UDC 004.4+378+80

Tetiana A. Vakaliuk
Doctor of Pedagogical Sciences, Professor, Professor, Department of Software Engineering
Zhytomyr Polytechnic State University, Zhytomyr, Ukraine
ORCID ID 0000-0001-6825-4697
tetianavakaliuk@gmail.com

Olha O. Osova
Doctor of Pedagogical Sciences, Associate Professor, Professor of the Foreign Philology
Department of the Municipal Establishment "Kharkiv Humanitarian Pedagogical Academy"
Kharkiv Regional Council, Kharkiv, Ukraine
ORCID ID 0000-0001-7316-1196
osova.olga@gmail.com

Oksana A. Chernysh
PhD in Philology, Associate Professor at the Department of Theoretical and Applied Linguistics
Zhytomyr Polytechnic State University, Zhytomyr, Ukraine
ORCID ID 0000-0002-2010-200X
chernyshoxana@gmail.com

Olha I. Bashkir
Doctor of Pedagogical Sciences, Associate Professor,
Professor at the Chair of Educology and Innovative Pedagogy
H.S. Skovoroda Kharkiv National Pedagogical University, Kharkiv, Ukraine
ORCID ID0000-0001-5237-9778
boi83@ukr.net

CHECKING DIGITAL COMPETENCE FORMATION OF FOREIGN LANGUAGE FUTURE TEACHERS USING GAME SIMULATORS

Abstract. The article substantiates the need for the formation of digital competence of future teachers of foreign languages (here and thereafter - teachers) as an important component of their professional competence. Taking into account the theoretical works of domestic and foreign scientists on the problem under study and the peculiarities of training teachers for professional activities in the context of the requirements of the New Ukrainian school, the concept of "digital competence of future teachers of a foreign language" is specified, its main structural components (motivational, content, operational) activity and personal-reflexive) are defined. Among the means, providing the formation of digital competence of teachers, the game simulators, considered in the context of obtaining professional experience, skills, and abilities. To determine the level of formation of digital competence of teachers, criteria (motivational, cognitive, operational-activational, reflexive-corrective) and indicators were developed, by which the levels of its formation (low, average, sufficient, high) were determined. To increase the level of formation of digital competence of teachers, game simulators, expedient for use in the process of their professional and pedagogical training, the content of the disciplines "Methods of teaching a foreign language in secondary school", "Innovative approaches to teaching foreign languages in high school", "Modern approaches to teaching foreign languages" was selected; forms, methods and ways of using game simulators in training teachers were developed and introduced. Based on the analysis of the results of the pedagogical experiment, the difference in the levels of formation of digital competence of teachers using game simulators in the experimental and control groups was proved, which confirms the effectiveness of formation of digital competence of teachers by game simulators.

Keywords: competence-based approach; competence; digital competence; game simulators; future foreign language teachers.

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1. INTRODUCTION

Problem statement. The rapid development of digital technologies and innovative means of education requires the preparedness of preparing professionals to apply technological innovations in future professional and pedagogical activities and revision of approaches to the formation of their professional competence. Digitalization of the educational process leads to profound changes in the system and structure of education, the dynamics of scientific and technical modernization, new approaches to the formation of professional competence of future teachers of a foreign language (here and thereafter - teachers). Consequently, an important component of professional competence of teachers is defined as digital competence, which provides "confident and critical use of digital technologies, as well as the presence of information and media literacy, algorithmic thinking, knowledge of the basics of programming, obtaining skills in Internet safety and cybersecurity, and understanding the peculiarities of work with information" [1], which is nowadays essential for effective professional activity in a foreign language information and communication space.

The need to improve the level of digital competence of modern professionals, the formation of the ability to foreign-language pedagogical interaction in a modern educational environment is noted in the legislative framework of Ukraine: the Law of Ukraine "On Higher Education" (2017), the Program "New skills for Europe" (2016), the Strategy for Higher Education Development in Ukraine for 2021-2031 (2020), etc. Thus, the Strategy for Development of Higher Education in Ukraine for 2021-2031 refers to megatrends that predetermine the future of education, one of which is determined by digitalization [2]. The document notes that education lags behind digitalization, which in turn will require more attention and efforts to use the possibilities of innovative technologies in the educational process [2]. According to “The Digital Agenda of Ukraine – 2020”, the skills of the modern specialist for most specializations, including education, is the ability to work with "digital" technologies, which leads to Ukraine promotion of professional digital competencies and skills as key components of the "digital" economy.

