom instruction, allowing

international students at the Financial University under the Government of the Russian Federation to utilize the e-dictionary without technical constraints during classroom sessions.

The e-dictionary was officially deployed in March 2025 as part of the institution's Russian as a Foreign Language (RFL) curriculum for economics and business students.

The pedagogical experiment was conducted at the Financial University under the Government of the Russian Federation from March 1 to May 31, 2025, employing a quasi-experimental research design with pre-test and post-test measurements to evaluate the comparative effectiveness of the interactive e-dictionary in Russian language classes.

The study cohort comprised 58 students with A2-B1 level proficiency in Russian as a foreign language, divided into two distinct groups: 1) experimental group A (N=28) and 2) control group B (N=30).

The study employed distinct technological approaches for each student group. Group A worked exclusively with the interactive e-dictionary as their primary lexical reference tool during classwork with specialized texts, while group B relied solely on the available AI-powered translation tools (including DeepL, ChatGPT, and DeepSeek) under identical classroom conditions. A fundamental experimental protocol required complete segregation of these tools during classroom activities involving professional texts. This meant the experimental group could only access the e-dictionary for translation support and vocabulary assistance, whereas the control group was restricted to using only AI tools when performing identical academic tasks. This deliberate isolation of tools ensured methodological purity, preventing any cross-contamination between experimental conditions that could compromise the study's internal validity. Both groups worked with identical professional texts and completed parallel assignments, differing only in their access to reference technologies.

Prior to the experimental training intervention, all participants completed a comprehensive diagnostic assessment (pre-test) designed to evaluate their baseline knowledge of domain-specific terminology. This pre-test consisted of 50 test questions with a 60-minute time limit for completion. Following the experimental training period, learning outcomes were assessed using a 50-item post-test with identical structure and time constraints (60-minute limit) as the pre-test.

Both the pre-test and post-test phases were conducted through the university's learning management system (LMS) platform, ensuring consistent digital testing conditions across all participants. The assessment platform incorporated automated scoring algorithms that instantly calculated performance metrics based on the percentage of correctly answered test-questions. Scoring protocols established a maximum achievable performance benchmark of 100 points, with raw scores converted to percentage values for comparative analysis. This standardized scoring metric allowed for precise measurement of individual progress while facilitating direct intergroup comparisons.

To comprehensively evaluate participants' subjective perceptions regarding the effectiveness of the implemented learning tools (interactive e-dictionary versus AI-based tools), an anonymous online survey (Appendix 1) was administered to all study participants (N=58). The survey instrument incorporated three distinct question formats across 10 total items.

The questionnaire began with two ***multiple-choice questions*** serving as foundational indicators for general information on a respondent. These initial questions collected essential metadata about each respondent's experimental group assignment (Group A or B) and documented their frequency of reference tool utilization when working with individual lexical items, phrase, or complete sentences during the learning process.

At the core of the survey were five ***Likert-scale questions***, each utilizing a standardized five-point metric ranging from 1 ("strongly disagree") to 5 ("strongly agree"). These quantitative measures systematically assessed five critical dimensions of the learning tools' performance: (1) interface accessibility and responsiveness, (2) translation accuracy and reliability, (3) depth and comprehensiveness of provided information, (4) effectiveness in facilitating professional vocabulary acquisition and retention, and (5) self-sufficiency as a reference resource (specifically, whether supplementary materials were required to compensate for any informational gaps).

The survey concluded with three ***open-ended response*** questions designed to elicit qualitative reflections. These narrative prompts encouraged participants to engage in critical analysis of their assigned tool's strengths and limitations, while also exploring potential correlations between their subjective user experience and objective test performance outcomes. The open-response format provided valuable contextual insights that complemented and enriched the quantitative Likert-scale data.

The comparative analysis of post-test scores between the experimental group (N=28) and control group (N=30) employed primary analytical methods such as ***visual histogram*** representation of score distributions and ***independent samples t-tests***, which were appropriately applied without additional normality testing given the sample size exceeding 30 participants per group. Statistical

significance of post-test outcomes was further quantified through ***calculation of p-values***, with the conventional alpha threshold of $p < 0.05$ establishing significance levels for all between-group comparisons.

Prior to full implementation, the survey underwent rigorous pilot testing with a subset of participants (N=10) to verify question clarity and procedural validity. The internal consistency reliability of the 5-point Likert scale questionnaire items was empirically validated through ***calculation of Cronbach's alpha coefficient***, yielding a strong reliability estimate of $\alpha = 0.96$.

RESULTS AND DISCUSSION

The empirical outcomes of this controlled pedagogical intervention provide compelling evidence supporting the efficacy of interactive electronic dictionaries as instructional tools for acquiring foreign language professional vocabulary. A comprehensive analysis of the collected performance metrics reveals statistically significant advantages associated with dictionary-assisted learning compared to AI-assisted learning (Table 1).

