



EXPERIMENTAL STUDY OF THE EFFECTIVENESS OF DIGITAL TECHNOLOGIES IN DEVELOPING STUDENTS' LANGUAGE COMPETENCE

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Abstract

This article presents the results of an experimental study on the effectiveness of digital technologies in developing the language competence of secondary school students. The purpose of the study was to empirically examine the impact of digital educational tools on the level of students' language competence. During the pedagogical experiment, digital learning tasks, interactive activities, and elements of blended learning were implemented. The experiment involved both control and experimental groups and consisted of diagnostic, formative, and final assessment stages.

Keywords: Experimental study, language competence, digital technologies, digital educational environment, language education, blended learning, interactive learning, digital learning tasks, pedagogical experiment, secondary school students, communicative competence, educational effectiveness.

Introduction

In recent years, digital technologies have become an integral part of language education, increasing the need for empirical evidence of their effectiveness in developing students' language competence. While numerous studies have examined the theoretical aspects of digital language learning, relatively few have experimentally evaluated the impact of digital technologies in secondary schools. The purpose of this study was to experimentally assess the effectiveness of digital technologies in developing the language competence of secondary school



students. The pedagogical experiment was conducted according to the principles of systematicity, objectivity, and reliability and included diagnostic, formative, and final assessment stages.

The study aimed to determine students' initial level of language competence, implement a system of digital learning tasks in the experimental group, compare the outcomes with those of a control group receiving traditional instruction, and statistically analyze the obtained results.

The experiment involved 156 students in Grades 10-11 from four secondary schools in the Republic of Karakalpakstan: Secondary School No. 27 (Nukus District), Secondary School No. 17 (Chimbay District), Secondary School No. 3 (Khojeyli District), and Secondary School No. 37 (Kungrad District). The sample was selected to ensure representativeness by including schools with different social contexts, levels of technological infrastructure, and experience in using digital educational technologies.

The participants were divided into control and experimental groups. The control group consisted of 81 students who received instruction through traditional Russian language teaching methods, while the experimental group included 75 students who were taught using a methodology based on digital technologies and interactive learning activities.

The participants were 16-17-year-old students in Grades 10-11. Since Russian was not the native language for most of them, the study was conducted in a multilingual educational environment typical of the Republic of Karakalpakstan. Before the experiment, the students had no systematic experience using digital educational platforms in Russian language learning. This ensured the objectivity of the study and allowed the impact of digital technologies on the development of language competence to be assessed more accurately. The sample was sufficiently large, geographically representative, and methodologically well designed, providing a reliable basis for evaluating the effectiveness of digital technologies in secondary language education.

The pedagogical experiment followed the classical three-stage design: diagnostic, formative, and final assessment. During the diagnostic stage, students' initial level of language competence was assessed through language tests, classroom observations, and analysis of learning activities. The results confirmed that the



control and experimental groups had comparable baseline levels of language competence, ensuring the validity of the subsequent comparative analysis.

The formative stage was the core phase of the study and involved the systematic integration of digital technologies into the language instruction of the experimental group. Students completed digital learning tasks, interactive exercises, multimedia activities, and blended learning assignments, while the control group continued to receive traditional instruction without the systematic use of digital tools. This stage aimed to develop students' vocabulary, grammar, and communicative skills, as well as to enhance their learning motivation and learner autonomy.

During the final assessment stage, students' language competence was re-evaluated using the same diagnostic instruments employed at the beginning of the experiment, ensuring the comparability of the results. The collected data were analyzed quantitatively and qualitatively, including statistical analysis using Student's t-test, to determine the significance of the differences between the control and experimental groups.

A summary of the objectives, content, and outcomes of each stage of the experiment is presented in Table 1.

Table 1. Stages of the Pedagogical Experiment

Stage of the Experiment	Objective	Main Activities	Expected Outcome
Diagnostic Stage	Determine the initial level of language competence	Assessment of students' language competence	Comparable baseline between the groups
Formative Stage	Implement digital technologies	Digital learning tasks and interactive activities	Development of language skills
Final Assessment Stage	Evaluate the effectiveness of the intervention	Post-test assessment and data analysis	Identification of learning progress

The step-by-step organization of the pedagogical experiment ensured the systematic nature of the study and made it possible to monitor the development of students' language competence through the use of digital technologies. The



implementation of the diagnostic, formative, and final assessment stages provided a reliable methodological basis for analyzing the experimental data and testing the research hypothesis.

The experimental group received instruction through a specially designed system of digital learning tasks, interactive activities, and blended learning elements, while the control group followed the same curriculum using traditional teaching methods without the systematic integration of digital technologies. Digital tools were incorporated into different stages of the lesson, including presentation, practice, independent learning, and assessment.

A variety of digital resources, including multimedia materials, interactive platforms, and online learning tools, were selected according to their pedagogical value and suitability for Grade 10-11 students.

