


# Digitally oriented strategies for developing professional competence of future foreign language specialists

## Estrategias orientadas digitalmente para el desarrollo de la competencia profesional de futuros especialistas en lenguas extranjeras

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### Abstract

This study aims to substantiate and experimentally verify the effectiveness of digitally oriented pedagogical technology for developing professional competence among undergraduate students majoring in foreign languages. A quasi-experimental mixed-methods research design was employed, involving control (n = 77) and experimental (n = 79) groups. The pedagogical intervention integrated digital learning platforms, language learning applications, artificial intelligence-based tools, digital portfolios, and gamified learning activities into the instructional process. Data were collected through questionnaires, diagnostic tests, structured observations, and self-assessment scales, covering motivational, cognitive, epistemological, activity-based, and communicative components of professional competence. Quantitative data were analyzed using Pearson's chi-square test ( $\chi^2$ ) at a significance level of  $\alpha = 0.05$ . The findings reveal statistically significant improvements in the overall level of professional competence and its individual components in the experimental group compared to the control group. The results confirm that the implementation of digitally oriented pedagogical technology contributes to higher levels of student motivation, professional knowledge acquisition, communicative skills, and practical language use. The study provides empirical evidence supporting the effectiveness of digital technologies in foreign language teacher education and offers practical implications for modernizing professional training in higher education institutions.

**Keywords:** professional competence, foreign language specialists, digital technologies, digital educational environment, higher education.

### Resumen

El presente estudio tiene como objetivo fundamental y verificar experimentalmente la eficacia de una tecnología pedagógica orientada digitalmente para el desarrollo de la competencia profesional en estudiantes universitarios de especialidades filológicas. Se empleó un diseño de investigación cuasi experimental de métodos mixtos, que incluyó un grupo de control (n = 77) y un grupo experimental (n = 79). La intervención pedagógica integró plataformas de aprendizaje digital, aplicaciones para el aprendizaje de lenguas, herramientas basadas en inteligencia artificial, portafolios digitales y actividades de aprendizaje gamificadas en el proceso educativo. La recolección de datos se realizó mediante cuestionarios, pruebas diagnósticas, observaciones estructuradas y escalas de autoevaluación, abarcando los componentes motivacional, cognitivo, epistemológico, procedimental y comunicativo de la competencia profesional. Los datos cuantitativos se analizaron mediante la prueba de chi-cuadrado de Pearson ( $\chi^2$ ) con un nivel de significación de  $\alpha = 0,05$ . Los resultados evidencian mejoras estadísticamente significativas en el nivel general de la competencia profesional y en sus

componentes individuales en el grupo experimental en comparación con el grupo de control. Los hallazgos confirman que la implementación de tecnologías pedagógicas orientadas digitalmente contribuye al incremento de la motivación estudiantil, la adquisición de conocimientos profesionales, el desarrollo de habilidades comunicativas y el uso práctico de la lengua extranjera. El estudio aporta evidencia empírica sobre la eficacia de las tecnologías digitales en la formación de especialistas en lenguas extranjeras y ofrece implicaciones prácticas para la modernización de la educación superior.

**Palabras clave:** competencia profesional, especialistas en lenguas extranjeras, tecnologías digitales, entorno educativo digital, educación superior.

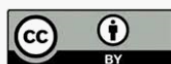
## Introduction

The modernization of the education system worldwide is a major trend, accompanied by significant changes in the practical and theoretical approaches to the educational process in higher education. Over time, the tasks and goals of language training for specialists in the higher education system have changed, reflecting cultural and political trends in society's development. With an emphasis on expanding the language competence of higher education students, we can state that today, a change in the educational paradigm is becoming one of the key professional competencies that determine the readiness of specialists for successful professional interaction in the academic, international, and scientific space (Moisés & Borges, 2021).

The issue of creating innovative learning tools in the context of the informatization of education, aimed at organizing work in a single information and educational space for education seekers to improve the quality of education, is becoming increasingly relevant. Digital educational resources are learning tools; they are information sources containing text, graphics, video, photos, and other content, aimed at implementing the tasks and goals of modern education and presented in digital form. Multifunctional digital technologies provide the opportunity for quick access and search for necessary information sources, placement of a larger amount of information, high-quality and objective testing of students' knowledge, diverse use of graphic design, visual representation of complex processes and phenomena, simultaneous receipt of information, which is presented in various forms for future specialists in a foreign language: audio, visual, etc. Therefore, practical solutions to the tasks of forming professional competence of a person using digital technologies, and the informatization of the entire educational environment require improving the training of future specialists in a foreign language using digital technologies, mastering the methodology of designing the educational process based on the use of digital educational resources (Corbella & Marcos, 2020).