Table 1: Pre-test and Post-test Mean Score Comparison Across Groups (M±SD).

Group	Mean score ± SD (Pre-test)	Mean score ± SD (Post-test)	Change (%)
A	52.3 ± 7.5	78.5±8.7	↑50.1%
B	50.8 ± 6.9	64.9±10.9	↑27.8%

Source: Prepared by authors

The comparative analysis presented in Table 1 clearly illustrates that both student cohorts—the experimental group (A) and the control group (B)—began the study with nearly identical baseline proficiency in specialized vocabulary. The experimental group (A) initially scored an average of 52.3 points, while the control group (B) averaged 50.8 points, confirming equivalent starting conditions. However, upon completion of the experimental training period, group A exhibited a statistically significant 22.3% improvement in test scores compared to the control group.

A more granular examination of post-test performance, as visualized in Figure 2, reveals several key insights. While individual variability existed—meaning not every participant in the experimental group achieved uniformly high scores—the overall trend strongly favors dictionary-assisted learning.

Fig. 2: Students Post-test score data.

Source: Prepared by authors

Specifically, 93% of Group A (26 out of 28 students) outperformed their control group counterparts on the final assessment, indicating superior vocabulary retention and application. In contrast, the control group's results exhibited greater dispersion, with a notable portion of students failing to achieve comparable gains. These findings suggest that while alternative methods (e.g., AI tools) may benefit some learners, the structured, multimodal support provided by the interactive e-dictionary led to more consistent and substantial improvements across the experimental cohort.

The independent samples Student's t-test was calculated using the conventional formula for comparing means between two distinct groups:

$t = (M_1 - M_2) / \sqrt{(SD_1^2/n_1 + SD_2^2/n_2)}$, where the key parameters were operationalized as follows:

M_1 and M_2 represent the pre- and post-intervention mean scores (group A: 78.5, group B: 64.9);

SD_1 and SD_2 denote the standard deviations of each group's performance (group A: 8.7, group B: 10.9);

n_1 and n_2 indicate the sample sizes for respective groups (group A: 28, group B: 30).

The computational results yielded a substantial t-value of approximately 5.27 with 56 degrees of freedom (DF = 56). Subsequent determination of the p-value revealed a significant probability value of $p < 0.0001$. This stringent statistical threshold indicates that the observed difference in learning outcomes between groups would occur by random chance less than one time in ten thousand repetitions of the experiment, thereby strongly supporting the alternative hypothesis that the experimental training produced genuine educational effects.

These quantitative outcomes find further corroboration in the supplementary qualitative data collected through participant surveys. The convergence of both statistical and self-report measures strengthens the validity of our conclusions.

The survey (Appendix 1) achieved a 100% response rate (N = 58), representing all participants involved in the experimental training. The frequency with which respondents accessed reference tools (either the e-dictionary or AI-based systems) per lexical unit is detailed in Table 2.

Table 2: Frequency (%) of tool access per lexical unit (term/phrase/sentence).

Group	1-2 times	3-5 times	6-8 times	9-10 times or more
A	38%	59%	3%	0%
B	5%	29%	57%	9%

Source: Prepared by authors

The survey data reveal distinct usage patterns between the two groups. Students in Group B, who relied on AI tools, exhibited significantly higher rates of repeated tool access per lexical item: 57% consulted AI-based resources 6–8 times, while an additional 29% did so 3–5 times when verifying translations or interpreting the same term, phrase, or sentence.

In contrast, Group A (using the e-dictionary) demonstrated markedly lower access frequency: 59% of students referred to the dictionary 3–5 times per lexical unit, while 38% required only 1–2 consultations. The substantial disparity in usage frequency—particularly the high rate of repeated AI tool access (>5 times) among 57% of Group B compared to Group A's more limited dictionary use—suggests several critical implications:

first, the elevated reliance on AI tools may stem from difficulties in interpreting AI-generated outputs, potentially due to inconsistencies, inaccuracies, or insufficient contextual detail, necessitating repeated verification;

second, the data imply a weaker pedagogical effect from AI tools, which may fail to reinforce memory retention or stimulate deeper cognitive processing, as they typically provide minimal explanatory information beyond direct translations;

finally, these patterns indicate a concerning level of dependency on AI tools among learners, who appear to require multiple interactions to achieve comprehension that dictionary users attain with fewer consultations.

These findings align with broader concerns about AI-assisted learning, where convenience may come at the cost of long-term lexis retention and independent problem-solving skills. The dictionary's structured, detailed entries seemingly promote more efficient learning, reducing the need for repeated lookups while enhancing comprehension and recall.

The mean values of participants' responses on the Likert scale (Appendix 1) are presented in Table 3, providing a comprehensive comparison between the two experimental groups across several critical evaluation criteria.