The priorities of foreign language pedagogical education development are specified in the state documents and oriented on digitalization of educational environment and integration of knowledge of foreign languages due to qualitative professional training of the teacher of a foreign language, who is ready to provide the European quality of education, transition to innovative forms and methods of educational process organization, as well as the introduction of digital technologies.

The relevance of the problem under study is strengthened, on the one hand, by the presence of a wide palette of means of preparation of teachers for professional activity, on the other hand - by the insufficient level of knowledge of teachers on their application in the process of foreign language teaching [3], [4]. Unlimited access to information, the insufficient level of formation of skills critically select it and use it in professional activity, strengthen the objective need of the new Ukrainian school in teachers of foreign language, who are ready to implement digital educational technologies.

The above gives reason to argue that solving the problem of the formation of digital competence of teachers as an important component of their professional competence is an urgent requirement of the present.

Analysis of recent research and publications. The review of scientific literature on the topic of research allows us to state that the problem of forming the digital competence of teachers utilizing game simulators in the domestic and foreign opinion is covered aspect by aspect. Thus, the theoretical issues of forming professional competence of future teachers employing information and communication technologies are reflected in the scientific works (O. Honcharova [4], R. Hurevych [5], I. Kostikova [3], L. Kartashova [6], L. Morska [10], etc.).

Noting the need to build digital competence of teachers, R. Gurevich notes that "digital technologies have entered the life of mankind forever and have become crucial in maintaining the sustainable functioning of society in quarantine and forced isolation during pandemics and contribute to long-term impact in postpandem" [5]. In turn, the scientist identifies some measures to support students and teachers (finding ways to level the inequality between students, organizing training sessions for faculty on teaching features of teaching with digital services, creating a special platform to exchange experiences between teachers in the field of digital education, methodological assistance in adapting programs to the forms of learning through digital technologies, etc.) and promotes an effective transition to online learning [5]. To organize an effective educational process, according to L. Kartashova, a necessary, "important component of professional competence of a modern specialist in any profession is digital competence" [6]. The researcher substantiates innovative approaches to solving the problem of forming and developing the digital competence of a teacher in the electronic environment of an educational institution [6].

The laws, structure, content of digital competence, and digital culture of future teachers are substantiated by V. Bykov, A. Gurzhii, M. Shishkina, L. Gavrilova, J. Topolnik, N. Morze, A. Buinitska, O. Spirin, T. Vakaliuk, A. Chernenko, etc. Yes, L. Gavrilova, analyzing the modern understanding of "digital culture" as a phenomenon of the information society, connects its main significance with the emergence of new specific information-virtual forms of culture and cultural communication. In the process of defining digital competence, the author proceeds from the general understanding of competence and singles out its main components from relevant knowledge, skills, experience, values, and holistically implemented in practice [7]. N. Morze pays special attention to the description of the content of the system of digital competence development as one of the key competencies of a teacher. The researcher theoretically justified and experimentally proved the effectiveness of this system, which allows scientific and pedagogical staff "to master modern ICT and pedagogical technologies for their further use in providing educational services and developing open high-quality educational content" [8].

The research on the problem of forming the digital competence of future teachers of different profiles has yielded significant scientific results. In particular, O.Romanovsky found out that the digital component of the professional competence of future teachers of mathematics reflects a set of knowledge, abilities, skills, and reflexive attitudes of future specialists in interaction with the information educational environment [9]. Studying the problem of formation of digital competence of future teachers of mathematics, the scientist determines the criteria and indicators, traces the levels of its formation [9]. Theoretical and methodological foundations for the formation of digital competence of future elementary school teachers are presented in the study of L. Petukhova [10]. The theoretical justification of the system of forming ICT competence of future computer science teachers is reflected in the scientific study by T. Schrol [11].

A separate cluster for the development of the problem under study is the works of foreign experts and scientists (Ch. Redecker, Y. Punie, S. Thiel, P. Fröhlich, A. Torres-Toukoumidis, M. Mäeots, F. Martin, A. Karl Betrus) aimed at justifying the conceptual foundations of using game simulators in the process of forming professional competence of future specialists. As noted by A. Torres-Toukoumidis, M. Mäeots, the use of gamification tools helps to implement the constructivist approach in the process of forming the digital competence of future specialists [12].

This problem was further developed in the works of such scientists as A. Zhernovnikova, L. Peretyaga, A. Kovtun, M. Korduban, A. Nalivaiko, N. Nalivaiko, V. Kontedailo, and others. In particular, according to the results of the study conducted by A. Zhernovnikova, it is proved that the use of game approaches in non-game processes has a positive value in determining the result of the formation of digital competence of future teachers [13].