Modern society is called an information society because people process and receive a large flow of information every day. The new generation is significantly different from previous generations in its need to use digital technologies in its own work, its adaptation to constantly changing living conditions, and its increasingly frequent use of digital technologies. Using information technology and digital media was not widespread across all areas of work ten years ago. However, in the modern economic situation, these competencies are the primary skills of future specialists necessary for the successful formation of a modern person's career. Today, people know how to watch something online, use IT skills, and write emails. Within the framework of digitalization, attention should be paid to the development of professional competence of future specialists in a foreign language using digital technologies from the very beginning of the educational process. In the context of

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the study, the opportunities provided by modern digital technologies are significant for language learning. Interest in this area of methodology is growing, becoming an integral part of the professional training of a modern specialist in a foreign language. The use of digital technologies in teaching foreign languages opens new opportunities for students and teachers in their own research. It enables them to undertake innovative tasks in the teaching and learning of a foreign language. Due to the widespread use of new digital technologies at the current stage of foreign language teaching, there is a need to review the ways and strategies for implementing the process of forming professional competence of future foreign language specialists using digital technologies, taking into account the trends in improving and modernizing education in the 21st century. In the context of profound socio-cultural and economic changes in the digital era, the relevance of the above is determined by the need for students to express themselves and define themselves, rather than solely by the social order (Orgado & Durão, 2022).

Thus, radical changes in the methods for developing the professional competence of future specialists in a foreign language using digital technologies give rise to new priorities in their training. This concerns the ability to operate with basic settings, mastering Internet resources, their digital component, experience in using innovative technologies, receiving, processing, memorizing professional information, finding the necessary information, forming knowledge on its basis, being able to select professional material using ICT, acquiring the skills necessary for the future profession to use digital technologies to work with professional materials.

Today, higher education is faced with the task of forming the professional competence of future specialists and professionals using digital technologies, and promoting students' awareness of their responsibility for searching, identifying, and placing their own information in the boundless space of Internet resources.

### Literature Review

Recently, technological advances have influenced language teaching and learning. Within the framework of digitalization, Schaefer et al. (2019) examined the development of professional competence among future foreign language specialists using digital technologies at the stage of the educational process. The authors showed the impact of digital technologies, which enabled different applicants in the educational space to experience the effectiveness of the learning process through innovative resources, namely digital stories and digital games, web conferencing, and telecollaboration. The study shows how these digital resources can contribute to L2 learning development.

In the context of the study, Galante et al. (2023) highlight the significant opportunities for language learning that modern digital technologies provide. Interest in this area of methodology is growing, becoming an integral part of the professional training of a modern foreign language specialist. The authors have demonstrated the benefits of multilingual pedagogy for students' language learning experience and conducted the necessary additional research to identify the most effective pedagogical methods to implement in a digital environment in foreign language learning programs. The authors describe the case studies conducted with students and teachers in Brazil in French, English, and Spanish. The researchers implemented five plurilingual strategies in language courses: pluriliteracy, translanguaging, intercultural comparisons, interlingual comparisons, and translation for mediation.

In modern society, the need for personality development through increasing globalization is the study of a second language in a multicultural environment.

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Harvey Arce & Cuadros Valdivia (2020) proposed innovative teaching methods for modern students, who are called digital media, and must adapt to the digital era of knowledge and educational technologies. Scientists have developed a digital resource for learning foreign languages that incorporates gamification and competition to attract students to the course and motivate them. Using a virtual environment, ways to improve the processing of the received theoretical information are shown, including elements of competitive activity and gamification, such as a user progress indicator, receiving medals for completing tasks, and a rating according to the points obtained, to motivate students and improve learning when learning a second language using the author's methodology.

The study by Jacome Paredes et al. (2025) examines the use of artificial intelligence-based digital tools for vocabulary memorization. It focuses on students enrolled in a program in which English is taught as a foreign language within the Linguistic and Pedagogical Program of Pedagogy of Foreign and National Languages (PINE) at the Southern State University of Manabí (UNESUM), Ecuador. The study used tools such as ChatGPT, augmented reality, and intelligent tutoring systems. The role of multimedia resources in vocabulary learning is proven. The importance of a digital adaptive environment is proven. Optimized interfaces are recommended for better student learning.

In Digital Language Education in the Context of Modern Trends, Pikhart et al. (2023) assessed the effectiveness of innovative tools from different perspectives of applied linguistics and psycholinguistics. The authors evaluated L2 vocabulary retention (as opposed to digital media) when using printed text. The study's results clearly show that students with access to printed vocabulary can better remember second-language vocabulary, write translations in their native language, and highlight fragments.

The aim of the study by Cabrera-Solano (2020), conducted at the Technical University of Loja, in southern Ecuador, is to analyze the use of digital portfolios (English as a Foreign Language) to improve EFL speaking skills in undergraduate English students. In this study, a mixed-methods approach was used to collect and analyze data, including observation sheets, pre- and post-questionnaires, and conversational rubrics. To create digital portfolios, students used their smartphones to access Google Drive, which contained videos and audio on the specific topics covered in the course. By analyzing students' oral speech, personalized feedback was provided through speech artifacts uploaded to each portfolio. The study's results demonstrated the effectiveness of digital portfolios in improving students' fluency and pronunciation.

The use of digital portfolios to improve EFL writing skills was demonstrated in a study of English as a foreign language (EFL) students enrolled in an English language course at a private university in southern Ecuador. Students used laptops and smartphones to create digital portfolios in Google Drive, including collaborative photos, reflective essays, and infographics on academic topics aligned with the course competencies. Digital portfolios are an effective learning tool that improves EFL students' writing skills and motivates them to reflect on their own progress.