Table 3: Likert Scale Evaluation (1-5 points). Mean Values by Group(M±SD).

Evaluation Criteria	Group A (M±SD)	Group B (M±SD)	P-value
Interface convenience and speed	3.7±0.7	4.7±0.6	0.0015
Translation accuracy	4.8±0.4	3.6±0.8	<0.0001
Level of detail	4.9±0.3	2.8±0.6	<0.0001
Vocabulary learning and memorizing support	4.8±0.4	3.8±0.8	<0.0001
Independence from external sources (Self-sufficiency)	4.6±0.5	3.7±1	<0.0001

Source: Prepared by authors

The data presented in Table 3 reveal several noteworthy findings regarding student perceptions of the learning tools. Participants in Group A, who utilized the interactive electronic dictionary, provided high ratings (4.8-4.9/5 points) for three crucial aspects: the accuracy of translations, the details and comprehensiveness of lexical information, and the dictionary's effectiveness in supporting vocabulary acquisition and retention. These high scores particularly reflect the value of the dictionary's supplementary features, including usage examples, idiomatic expressions, and built-in testing modules, which collectively enhance the learning and proper use of professional terminology.

Furthermore, Group A participants rated the dictionary's self-sufficiency – its capacity to serve as a standalone reference resource eliminating the need for additional tools – at a substantial 4.6/5 points. However, as anticipated, the

pilot version's interface usability and processing speed received more moderate evaluations (3.7/5 points), likely reflecting technical limitations inherent in this developmental stage of the product.

Conversely, Group B students, who worked with AI-based tools, demonstrated an inverse evaluation pattern. While they awarded high marks (4.7/5 points) for the speed and user-friendliness of AI interfaces, they rated these tools significantly lower (3.6-3.7/5 points) in two critical areas: translation precision and independence from supplementary resources. Most strikingly, the AI tools performed particularly poorly (2.8/5 points) in providing detailed linguistic information, a finding that aligns with their more limited pedagogical functionality.

These results collectively demonstrate a clear dichotomy in tool evaluation. All content-related criteria – including information quality, accuracy, and educational value – received substantially higher ratings from e-dictionary users (Group A) compared to AI tool users (Group B). Conversely, interface-related aspects were rated more favorably by AI tool users. We hypothesize that the dictionary's moderate interface evaluation stems primarily from technical and financial constraints encountered during the pilot version's development. This suggests that future versions of the dictionary, with improved interface design and system optimization, could potentially achieve higher ratings across all evaluation criteria while maintaining its strong performance in content-related aspects.

The application of Student's t-test for independent samples and subsequent calculation of p-values demonstrated statistically significant differences ($p = 0.0015$; $p < 0.0001$) in student evaluations across all assessment criteria, confirming that the observed disparities between groups were not attributable to random variation. While the data presented in Table 3 clearly establish the superior informational value and pedagogical utility of the interactive electronic dictionary compared to AI tools, they simultaneously highlight the need for e-dictionary's interface improvements to enhance usability and processing speed – aspects crucial for meeting contemporary students' expectations and learning preferences.

The qualitative analysis of open-ended responses further corroborates these findings. Designed to identify strengths and weaknesses of the respective learning tools (see Appendix 1), the open-response questions yielded several noteworthy patterns.

Among the top three advantages of the electronic dictionary identified by Group A participants were:

structured, deep and comprehensive information presentation (82% of respondents);

information reliability (76%);

self-contained nature of the resource (eliminating the need for supplementary references) (68%).

Conversely, Group B participants primarily valued AI tools for their

rapid translation capability (91%);

context-aware translation (79%).

Critical feedback from Group A focused on the ***"item-specific translation approach (requiring individual lexical unit analysis rather than whole-sentence processing) and consequent workflow deceleration"*** (37%). Group B's predominant criticisms targeted ***"insufficient terminological detail"*** (58%) and ***"inaccuracies in linguistic information provided"*** (36%).

These qualitative findings reinforce the quantitative results, demonstrating that while dictionary users appreciated the depth and veracity of lexical information, AI tool users valued primarily the speed and contextual adaptation of machine translation. This dichotomy reflects a fundamental tension in modern language education: the dictionary's requirement for meticulous lexical analysis conflicts with contemporary students' preference for rapid, holistic processing enabled by AI tools. While today's learners have grown accustomed to instantaneous AI solutions, perceiving the more deliberate dictionary approach as somewhat antiquated, the authors believe that this precise, structured engagement with lexical units – complete with grammatical annotations, usage examples, and retention exercises – ultimately yields superior vocabulary acquisition outcomes. In contrast, AI translations, while fast, lack the precision and didactic scaffolding necessary for deep lexical learning, resulting in the documented criticisms regarding informational inadequacy and linguistic inaccuracies when handling specialized terminology.