A summary of the experimental conditions and the digital technologies used is presented in Table 2.

Table 2. Experimental Conditions and Digital Technologies Used

Component	Description
Educational Environment	General secondary schools, face-to-face instruction
Instructional Conditions	Identical curriculum and class schedule for both groups
Technical Equipment	Computers, projector, interactive whiteboard
Digital Technologies	Multimedia resources and online learning activities
Modes of Instruction	Digital and blended learning
Assessment Methods	Online testing and automated assessment

The standardized experimental conditions and the systematic integration of digital technologies ensured the objectivity of the study and made it possible to evaluate the actual impact of digital tools on the development of students' language competence. These pedagogical conditions provided a solid foundation for the implementation of the formative stage and the subsequent analysis of the experimental results.



Language competence was conceptualized as an integrated construct comprising linguistic knowledge, communicative skills, and the practical use of language. Accordingly, three assessment criteria were identified: linguistic competence, language skills, and practical communicative competence. Each criterion was operationalized through a set of indicators that enabled both quantitative and qualitative evaluation of students' language development.

The linguistic criterion assessed students' mastery of vocabulary, grammar, and pronunciation. The language skills criterion evaluated learners' performance in listening, speaking, reading, and writing. The practical communicative criterion measured students' ability to use language effectively in authentic and educational communicative situations, demonstrating independence, initiative, and appropriate communicative behavior.

The main assessment criteria and indicators of students' language competence are presented in Table 3.

Table 3. Criteria and Indicators for Assessing Students' Language Competence

Criterion	Indicators
Linguistic	Knowledge of vocabulary; grammatical accuracy; correct pronunciation
Language Skills	Ability to understand spoken and written texts; ability to produce coherent spoken and written discourse; participation in communicative interaction
Practical Communicative	Appropriate language use; learner autonomy in language application; active participation in communicative tasks

The developed system of assessment criteria and indicators ensured a comprehensive and objective evaluation of students' language competence. Their application throughout the diagnostic, formative, and final assessment stages provided a methodological basis for analyzing learning progress and conducting subsequent statistical analysis.

To obtain reliable and comprehensive data, a combination of diagnostic instruments was employed, including language tests, performance-based tasks, classroom observation, and student questionnaires. The use of multiple



assessment methods enabled both quantitative and qualitative evaluation of students' learning outcomes.

Language tests were used to assess students' vocabulary, grammar, and spelling proficiency. Practical communicative tasks evaluated learners' listening, speaking, reading, and writing skills through authentic language activities. Classroom observation was conducted to assess students' engagement, participation, learner autonomy, and communicative behavior during the learning process. In addition, questionnaires were administered to investigate students' attitudes toward digital technologies, their learning motivation, and their self-assessment of language skills.

A summary of the diagnostic instruments used in the study is presented in Table 4.

Table 4. Diagnostic Instruments Used in the Study

Diagnostic Instrument	Purpose	Indicators Assessed
Language Tests	Assessment of linguistic knowledge	Vocabulary, grammar, and spelling
Performance-Based Tasks	Assessment of language skills	Listening, speaking, and writing
Classroom Observation	Analysis of learning behavior	Participation, engagement, and learner autonomy
Questionnaires	Assessment of motivation and attitudes	Learning interest, self-assessment, and attitudes toward digital technologies

The use of a comprehensive diagnostic framework ensured the objectivity and reliability of the assessment of students' language competence. Combining language tests, performance-based tasks, classroom observation, and questionnaires provided a comprehensive evaluation of the experimental outcomes and established a solid basis for subsequent data analysis and statistical processing.

A unified assessment procedure was developed to ensure consistent interpretation of the results throughout all stages of the experiment. Students' performance was evaluated according to the three assessment criteria—linguistic, language skills,



and practical communicative competence. Each indicator was assigned a numerical score reflecting its level of achievement, and the total score was converted into an overall proficiency level.

To ensure consistency, a three-level evaluation scale was adopted: low, moderate, and high. This scale made it possible to compare the control and experimental groups and to monitor changes in students' language competence during the course of the experiment.

Students at the low level demonstrated limited linguistic knowledge, underdeveloped language skills, and difficulty using the language in communicative situations. The moderate level indicated adequate language knowledge and skills for completing typical learning tasks but limited performance in more complex communicative contexts. Students at the high level displayed well-developed linguistic knowledge, strong communicative skills, learner autonomy, and the ability to use the language confidently in a variety of communicative situations.

The overall assessment and interpretation scale is presented in Table 5.