Campo Paredes & Duarte Varela (2025) analyzed Brazilian students' perceptions of the use of Tandem and Duolingo in Spanish as a foreign language. The study's results show that students positively evaluate these digital applications as supporting tools for consistent practice and vocabulary expansion. The teacher's role is emphasized as a guide and intercultural mediator in the learning process. The

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authors conclude that the teacher plays an essential role in foreign language learning, that modern applications complement the learning process, and that digital literacy is necessary.

**The purpose of the article** is to substantiate and experimentally verify the effectiveness of digitally oriented pedagogical technology for the formation of professional competence of future foreign language specialists.

### Methodology

#### Research Design

The study employed a **quasi-experimental mixed-methods design** combining quantitative and qualitative approaches. This design was chosen to comprehensively examine the effectiveness of digitally oriented pedagogical technology in developing the professional competence of future foreign language specialists.

The experimental design included **control (CG) and experimental groups (EG)** with pre-test and post-test measurements, enabling comparison of learning outcomes and assessment of statistically significant differences resulting from the intervention.

#### Participants

The empirical study was conducted between **2022 and 2024** in higher education institutions in Ukraine. The total sample consisted of **156 undergraduate students majoring in foreign languages**, who were randomly assigned to:

- Experimental group (EG): 79 participants
- Control group (CG): 77 participants

The groups were independent and comparable in terms of age, academic background, and initial level of professional competence, which was confirmed at the ascertaining stage. The sample size met methodological requirements for ensuring statistical reliability and generalizability of results.

#### Pedagogical Intervention

The experimental group was taught using a **digitally oriented pedagogical technology**, while the control group followed traditional instructional methods.

The pedagogical technology was based on the following methodological approaches: competence-based, student-centered, systemic, axiological, practice-oriented.

The intervention included: integration of digital learning platforms (Moodle, Google Classroom, LearningApps); use of language learning applications (Duolingo, Memrise, Babbel); application of AI-based tools (e.g., ChatGPT) for interactive language practice; digital portfolios and project-based tasks; gamification and online collaboration tools.

The instructional process was implemented consistently across all stages of the educational cycle in the experimental group.

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## Instruments and Data Collection

To assess the formation of professional competence, a **multicomponent diagnostic framework** was applied, comprising the following components: motivational, cognitive, epistemological, activity-based, communicative.

Data collection instruments included: structured questionnaires, diagnostic tests, observation protocols, self-assessment scales.

Measurements were conducted at two stages:

1. **Ascertaining stage (pre-test)** – to determine the initial level of professional competence.
2. **Formative stage (post-test)** – to evaluate changes resulting from the pedagogical intervention.

## Data Analysis

Quantitative data were analyzed using **methods of mathematical statistics**. To test the research hypotheses, the **Pearson's chi-square ( $\chi^2$ ) test** was applied at a significance level of  $\alpha = 0.05$ .

Two statistical hypotheses were formulated:

- **H<sub>0</sub> (null hypothesis):** there are no statistically significant differences between the experimental and control groups.
- **H<sub>1</sub> (alternative hypothesis):** there are statistically significant differences between the groups.

The empirical  $\chi^2$  values were compared with critical values to determine the acceptance or rejection of hypotheses. Statistical processing ensured a **95% confidence level**, confirming the reliability and validity of the findings.

Qualitative data were used to interpret quantitative results and provide additional insights into the learning process and students' engagement with digital technologies.

## Ethical Considerations

Participation in the study was voluntary. All participants were informed about the research objectives, procedures, and confidentiality of their data. Ethical principles of educational research were strictly observed.

## Results and Discussion

### The content of the digital environment for the formation of professional competence of future specialists in a foreign language.

The use of digital technologies in language classes contributes to the development of professional competence among future specialists in a foreign language. It forms the worldview of communicative verbal activity in three aspects:

- **H<sub>1</sub>** Communication of students through the use of network technologies in real time.

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- Interactive dialogic interaction with the student's computer – and as a result, the implementation of human-machine dialogue.
- Interaction of students with educational digital programs. Teaching various types of language activities: listening, speaking, reading, and writing are the main components of the content of foreign language teaching (Molina Guillén et al., 2025).

Educational computer programs, which are also simulators, help students independently build their knowledge, contribute to the development of professional competence among future specialists in a foreign language, and facilitate the organization of students' independent work (Nobrega & Rozenfeld, 2019).

The creation of a practice-oriented digital educational environment is an important condition for the formation of professional competence of future specialists (involving students in the use and development of modern web resources, web technologies, and software tools in the process of studying at the university), such as:

- Internet resource: MOZAIK Education (interactive software for teachers, featuring virtual laboratories and programs).
- Google Classroom (a platform created for online learning, using graphic and text information, video, etc.).
- Edmodo is a web application (similar to a social network) used to facilitate effective student interaction.
- Moodle (an innovative open system for managing distance education) uses innovative tools to ensure the educational process.
- LearningApps.org (an online service created to provide interactive tasks, create various exercises, etc.).
- Zoom (a service created for the purpose of conducting online meetings and video conferences) (Rodríguez-Vizzuett et al., 2019).