At the same time, the conducted analysis of scientific works on the topic of research allows us to state that despite the increased interest of scientists in the issues of professional training of future teachers, the problem of forming digital competence of future foreign language teachers utilizing game simulations requires more detailed study.

Therefore, the **aim of the research** is to check the effectiveness of the formation of digital competence of future teachers of foreign languages by means of game simulators.

2. RESEARCH METHODOLOGY

In the research a set of complementary methods was used, reflecting the dialectical unity of knowledge at the theoretical and empirical levels, namely: analysis, synthesis of psychological and pedagogical, methodological, and general technical literature to form the main provisions of the study; comparison, synthesis, systematization of scientists' views on different aspects of the problem under study; educational experiment to determine levels of learning achievements and motivation of future foreign languages teachers; methods of mathematical statistics for data processing obtained during the ascertaining stage of the study.

During the implementation of the ascertaining stage of the pedagogical experiment, the theoretical and methodological concepts of the introduction of digital technologies of teaching foreign languages in the provincial-pedagogical training of specialists were studied; a cross-section of the levels of learning achievement of teachers according to certain criteria (motivational, cognitive-informational, technological-activity, personal-reflective) and indicators of formation of digital competence was conducted, levels of formation of digital competence were determined The experimental study also involved data processing obtained at the ascertaining and formative stages, their comparative analysis, and checking the results obtained using mathematical statistics methods.

The experimental work involved 216 students of Kharkiv Humanitarian Pedagogical Academy (EG 109 students) and H.S. Skovoroda Kharkiv National Pedagogical University (CG 107 students).

The research program included the use of the following techniques: "Diagnosis of motives of digital activity" (motivational criterion); "Diagnosis of knowledge of digital educational technologies in future professional activity" (cognitive-informational criterion); "Diagnosis of the level of readiness of the teacher to implement digital technologies in education" (technological-activity criterion); "Reflection of own digital activity" (personal-reflexive criterion).

3 RESULTS

The competency-based approach is the basis of future foreign language teachers' training for professional activities, and its result is defined as a high level of professional competence formation, characterizing the readiness of future foreign language teachers for professional and pedagogical activities.

The understanding of the competence approach is based on the essence of the main concept underlying it − the concept of "competence". Based on the analysis of scientific and pedagogical sources [8], [9], [14], [15], we view competence as a set of knowledge, skills, and activities.

One of the key competencies for lifelong learning at the beginning of the XXI century according to the European Parliament and the European Council digital competence of specialists was recognized [16]. The very concept of digital competence is used in the

educational system of Norway, which became the first country to include digital competence in the national curriculum.

Intensive integration processes in the world educational space, the mediatization of education, and the introduction of digital technologies in the educational process of modern institutions of higher education in Ukraine led to the allocation of digital competence in the professional competence of specialists, which is reflected in the project "Digital Agenda of Ukraine 20 2020") [17] and the concept of the New Ukrainian School [18].

Digital competence is defined as the ability to navigate in information space, obtain information, and operate it following their own needs and the requirements of the modern high-tech information society, confidently and critically apply information and communication technologies to create, search, process, exchange information in professional activities, in public space, private communication; algorithmic thinking, skills of safe use of resources on the Internet.

According to S. Prokhorova's research, the standard of digital competence for teachers includes four blocks: technological, socio-moral, pedagogical, and professional [15].

In turn, Brazdekis defines digital competence as a more complex phenomenon covering seven spheres: basic, technological, the sphere of strategic development of digital technologies, ethical, the sphere of integration of digital technologies in a particular subject of teaching, didactic, and sphere of management of educational process using digital technologies [19].

Among other structural elements of digital competence of teachers P. Kirchner, P. Bruiskere determine the ability to use special software that promotes the development of professional thinking and the ability to effectively use and adapt digital technology to organize group and individual forms of work, creating didactic materials [20].

Studying scientific sources and normative documents allows us to state that the digital competence of teachers covers such basic blocks as information literacy, communication, cooperation and cybernetics, creation of digital content, computer security [1], [5], [15], [21].

Among the tools providing the formation of digital competence of teachers, we single out game simulators, considered in the context of gaining professional experience, skills, and abilities.

In a broad sense, simulators are interpreted as models reflecting complex real systems. Game simulators are used in the educational process to design and analyze models of student and student development, as well as to study virtual environments [22], [23], [24].

In the context of this study, game simulators will be understood as multimedia support in the form of games, which allows motivating and interest students in active learning activities with the help of fully or partially simulated professional and pedagogical situations.