Table 5. Interpretation Scale for Students' Language Competence Levels

Competence Level	Score Range	Level Description
Low	0-49%	Fragmentary language knowledge and low communicative activity
Moderate	50-74%	Basic language knowledge and skills; able to complete standard learning tasks
High	75-100%	Well-developed language knowledge and strong communicative skills

The developed assessment procedure and interpretation scale ensured an objective and systematic evaluation of students' language competence. Applying the same assessment scale at both the diagnostic and final assessment stages provided a reliable methodological basis for comparing results, identifying learning progress, and conducting statistical analysis.



A comparative analysis of the control and experimental groups was carried out to determine differences in students' language competence following the formative stage of the pedagogical experiment. The analysis was based on the results of the final assessment and aimed to evaluate the effectiveness of digital technologies in language instruction.

The findings demonstrated positive changes in the experimental group compared with the control group. The proportion of students achieving **high** and **moderate** levels of language competence increased substantially in the experimental group, whereas the improvements observed in the control group were less pronounced. The comparative results of students' language competence in the control and experimental groups are presented in Table 6.

Table 6. Results of the Final Assessment of Students' Language Competence (%)

Competence Level	Experimental Group (%)	Control Group (%)
High	38.7	19.5
Moderate	46.6	44.3
Low	14.7	36.2

As shown in Table 6, the experimental group demonstrated a substantially higher proportion of students with a high level of language competence than the control group. At the same time, the percentage of students with a low level of language competence decreased considerably. In contrast, although the control group showed slight improvement, a relatively large proportion of students remained at the low proficiency level.

The qualitative analysis also indicated that students in the experimental group were more actively engaged in communicative tasks, demonstrated stronger vocabulary and grammatical proficiency, and used the language more confidently in both spoken and written communication. By comparison, students in the control group experienced greater difficulty when completing communicative and performance-based language activities. These findings confirm the positive impact of digital technologies on the development of students' language competence and demonstrate that digital instruction is more effective than traditional teaching approaches.



The analysis of students' language competence across the different stages of the pedagogical experiment revealed clear patterns of improvement over time. Results from the diagnostic, formative, and final assessment stages were compared for both the control and experimental groups.

At the diagnostic stage, the two groups demonstrated comparable levels of language competence, with most students classified at the moderate or low proficiency levels. During the formative stage, the systematic integration of digital technologies in the experimental group led to continuous improvement in vocabulary, grammar, and communicative skills, whereas progress in the control group was considerably more limited.

The final assessment revealed statistically meaningful differences between the two groups. The experimental group showed a marked increase in the proportion of students achieving a high level of language competence and a significant reduction in the number of students at the low level. In contrast, the control group demonstrated only modest improvements that had little effect on overall language proficiency.

The changes in students' language competence throughout the three stages of the experiment are presented in Table 7.

Table 7. Changes in Students' Language Competence Levels During the Experiment (%)

Stage of the Experiment	Group	High Level (%)	Moderate Level (%)	Low Level (%)
Diagnostic Stage	Experimental	14.6	48	37.4
	Control	15.2	46.8	38
Formative Stage	Experimental	27.9	50.4	21.7
	Control	18.6	48.1	33.3
Final Assessment Stage	Experimental	38.7	46.6	14.7
	Control	19.5	44.3	36.2

The data presented in Table 7 demonstrate a clear positive trend in the development of language competence among students in the experimental group throughout all stages of the study. The most notable changes include a substantial



increase in the proportion of students achieving a high level of language competence and a corresponding decrease in the proportion of students at the low level.

These findings confirm the effectiveness of integrating digital technologies into language instruction. The systematic use of digital learning tools contributed to more rapid development of students' language skills and resulted in sustained improvements in their overall language competence.

Conclusion

The experimental study was conducted to empirically evaluate the effectiveness of digital technologies in developing the language competence of secondary school students. The findings provide comprehensive evidence of the positive impact of digital learning tools on students' linguistic knowledge, language skills, and communicative competence.

The results revealed a clear positive trend in the experimental group throughout all stages of the study. Comparative analysis of the control and experimental groups demonstrated a substantial increase in the proportion of students achieving high and moderate levels of language competence, accompanied by a marked decrease in the number of students at the low proficiency level. In contrast, the control group showed only modest improvement, confirming the advantages of instruction supported by digital technologies.

Statistical analysis using Student's *t*-test confirmed that the differences between the experimental and control groups were statistically significant ($p \leq 0.05$). These findings indicate that the observed improvement in the experimental group resulted from the systematic integration of digital technologies into the language learning process, thereby supporting the research hypothesis.

The practical significance of the study lies in the possibility of applying the developed system of digital learning tasks and interactive activities in secondary school language education, particularly for students in Grades 10-11. The proposed approach can also be used in teacher professional development programs and in the implementation of digital and blended learning models.

Overall, the findings confirm the high effectiveness of digital technologies in developing students' language competence and support their systematic



integration into school language education. Future research should focus on expanding the experimental sample and investigating the impact of specific digital tools on individual components of language competence.

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