Significant in the formation of professional competence of future foreign language specialists is the Internet portfolio – a technology that serves as an important tool for the teacher, integrates the capabilities of information and pedagogical technologies, and determines the degree of readiness of the specialist for professional activity in the conditions of digital requirements (Rocha & da Silva, 2020).

Let us consider the most common computer programs that should be used in the formation of professional competence of future foreign language specialists. Memrise, Duolingo, and Babbel offer interactive exercises, vocabulary trainers, and grammar tasks for language learning. They are ideal for different levels of language learning, for repeating vocabulary or grammar, and for practicing the language at any time and anywhere. These programs help develop speaking, listening, and reading skills through tasks and interactive exercises that adapt to learners' levels. Babbel and Memrise provide context and create real situations that allow you to use expressions and phrases in communication. Duolingo uses a system of achievements and points, which motivates higher education students to continue their studies. These programs allow students to significantly improve their language proficiency, providing a comprehensive approach to language learning. Tasks using the Duolingo application "Language Journey Blog" are practical. Its purpose is reflection and self-assessment, improving language skills, and motivating students to study further. Duolingo tools should be used to learn grammar and new vocabulary; iMovie, YouTube, Adobe Spark, or a phone camera are valuable tools for editing and recording videos (Acosta Padrón et al., 2022).

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Chatbots and artificial intelligence. GPT-based bots, such as ChatGPT, offer a dialogue mode and help develop communication skills. Artificial intelligence can correct errors, maintain a conversation on various topics, generate tasks, and explain rules. Artificial intelligence services analyze a student's knowledge level and recommend personalized exercises based on problem areas and progress (Casimiro Perlaza & Vega Rosas, 2025).

Online language learning platforms. Online language learning platforms offer English courses from Udemy, Coursera, and edX, which include tests, video lessons, and exercises. The courses are highly specialized (e.g., technical English, business English), which helps students choose topics that interest them. Zoom and other video conferencing services play an important role, allowing for online classes in groups or with teachers (Cristancho Triana & Corredor Aponte, 2023).

Gaming platforms and gamification. Gamification makes learning more fun through the following platforms: Kahoot!, Quizlet. Applicants to the educational space can compete in quizzes and play games, which help consolidate the material already studied in an interesting and easy way (Llanes Sánchez et al., 2022).

Social networks and communities. Popular platforms are Reddit, Instagram, and Facebook, where you can follow pages with educational content or join groups for studying a foreign language. This promotes live speech, vocabulary, and trends relevant to everyday communication. Students have the opportunity to follow bloggers and English-speaking accounts, communicate in communities, and connect with native speakers on online forums and with those who are studying a foreign language to get support and practice, learn about different cultures, and increase their vocabulary (Lunevich, 2021).

### **Organization and course of the experimental study**

The purpose of the experimental work was to verify the effectiveness of the developed pedagogical technology and pedagogical conditions for the formation of professional competence of future foreign language specialists using digital technologies.

The experimental work consisted of the following stages:

**The search stage** provided justification for the study's relevance, defined the research problem, analyzed literary sources and scientific research, and examined the use of educational digital technologies.

**The conceptual stage** included defining the research apparatus, formulating the goal, justifying the pedagogical technology, and specifying the pedagogical conditions for the development of professional competence among future foreign language specialists using digital technologies.

**The prognostic stage** provided for the development of the experimental methodology, the selection of methods and means of diagnostics, and the assessment of the formation of the components of professional competence of future foreign language specialists using digital technologies, as well as the processing and collection of empirical data.

**The organizational stage** allowed determining the sample volume and the general sets of the studied elements, and forming the experimental and control groups.

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**The technological stage** involved conducting a pedagogical experiment, which included the formative and ascertaining stages.

At the **ascertaining stage**, the initial level of professional competence in a foreign language for future specialists was established. Using mathematical statistics methods, the data obtained were processed to verify the absence or presence of differences (statistically significant) between the experimental and control groups.

In the experimental group, during the **formative stage** of the study, pedagogical technology and pedagogical conditions for developing the professional competence of future specialists in a foreign language using digital technologies were introduced. During 2022-2024, the educational process in the experimental group was organized using the selected stages. In the control and experimental groups, a final and ongoing assessment and diagnosis of the development of professional competence in a foreign language among future specialists were systematically carried out.

The stage of implementing the generalized results of the experimental work enabled us to analyze the practical outcomes and formulate conclusions regarding the goal of the experimental work.

During the experiment, to diagnose the development of professional competence in a foreign language according to specific components, indicators, and levels, diagnostic techniques and empirical methods were used.

A hypothesis was formulated: the introduction of developed pedagogical conditions into the professional training process of future specialists in a foreign language increases the effectiveness of the formation of professional competence in these specialists.

In the control and experimental groups, the number of respondents should be at least 69 people to ensure the reliability of the experiment.

Within the sample population (156 participants in the experiment), a control group (77 respondents) and an experimental group (79 respondents) were selected, and the groups were independent. According to the results of the survey of the sample, it is necessary to compare the formation of professional competence of future specialists in a foreign language among students and formulate conclusions about the probability, existing differences, the influence of pedagogical technology and pedagogical conditions of the formation of professional competence of future specialists in a foreign language using digital technologies, the possibility of extending the obtained effect to the general population of respondents.