The main advantage of using game simulators in the process of professional training of teachers lies precisely in its motivational properties. In addition, some experience of using game simulators in the educational process allows us to characterize them as one of the effective digital tools, which contributes to the assimilation of large amounts of information and its more lasting content in memory [20], [23], [25], [26]. Game simulators should be used to form skills to solve non-standard professional situations in the conditions of the innovative educational environment, critically and creatively solve foreign language communication tasks, for greater visualization of learning materials, stimulation of interest in learning, development of pedagogical improvisation skills, etc.

With the increased need to organize distance and blended learning, caused by the spread of the worldwide pandemic COVID-19, game simulators can be used to improve the digital competence of the teachers to use game simulators in the teaching system, as well as to increase student involvement in the learning process [27], [28], [29], [30]. At the same time, game simulators should be introduced in the educational process considering didactic principles (systematicity, activity, consistency, etc.).

In this regard, within the framework of teaching individual disciplines ("Methods of teaching a foreign language in secondary school", "Innovative approaches to teaching foreign languages in higher education", "Modern approaches to teaching foreign languages"), it was proposed to work with the following digital services for teaching foreign languages, including game simulators:

– **The Language Magician** is a computer simulation game, the main purpose of which is to help the teacher assess the educational achievements of students. A fascinating plot of the game and a variety of bright characters stimulate cognitive interest; develop language and digital skills of students. During the game, the teacher gets information about the students' achievements without using stressful control methods. At the same time, the game helps to test listening, reading, and writing skills. The game can be used at the initial stage of learning a foreign language both individually, with an individual student or student, and for group work (Fig. 1). According to the plot of the game, each of the participants plays the role of an assistant wizard living in the countryside, communicating with animals and practicing his witchcraft skills. One day, an evil wizard – the owner of the dark tower - kidnaps the animals. To get the animals back, the wizard's helper must overcome a series of obstacles in the dark tower (perform certain tasks). The tasks meet international standards for teaching foreign languages and help test both speech skills and soft skills in non-standard communication situations.

Fig.1. The Language Magician – A computer simulation game for learning a foreign language

– **Unicampus** is an online offering from the Goethe Institute (https://www.goethe.de/de/spr/spr/21103043.html) in the form of a game that helps users become familiar with the prototype of a German university, its structure (dormitory, dining hall, library, study department, etc.), and the features of student life in Germany (Fig. 2).

Michael is the protagonist of the game enters a German university, during the game students get acquainted with the various locations of the university campus. After completing all the tasks and successfully passing the first level, the main character gets acquainted with fellow student Oscar, who invites him to his laboratory, where an unpredictable event happens to them, which must be corrected on the second level. All the events and tasks to them meaningfully connect all the campus locations, thus contributing to a deeper learning experience. In the process of stimulating learning situations students get the necessary

information about the educational system in Germany and the structure of the institution of higher education, gain experience in solving problems that arise in the process of learning and student life, as well as build skills for the implementation of game simulations in the educational process of higher education to improve their digital competence.

Fig.2. Unicampus – A computer simulation game for learning a foreign language

During the experimental study, the mentioned digital service was used both during the students' independent work and during the main language classes. For example, in foreign language classes, different campus locations were chosen as topics of conversation, their features were discussed and compared with the university campuses in Ukraine. As tasks for independent work, students independently chose a campus location they were unfamiliar with before, worked through the material on their own and studied vocabulary. The final task was to create lexical clouds or collages of corresponding campus locations using digital tools.

– **Minecraft** is one of the virtual video games among children and youth. Before plunging into the virtual world of the game, participants chose one of the game modes.

Depending on the goal, you can choose a creative mode, survival mode, adventure mode, etc. Minecraft is increasingly being used in educational institutions. To make the video game available to schools, MinecraftEdu was created.

Using a version of MinecraftEdu in a pilot study, students and teachers worked in a virtual classroom. Using handheld game cameras, students were able to document the results of their projects or homework assignments. The use of the above game in the process of teaching a foreign language intensified the students' foreign language activities. For example, the simulation game tasks discussed complex environmental transformations, time and resource management. In addition, in the process of using the simulation game, students practiced digital skills and abilities and became more familiar with the possibilities of digital products for foreign language learning.

– **Sims4** is a computer game in which students can create the school or university of their dreams. The game offers many possibilities for the development of personal creativity. The schoolyard, sports field, teachers, classrooms, canteen, library, etc. can be created individually according to one's ideas. In this way, it is possible to form media skills, as well as foreign language skills, spatial thinking, and project presentation.

During independent work students created during the game projects "Innovative office of a foreign language", "Teacher of the XXI century", "Modern Library" which then were presented in the course "Innovative approaches to foreign language teaching". Digital project

activities students carried out in the process of using this simulation game, was aimed at solving the subject-subject and subject-object relations between the participants in the educational process to form the digital competence of teachers.