The author's beliefs are complemented by the data obtained from the final reflective question in the survey – "How did using the tool affect your learning outcomes?" (see Appendix 1) – not only yielded additional positive feedback about the tools (which were added to statistics above), but also provided several insightful reflective observations. Below we present some of the most noteworthy responses (the original grammar and punctuation of the responses have been preserved).

Group A (E-Dictionary Users)

First time I use dictionary I don't like it because need check every word, it's boring... But later I find I use dictionary more less, and my Russian already improved after 2 lessons with this dictionary.

I never really noticed all the extra stuff this dictionary shows about words before. Like, I used to just care about the translation, but then I realized—the more I see a word's

different forms and how it's used, the easier it gets to remember. Now I even use some of them when I talk, which is cool.

Yes, it's boring this word-by-word method, but slowly all terms are becoming like friends. Takes time, but results are rewarding.

Group B (AI Tool Users):

Honestly, it's so cool that teachers let us using AI and stuff. Learning like this is actually great – like we're all speaking the same language.

AI is helping for fast translation of words only, but to properly memorize I must do writing, rewriting, and also checking grammar forms... all these extra sources is too much.

I like using AI, but it's a little scary because sometimes it makes mistakes and for me it's a foreign language, so it's hard to tell. Old-fashioned books feel safer and more reliable.

These reflective comments provide valuable qualitative insights that complement our quantitative findings. While dictionary users initially resisted the tool's demands, they ultimately recognized its effectiveness for deep learning. In contrast, AI users appreciated the convenience, speed, and modern appeal of their tool but raised concerns about its accuracy and the need for supplementary memorization efforts. Thus, student feedback once again highlights the paradox: tools designed to make life and learning effortless, more productive and faster (like AI) may inadvertently hinder the cognitive processes required for stronger memory encoding, whereas more demanding tools (e.g., dictionaries) prove more effective.

CONCLUSIONS

This study presents the conceptualization, development, and empirical validation of an interactive electronic dictionary designed for professional Russian as a foreign language (RFL) vocabulary acquisition, with comparative efficacy analysis against modern artificial intelligence tools. The dictionary's theoretical framework was built upon five foundational principles: (1) text-centric design ensuring contextual learning, (2) seamless integration with learning materials, (3) multilingual support for English- and Chinese-speaking learners, (4) strategically implemented informational redundancy through multimodal content, and (5) practice-oriented interactivity with embedded audio and exercises. The operational prototype was developed using iSpring Suite 11 as an authoring platform, successfully integrated into the university's learning management system, and implemented in experimental training for Chinese- and English-speaking RFL students.

The quasi-experimental research design, involving an experimental group (N=28) utilizing the e-dictionary and a control group (N=30) employing AI translation tools, yielded statistically significant results ($p < 0.05$) favoring the e-dictionary intervention. Importantly, both groups began the study with nearly identical baseline proficiency levels (Group A: 52.3 ± 7.5; Group B: 50.8 ± 6.9), eliminating initial competency as a confounding variable. Post-intervention assessment revealed a striking 50.1% improvement in vocabulary test scores among e-dictionary users compared to 27.8% in the AI group, demonstrating a robust 22.3 percentage-point pedagogical advantage for the e-dictionary approach.

Three critical strengths emerged from qualitative analysis of learner feedback:

- first, the dictionary's systematic organization and reliable presentation of deep linguistic information received consistent praise (4.9/5 rating);
- second, its translation accuracy (4.8/5) outperformed AI tools;
- third, its self-contained design (4.6/5) reduced dependency on external resources.

However, user evaluations identified e-dictionary's interface responsiveness (3.7/5) as requiring optimization in future versions—a limitation attributable to current technical constraints of the pilot implementation.

These findings carry important theoretical and practical implications. The 22.3% performance gap substantiates the cognitive benefits of using the e-dictionary over passive AI translation. Practically, the results suggest that while AI tools excel in accessibility and speed, purpose-built electronic dictionaries better facilitate professional vocabulary retention.

Future research directions should pursue three key avenues: (1) multilingual expansion incorporating additional language translations with culturally adapted examples, (2) implementation of adaptive algorithms for personalized learning paths based on error pattern analysis, and (3) development of hybrid intelligent systems combining e-dictionaries with AI tools. Of particular importance is creating discipline-specific versions for fields like medicine, engineering, and international business, as the current economics-focused prototype demonstrated particular efficacy in professional vocabulary acquisition.

Ultimately, this study contributes to the growing body of evidence that thoughtfully designed digital lexicographic resources can complement—and in certain aspects surpass—AI-driven tools for professional language learning. The demonstrated 22.3% efficacy advantage, coupled with strong learner acceptance ratings, positions

interactive e-dictionaries as valuable assets in future technology-enhanced language education.

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