To analyze the data obtained in the empirical study, we introduced a method of testing statistical hypotheses, in particular, two statistical hypotheses:

- **Null hypothesis  $H_0$**  – hypothesis about the absence of differences between the experimental group and the control group.
- **Alternative hypothesis  $H_1$**  – hypothesis about the significance of differences between the experimental and control groups.

Let us reveal the methodology for testing hypotheses: based on the EG and CG indicators (data on the results of observations), the empirical value ( $\chi^2_{emp}$ ) of the criterion was calculated, which was compared with the critical ( $\chi^2_{crit}$ ) value of the criterion given in the table of critical values  $\chi_\alpha$  (known reference number), with a significance level of 0.05 (given probability of error). In our study, a 5% possibility of

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error is allowed; that is, the reliability of the result was chosen at 95% (i.e., a probability level of 0.05). The value of  $\chi^2_{crit}$  is determined for the significance level  $\alpha=0.05$  according to the table, and is equal to 4 – the number of degrees of freedom. Thus,  $9.49 = \chi^2_{crit}$ . If the empirical ( $\chi^2_{emp}$ ) value of the criterion is equal to the critical  $\chi^2_{crit}$  or is less, then the null hypothesis is accepted, that is, the qualitative characteristics of the EG and CG respondents coincide with a probability of 95%. Moreover, if the empirical ( $\chi^2_{emp}$ ) value of the criterion is greater than the critical  $\chi^2_{crit}$ , then the null hypothesis is rejected, and the alternative hypothesis is accepted. Then, with a confidence of 95%, the qualitative characteristics of the EG and CG students are considered different.

### Ascertaining stage

Diagnosis of the formation of the motivational component of professional competence among respondents revealed the following:

- 79% of respondents in the CG and 81% in the EG had an average, low, or critical level.
- 21% of respondents in the CG and 19% in the EG had a sufficient, high level.

Thus, the results of the experiment show that most respondents at the beginning of the experiment had poorly formed motivational attitudes toward professional competence.

**Table 1.**

*Formation of the motivational component of professional competence of future foreign language specialists (stating stage)*

Levels	Control group %	Experimental group %
Low	18	19
Critical	32	32
Average	30	30
Sufficient	15	12
High	5	7

Let's assess the reliability of the obtained data and compare the experimental and control groups in terms of the level of formation of the motivational component of professional competence in respondents.

Let us formulate two hypotheses:

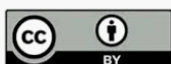
**Hypothesis H<sub>0</sub>:** The control group and the experimental group of respondents do not significantly differ in the level of formation of the motivational component.

**Hypothesis H<sub>1</sub>:** The control group and the experimental group of respondents differ significantly in the level of formation of the motivational component. The obtained  $\chi^2_{emp}$  is less than  $\chi^2_{crit}$  ( $0.304 < 9.49$ ); therefore, the hypothesis H<sub>0</sub> is accepted: the control and experimental groups of respondents do not differ significantly in the level of formation of the motivational component.

Diagnosis of the cognitive component of professional competence in respondents showed the following:

- 79% of respondents in the CG and 78% in the EG had average, low, and critical levels.

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- 21% of respondents in the CG and 22% of respondents in the EG had a sufficient, high level.

Thus, the results of the experiment show that most respondents at the outset demonstrated insufficient knowledge of the specified problem.

**Table 2.**

*Formation of the cognitive component of professional competence of future specialists in a foreign language (statistical stage)*

Levels	Control group %	Experimental group %
Low	19	20
Critical	28	28
Average	32	30
Sufficient	14	15
High	7	7

Let us assess the reliability of the collected data and compare the experimental and control groups based on the level of cognitive development in the formation of respondents' professional competence.

Let us formulate two hypotheses:

**Hypothesis H<sub>0</sub>:** The experimental group and the control group of respondents do not significantly differ in the level of formation of the cognitive component.

**Hypothesis H<sub>1</sub>:** The experimental group and the control group of respondents differ significantly in the level of formation of the cognitive component. The obtained  $\chi^2_{emp}$  is less than  $\chi^2_{crit}$  ( $0.304 < 9.49$ ); therefore, the hypothesis H<sub>0</sub> is accepted: the experimental and control groups of respondents do not differ significantly in the level of formation of the cognitive component.

Diagnosis of the epistemological component of professional competence in respondents showed the following:

- 78% of respondents in the CG and 76% in the EG had average, low, and critical levels.
- 22% of respondents in the CG and 24% of respondents in the EG had a sufficient, high level.

Thus, the results of the experiment show that at the outset, most respondents demonstrated insufficient knowledge of the specified problem.

**Table 3.**

*Formation of the epistemological component of professional competence of future specialists in a foreign language (confirmatory stage)*

Levels	Control group %	Experimental group %
Low	17	19
Critical	28	29
Average	33	28
Sufficient	16	16
High	6	8

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Let's assess the reliability of the collected data and compare the experimental and control groups regarding the level of epistemological component development in respondents.

Let us formulate two hypotheses:

**Hypothesis H<sub>0</sub>:** The experimental and control groups of respondents do not significantly differ in terms of the level of formation of the epistemological component.