In addition to the above-mentioned simulators, students were additionally offered Voki and ClassDojo.

– **Voki** is a digital service for creating talking avatars. During foreign language learning, students can choose a particular literary or historical character or group of characters, reproduce their visual image, voice or write text, then voice the avatar, control the behavioral trajectory depending on the situation, etc. (Fig. 3). In the process of using the specified service in the classes of foreign language (German, English) and country studies of Germany students worked on the images of fairy-tale characters (Cinderella, Snow White, Hansel, Gretel, etc.), famous political and historical figures (A. Merkel, E. Bavarian, F. Joseph), prepared fragments from individual scenes, which helped to develop foreign language speaking skills, automation of the use of grammar constructions in oral and written speech, formation of socio-cultural skills and skills of using digital services in It should be noted that the introduction of this service in the training process of future teachers of a foreign language contributed to the sustainable motivation of students to learn a foreign language and to the use of digital services in the future professional and pedagogical activity, as students themselves experienced positive emotions when performing tasks and an incentive to further active learning and cognitive activity.

Fig.3. Voki – digital service for foreign language learning.

– **ClassDojo** is a digital tool that allows you to manage groups of students. This service acts as an auxiliary tool, in the process of using which the teacher manages the learning activities of students and stimulates them in their virtual classrooms to behave properly. The introduction of the specified digital service in foreign language classes in the training process of future teachers of foreign languages expanded the idea of the latter regarding the didactic possibilities of digital services in the process of teaching a foreign language, as students were participants in the virtual learning space, they were well oriented in the settings of the virtual classroom, were familiarized with the functions tabs (portfolio, statistics, messages, etc.). By choosing "useful" activities for which students received rewards and the opportunity to use animated avatars that could rejoice in successes and be sad when the number of points was not enough, the instructor could encourage students to be active learners. During the course "Innovative approaches to teaching foreign languages" students also discussed the advantages

and disadvantages of one or another digital service for use in future professional and pedagogical activities and determined the appropriateness of their use depending on the learning environment.

It should be noted that in the process of teaching the mentioned disciplines the teacher independently selects forms and methods appropriate in combination with game simulators and digital services, which respectively act as means in the educational process.

Taking into account the theoretical groundwork of domestic and foreign scientists on the problem under study and the peculiarities of future foreign language teachers' training for professional activity in the context of the requirements of the New Ukrainian school, we believe that the readiness of future foreign language teachers to use digital technologies in future professional activity is determined by the formation of digital competence, the main structural components of which are motivational, content, operational-activational and personal-reflexive.

The motivational component of the formation of digital competence of teachers is conditioned by the presence of a stable need to study and implement the experience of using game simulators in future professional activity. It assumes the presence of motivation, positive attitude, and sustainable cognitive interest in the implementation of digital technologies in the process of the professional and pedagogical activity, arising from the awareness of the personality of the imbalance between knowledge, abilities, skills of using digital learning tools and the need to acquire new, deeper and more flexible.

The content component of the formation of digital competence of teachers implies the provision of a system of knowledge regarding the essential characteristics of game simulators, their didactic possibilities in the process of teaching foreign languages. The levels of development of the content component are characterized by completeness, depth, consistency, the strength of knowledge, as well as the creative nature of their assimilation.

The operational-activational component provides the formation of developed abilities to diagnose, predict and creatively use game simulations in the structure of own professional activity for self-improvement and development of digital competence. The communicative component of this component is realized in the ability to organize professionally directed subject-subject interaction in the conditions of a digital educational environment, mastering verbal and nonverbal ways of communication using the capabilities of game simulators.

Following the team of scientists [9], we believe that the operational-activational component of future teachers' digital competence has a two-level structure, including the basic and subject-oriented levels. The basic level forms a system of knowledge, skills, and abilities necessary for teachers to find, store and share important information for teaching using digital technology. The subject-oriented level implies the formation of future foreign language teachers' readiness to use game simulators in future professional activity taking into account the peculiarities of the "Foreign language" subject. That is why the study of digital learning technologies is determined by the needs of modern training of teachers for professional activity.

The personal-reflexive component of the formation of digital competence of teachers was supposed to determine the ability to comprehend the results of the implementation of game simulators in the process of teaching foreign languages and the correction of own professional activity on the use of digital educational technologies based on self-assessment and self-analysis, self-consideration in professional activity by means of the use of game simulators.

In the context of the problem under study, it should be noted that the functioning of each component occurs in close relationships and interactions with each other.