**Hypothesis H<sub>1</sub>:** The experimental group and the control group of respondents differ significantly in terms of the level of formation of the epistemological component.

Let's calculate the Pearson criterion. The obtained  $\chi^2_{emp}$  is less than  $\chi^2_{crit}$  ( $1.02 < 9.49$ ); therefore, the hypothesis H<sub>0</sub> is accepted: the experimental and control groups of respondents do not differ significantly in the level of formation of the epistemological component.

The diagnosis of the activity component of professional competence among respondents showed the following:

- 78% of respondents in the CG and 75% in the EG had an average, low, or critical level.
- 22% of respondents in the CG and 24% in the EG had a sufficient, high level.

Therefore, at the beginning of the experiment, respondents demonstrated insufficient knowledge of the specified problem.

**Table 4.**

*Formation of the activity component of professional competence of future foreign language specialists (statistical stage)*

Levels	Control group %	Experimental group %
Low	17	19
Critical	28	29
Average	33	27
Sufficient	16	16
High	6	8

Let's assess the reliability of the obtained data and compare the experimental and control groups in terms of the level of formation of the activity component of professional competence among respondents.

Let's formulate two hypotheses:

**Hypothesis H<sub>0</sub>:** The experimental and control groups of respondents do not significantly differ in the level of formation of the activity component.

**Hypothesis H<sub>1</sub>:** The experimental group and the control group of respondents differ significantly in the level of formation of the activity component.

Let's calculate the Pearson criterion. The obtained  $\chi^2_{emp}$  is less than  $\chi^2_{crit}$  ( $0.435 < 9.49$ ); therefore, the hypothesis H<sub>0</sub> is accepted: the experimental and

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control groups of respondents do not differ practically in the level of formation of the activity component.

The diagnosis of the communicative component of professional competence among respondents showed the following:

- 82% of respondents in the CG and 81% in the EG had an average, low, critical level.
- 18% of respondents in the CG and 19% in the EG had a sufficient, high level.

Therefore, at the beginning of the experiment, respondents demonstrated insufficient knowledge of the specified problem.

**Table 5.**

*Formation of the communicative component of professional competence of future specialists in a foreign language (confirmatory stage)*

Levels	Control group %	Experimental group %
Low	18	19
Critical	35	31
Average	28	31
Sufficient	10	13
High	8	6

Let us assess the reliability of the collected data and compare the experimental and control groups regarding the level of development of the communicative component of professional competence in respondents.

Let's formulate two hypotheses:

**Hypothesis H<sub>0</sub>:** The experimental and control groups of respondents do not significantly differ in the level of formation of the communicative component.

**Hypothesis H<sub>1</sub>:** The experimental group and the control group of respondents differ significantly in the level of formation of the communicative component.

Let's calculate the Pearson criterion. The obtained  $\chi^2_{emp}$  is less than  $\chi^2_{crit}$  ( $0.604 < 9.49$ ); therefore, the hypothesis H<sub>0</sub> is accepted: the experimental and control groups of respondents do not differ significantly in the level of formation of the communicative component.

According to the results of the ascertaining stage, the respondents demonstrated insufficient depth of knowledge of the specified problem.

**The formative stage of the study**

Because respondents had limited knowledge of the specified problem, we developed a pedagogical technology. In the EG, pedagogical conditions for the development of professional competence in a foreign language among future specialists using digital technologies were proposed.

The pedagogical technology for the formation of professional competence in a foreign language among future specialists using digital technologies was introduced in the EG. The CGs followed the standard methodology.

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The pedagogical technology included:

- Application of scientific approaches (competence, student-centered, axiological, systemic, practice-oriented).
- Use of pedagogical principles (positive motivation for learning; developmental learning; consciousness and activity; professional orientation of education; elective learning; consistency and systematicity).
- Conducting topics on the digitalization of the content of individual components of the philological cycle.
- Selective educational components, where issues of digital technologies are thoroughly considered.
- Master class for creating educational professional products using digital technologies.
- Innovative ways of using digital technologies to form the professional competence of future foreign language specialists.
- Modern methods for the formation of the components of the professional competence of future foreign language specialists.
- Implementation of pedagogical conditions for the formation of the professional competence of future foreign language specialists using digital technologies.

Let us present the results of the formative stage of the pedagogical experiment.

We obtained empirical data at the end of the formative stage, which gave grounds to speak about the formation of professional competence in the respondents of the experimental group and the control group:

- In the EG and CG, the percentages of respondents reporting high or sufficient levels of formation of professional competence in a foreign language among future specialists through digital technologies increased. However, the relative indicators in the experimental group are much higher, and the growth is more pronounced.
- We observe significant differences between respondents with a high and sufficient level of formation of the components of their professional competence for future specialists in a foreign language using digital technologies between the experimental and control groups. It has been proven that future specialists in a foreign language in the EG developed professional competence through digital technologies at a higher level than in the CG.
- Positive results in the experiment were achieved due to the introduction of pedagogical technology.

We will show positive results for each criterion (formative stage of the study).

Diagnosis of the formation of the motivational component of professional competence of future specialists in a foreign language by means of digital technologies revealed the following:

- 73% of respondents in the CG and 46% in the EG had an average, critical, low level.
- 27% of respondents in the CG and 54% in the EG had a sufficient, high level.

Thus, the results of the experiment demonstrate the effectiveness of implementing pedagogical technology in the EG.

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The most significant difference was observed at a statistically significant level between the CG and the EG (-19%). The share of respondents in the EG with a sufficient level of this component's formation exceeds that in the CG.

**Table 6.**

*Formation of professional competence of future specialists in a foreign language by means of digital technologies (motivational component, formative stage)*

Levels	Control group %	Experimental group %
Low	13	6
Critical	24	12
Average	36	28
Sufficient	19	39
High	8	15

Let us compare the experimental and control groups in terms of the level of motivational component formation and assess the reliability of the data obtained. Let's formulate two hypotheses:

**Hypothesis H<sub>0</sub>:** The experimental and control groups of respondents do not significantly differ in the level of formation of the motivational component.

**Hypothesis H<sub>1</sub>:** The experimental group and the control group of respondents differ significantly in the level of formation of the motivational component of professional competence.

Let's calculate the Pearson criterion. The obtained  $\chi^2_{emp}$  is greater than  $\chi^2_{crit}$  (12.689 > 9.49); therefore, the hypothesis H<sub>1</sub> is accepted: the experimental and control groups of respondents differ significantly in the level of formation of the motivational component of professional competence.

Diagnosis of the formation of the cognitive component of professional competence of future specialists in a foreign language by means of digital technologies showed that:

- 75% of respondents in the CG and 59% in the EG had an average, critical, low level.
- 25% of respondents in the CG and 41% in the EG had a sufficient, high level.

Thus, the results of the experiment demonstrate the effectiveness of implementing pedagogical technology in the EG.

The most significant difference was observed at a sufficient level between the CG and the EG (-8%). The share of respondents in the EG with a sufficient level of this component's formation exceeds that in the CG.

**Table 7.**

*Formation of professional competence of future specialists in a foreign language by means of digital technologies (cognitive component, formative stage)*

Levels	Control group %	Experimental group %
Low	16	9
Critical	33	18
Average	26	33
Sufficient	16	24
High	9	17

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Let's compare the control and experimental groups by the level of cognitive component formation and assess the reliability of the data obtained.

Let's formulate two hypotheses:

**Hypothesis H<sub>0</sub>:** The experimental and control groups of respondents do not differ significantly in the level of formation of the cognitive component.

**Hypothesis H<sub>1</sub>:** The experimental group and the control group of respondents differ significantly in the level of formation of the cognitive component of professional competence.

Let's calculate the Pearson criterion. The obtained  $\chi^2_{emp}$  is greater than  $\chi^2_{crit}$  (9.866 > 9.49); therefore, the hypothesis H<sub>1</sub> is accepted: the experimental and control groups of respondents differ significantly in the level of formation of the cognitive component of professional competence.

Diagnosis of the level of formation of the epistemological component of professional competence of future specialists in a foreign language by means of digital technologies showed that:

- 77% of respondents in the CG and 62% in the EG had an average, critical, low level.
- 23% of respondents in the CG and 38% in the EG had a sufficient, high level.

Thus, the results of the experiment demonstrate the effectiveness of implementing pedagogical technology in the EG.

The most significant difference was observed at a sufficient level between the CG and the EG (-9%). The share of respondents in the EG with a sufficient level of this component's formation exceeds that in the CG.

**Table 8.**

*Formation of professional competence of future specialists in a foreign language by means of digital technologies (epistemological component, formative stage)*

Levels	Control group %	Experimental group %
Low	15	4
Critical	31	18
Average	31	40
Sufficient	15	24
High	8	14

Let us compare the experimental and control groups in terms of epistemological component formation and assess the reliability of the obtained data.

Let's formulate two hypotheses:

**Hypothesis H<sub>0</sub>:** By the level of formation of the epistemological component, the experimental and control groups of respondents do not differ significantly.

**Hypothesis H<sub>1</sub>:** By the level of formation of the epistemological component of professional competence, the experimental group and the control group of respondents differ significantly.

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Let's calculate the Pearson criterion. The obtained  $\chi^2_{emp}$  is greater than  $\chi^2_{crit}$  ( $10.926 > 9.49$ ); therefore, the hypothesis  $H_1$  is accepted: the control and experimental groups differ significantly in the level of formation of the epistemological component of professional competence.

Diagnosis of the level of formation of the activity component of professional competence of future foreign language specialists using digital technologies showed that:

- 78% of respondents in the CG and 58% in the EG had an average, critical, low level.
- 22% of respondents in the CG and 42% in the EG had a sufficient, high level.

Thus, the results of the experiment demonstrate the effectiveness of pedagogical technology in the EG.

The most significant difference was observed at a statistically significant level between the CG and the EG (-13%). The share of respondents in the EG with a sufficient level of this component's formation exceeds that in the CG.

**Table 9.**

*Formation of professional competence of future foreign language specialists using digital technologies (activity component, formative stage)*

Levels	Control group %	Experimental group %
Low	17	7
Critical	29	20
Average	32	31
Sufficient	14	28
High	8	14

Let's compare and assess the reliability of the data obtained in the experimental and control groups by the level of formation of the activity component.