To assess the level of formation of digital competence of teachers the following criteria were developed: motivational (the need for game simulators; attitude towards the use of game simulators in the process of teaching foreign languages; cognitive interest in the use of digital learning tools), cognitive (the formation of a system of knowledge about game simulators, their didactic potential in the process of teaching foreign languages, the formation of subject

knowledge (foreign language); the ability to methodically use game simulators in the process of foreign language learning), reflexive-corrective (the ability to perform reflexive self-analysis and self-reflection of digital activity within the future profession; the ability to evaluate the results of the implementation of simulators in the educational process; the ability to self-correct digital activity).

Per the above criteria and indicators and taking into account the theoretical aspects of the problem under study, the levels of formation of digital competence of teachers were determined: low, average, sufficient, high.

At the ascertaining stage of the pedagogical experiment, many measuring procedures were carried out to determine the levels of formation of digital competence of teachers according to certain criteria and indicators.

To determine the primary level of the state of formation of digital competence of teachers on the motivational criterion, a questionnaire was developed following the allocated in the material's structure of the specified competence. Each question was evaluated individually on a 4-point scale, and then the points were summed up.

The questions of the questionnaire are presented in the form of value judgments and problem situations:

1. Do you intend to work in the future in your chosen specialty of a foreign language teacher?

2. Are you intimidated by difficulties in a professional activity that require finding non-standard approaches to solve them?

3. Do you think that digital technologies improve the quality of education?

4. Do you agree with the opinion that the use of game simulators in the process of teaching a foreign language is obligatory?

5. In your opinion, should the application of game simulators necessarily accompany your professional-pedagogical activity?

6. Do you find it difficult to use digital technologies in preparation for classes?

The results of the survey of respondents on the levels of formation of the motivational component of the formation of digital competence of teachers at the ascertaining stage are reflected in Table 1 and Fig. 4.

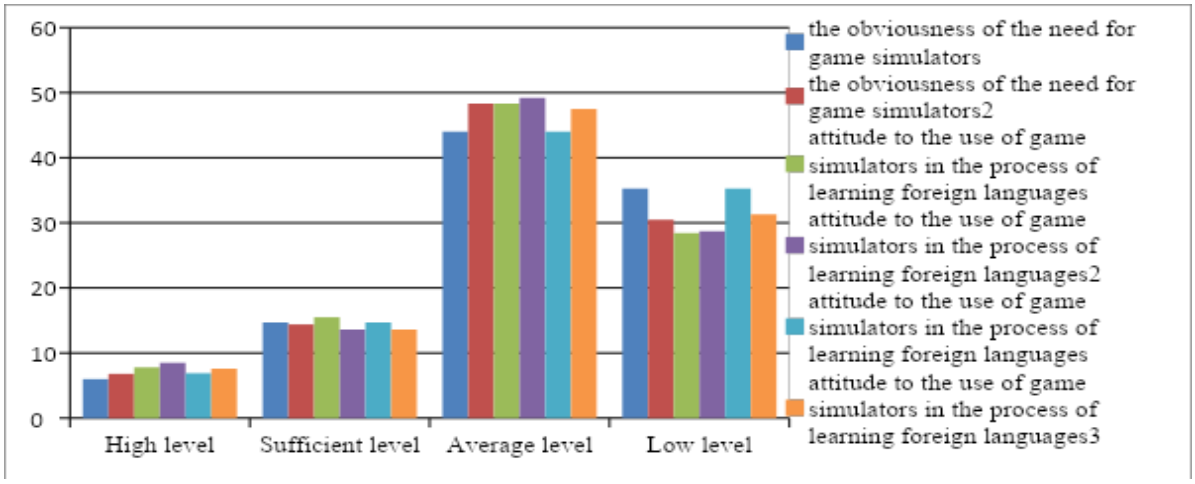

Fig. 4. The results of testing the motivational criterion of the formation of digital competence of future teachers of foreign languages in the ascertaining stage

Table 1

The results of testing the motivational criterion for the formation of digital competence of future teachers of foreign languages in the ascertaining stage

Criteria	Indicators	Levels	EG		CG	
			Quantitative data	%	Quantitative data	%
Motivational	Existence of need for game simulators	H	5	6,0	6	6,8
		S	15	14,7	15	14,4
		A	49	44,0	53	48,3
		L	40	35,3	33	30,5
	Attitude towards the use of game simulators in the process of teaching foreign languages	H	7	7,8	8	8,5
		S	16	15,5	12	13,6
		A	54	48,3	55	49,2
		L	32	28,4	32	28,7
	The presence of cognitive interest in the use of digital learning tools	H	6	6,9	7	7,6
		S	15	14,7	13	13,6
		A	52	44,0	53	47,5
		L	36	35,3	34	31,3

Considering the results presented in Table 1, we can say that at the ascertaining stage both groups had a low and average level of motivational criterion formation because most students - teachers were not aware of the range of opportunities that game simulators have for the formation of digital competence.