Let us formulate two hypotheses:

**Hypothesis  $H_0$ :** The experimental and control groups of respondents do not differ significantly in terms of the level of formation of the activity component.

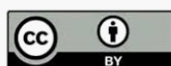
**Hypothesis  $H_1$ :** The experimental group and the control group of respondents differ significantly in terms of the level of formation of the activity component of professional competence.

Let's calculate the Pearson criterion. The obtained  $\chi^2_{emp}$  is greater than  $\chi^2_{crit}$  ( $10.129 > 9.49$ ); therefore, the hypothesis  $H_1$  is accepted: the control and experimental groups differ significantly in the level of formation of the activity component of professional competence.

Diagnosis of the level of formation of the communicative component of professional competence of future specialists by means of digital technologies showed that:

- 78% of respondents in the CG and 62% in the EG had average, critical, or low levels.
- 22% of respondents in the CG and 38% in the EG had sufficient, high levels.

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Thus, the experimental results demonstrate the effectiveness of pedagogical technology in the EG.

The most significant difference was observed at a statistically significant level between the CG and the EG (-13%). The share of EG respondents with a sufficient level of this component's development exceeds that in the CG.

**Table 10.**

*Formation of professional competence of future specialists in a foreign language by means of digital technologies (communicative component, formative stage)*

Levels	Control group %	Experimental group %
Low	15	8
Critical	33	20
Average	30	34
Sufficient	14	27
High	8	11

In the experimental and control groups, we will assess and compare the reliability of the collected data regarding the level of development of the communicative component.

We will formulate two hypotheses:

**Hypothesis H<sub>0</sub>:** The control and experimental groups of respondents do not differ significantly in terms of the level of formation of the communicative component.

**Hypothesis H<sub>1</sub>:** The experimental group and the control group of respondents differ significantly in terms of the level of formation of the communicative component of professional competence.

We will calculate the Pearson criterion. The obtained  $\chi^2_{emp}$  is greater than  $\chi^2_{crit}$  ( $10.872 > 9.49$ ); therefore, the hypothesis H<sub>1</sub> is accepted: regarding the level of formation of the communicative component of professional competence. The control and experimental groups of respondents differ significantly.

The analysis of the presented data from the formative experiment allows us to conclude that the experimental group, which engaged in innovative pedagogical technology, exceeds the control group in the level of formation of all the identified components of professional competence among the respondents. The analysis of the dynamics indicates positive changes in the experimental group, which are more pronounced than in the control group.

The results of the formative stage of the experiment show that between the control and experimental groups of respondents, there are statistically significant differences in the level of formation of professional competence in general and its individual components, with more significant positive changes observed in the experimental group than in the control. Therefore, we are discussing the effectiveness of innovative pedagogical technology for developing professional competence in future specialists through digital technologies.

## Conclusions

The content of the digital environment for the development of professional competence among future specialists in a foreign language is presented. The

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advantages of integrating digital technologies into language teaching are demonstrated. The integration of digital technologies into language teaching ensures the transfer of skills, abilities, and knowledge to students in a specific professional field. It orients them towards independent activity, encompassing cognitive, value, motivational, and other components.

The main aspects and conditions for the development of professional competence in a foreign language among future specialists are described. It is proven that the creation of a practice-oriented digital educational environment is a significant condition for the formation of professional competence of future specialists (by involving students in the use and development of modern web resources, web technologies, and software tools during their studies at the university).

The most common computer programs for developing professional competence in a foreign language are considered.

The purpose of the experimental work was to verify the effectiveness of the developed pedagogical technology and pedagogical conditions for the development of professional competence in a foreign language among future specialists using digital technologies.

The results of the ascertaining stage of the experiment gave grounds to express preliminary assumptions regarding the formation of professional competence of future specialists in a foreign language:

- Respondents who entered the sample revealed an insufficient level of formation of all components (identified by us) of professional competences.
- Respondents in the experimental and control groups reported approximately the same levels of professional competence development, with individual-level differences that, on average, did not exceed 1.7%. Therefore, we are talking about a homogeneous sample. This is shown by the example of each component.

Due to respondents' limited knowledge of the specified problem, we developed a pedagogical technology. The EG proposed pedagogical conditions for the development of professional competence in a foreign language among future specialists using digital technologies.

The analysis of the presented data from the formative experiment allows us to conclude that the experimental group, which engaged in innovative pedagogical technology, exceeds the control group in the level of formation of all the identified components of professional competence among the respondents. The analysis of the dynamics indicates positive changes in the experimental group, which are more pronounced than in the control group.

The results of the formative stage of the experiment show that between the control and experimental groups of respondents, there are statistically significant differences in the level of formation of professional competence in general and its individual components, with more significant positive changes observed in the experimental group than in the control. Therefore, we are discussing the effectiveness of an innovative pedagogical technology for developing professional competence in future specialists through digital technologies.

Our research does not cover all aspects of this problem. Further scientific research should focus on the influence of the educational information environment on

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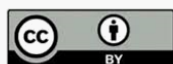
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education to implement differentiated and individual approaches, support students' choice of an individual learning trajectory, and enhance research activities through the use of online educational resources.

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