The experimental study involved checking the formation of digital competence of teachers on the cognitive criterion, which was provided by testing and questioning. For example, during the experiment, students had to give answers to the following questions: "What types of game simulators do you know?", "How does dynamic imagery affect information perception?", "What game simulators are most effective for developing students' foreign language communication skills?" and so on. The students were offered the following information to study: the essence and types of modern game simulators for teaching a foreign language, the didactic potential of game simulators in the process of teaching a foreign language; criteria for selecting game simulators to develop foreign language speaking skills of students; the features of using game simulators in educational institutions; ergonomic and health-saving requirements when organizing digital activities in foreign language classes, etc.

The results of determining the level of formation of the cognitive component of the formation of digital competence of teachers are presented in Table 2 and Fig. 5.

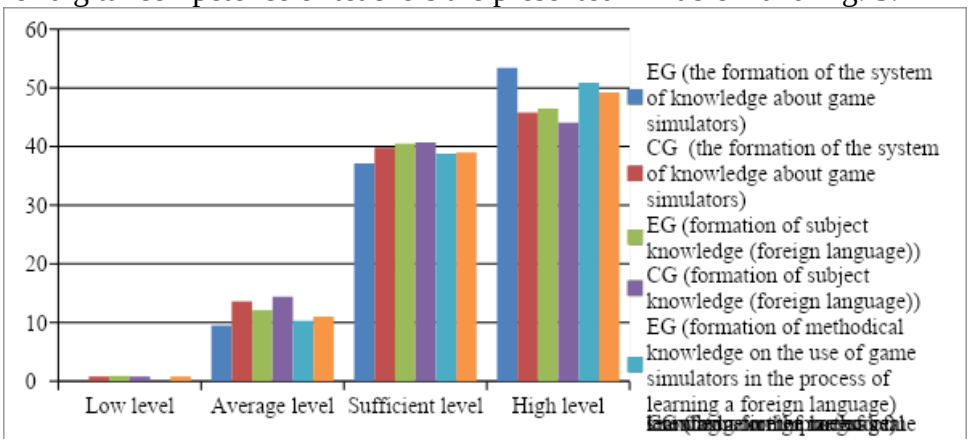

Fig. 5. The results of testing the cognitive criterion of the formation of digital competence of future teachers of foreign languages in the ascertaining stage

Table 2

The results of testing the cognitive criterion for the formation of digital competence of future teachers of foreign languages in the ascertaining stage

Criteria	Indicator	Levels	EG		CG	
			Quantitative data	%	Quantitative data	%
Cognitive	The formation of a system of knowledge about game simulators, their didactic potential in the process of teaching foreign languages	H	0	0	1	0,8
		S	9	9,5	13	13,6
		A	41	37,1	44	39,8
		L	59	53,4	49	45,8
	Formation of subject knowledge (foreign language)	H	1	0,9	1	0,8
		S	12	12,1	15	14,4
		A	44	40,5	45	40,7
		L	52	46,5	48	44,1
	Formation of methodological knowledge on the use of game simulators in the process of teaching a foreign language	H	0	0	1	0,8
		S	10	10,3	12	11,0
		A	43	38,8	43	39,0
		L	56	50,9	51	49,2

Based on the analysis of the data in Table 2, it was revealed that most of the respondents demonstrated a low level of digital competence formation on the cognitive criterion, which will require special attention in the future research process.

Determination of the level of formation of digital competence of teachers on the operational-activational criterion was carried out in the process of performing practical and individual tasks while studying the disciplines "Methods of teaching a foreign language in high school", "Innovative approaches to teaching foreign languages in high school", "Modern approaches to teaching foreign languages", as well as the implementation of the method "Diagnosis of the level of readiness of the teacher to implement digital technologies in education", which reflected certain skills of future professionals in the field of digital technology in general and game simulators in particular (Table 3 and Fig. 6).

Table 3

The results of testing the operational and operational criteria for the formation of digital competence of future teachers of foreign languages in the ascertaining stage

Criteria	Indicator	Levels	EG		CG	
			Quantitative data	%	Quantitative data	%
Operational-activational	Ability and skills to select the best digital services for the development of foreign language skills;	H	31	28,4	30	27,1
		S	51	45,7	53	49,2
		A	24	22,4	22	21,2
		L	3	3,5	2	2,5
	Presence of subject skills (foreign language) and ways of their implementation when using game simulators	H	34	31,0	29	28,0
		S	56	50,0	57	52,5
		A	18	18,1	19	17,8
		L	1	0,9	2	1,7
	Ability to the methodologically correct use of game simulators in the process of teaching a foreign language	H	33	30,2	30	28,0
		S	53	48,3	57	50,8
		A	22	20,7	20	19,5
		L	1	0,8	2	1,7

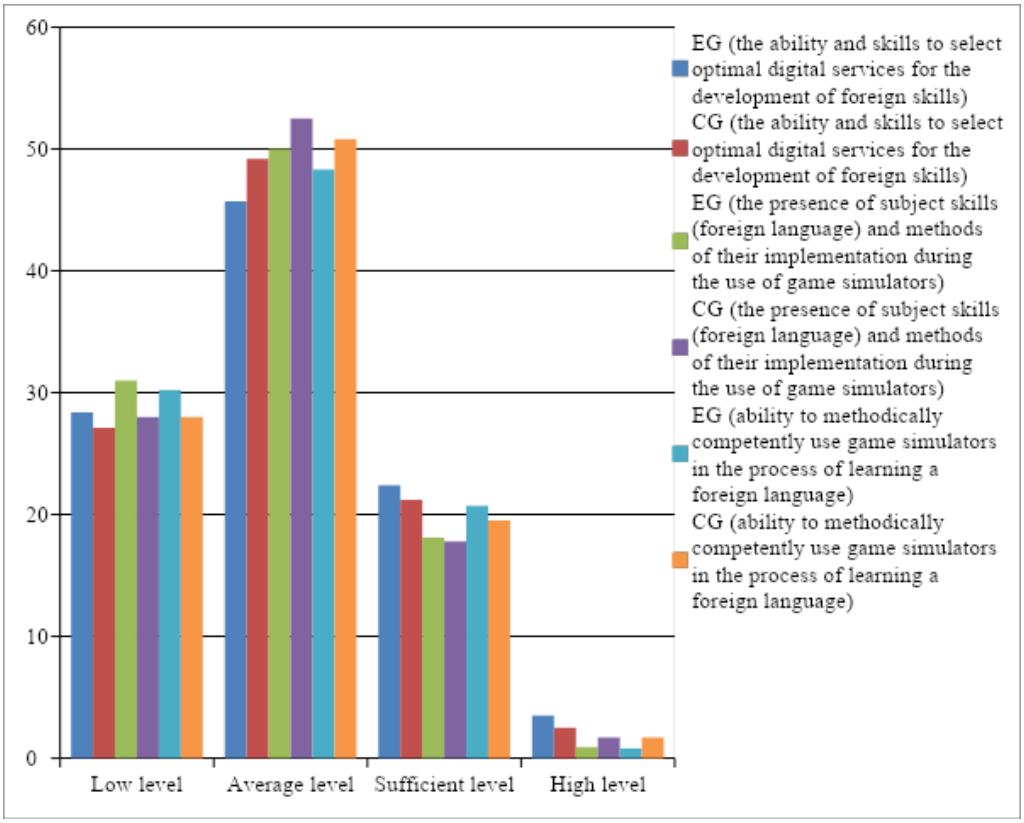

Fig. 6. The results of testing the operational and activity criterion of the formation of digital competence of future teachers of foreign languages at the ascertaining stage

According to the results presented in Table 3 and Fig. 6, we can state that in both groups the number of teachers with sufficient and average level of digital competence formation on the operational-activational criterion prevails, which requires practicing the abilities to use game simulators competently in the future professional and pedagogical activity.

Determination of the level of reflection of teachers to apply game simulators in the future professional activity was carried out by a technique "Reflexion of own digital activity" during which students had an opportunity to analyze the results of their activity, ways, and opportunities to evaluate digital resources, self-analysis, and self-assessment of their knowledge and skills of application of game simulators in professional activity. An additional source of information was the essays "Teacher in the age of digitalization", "Teaching foreign languages in a digital environment", in writing which students shared their reflections on the problem under study, analyzed their own experience of digital activity, and outlined ways of its correction (Table 4 and Fig. 7).

Table 4

The results of testing the reflection-correctional criterion of formation of digital competence of future teachers of a foreign language in the ascertaining stage

Indicator	Indicator	Levels	EG		CG	
			Quantitative data	%	Quantitative data	%
Reflexive and Corrective	Ability to carry out reflexive self-analysis and self-reflection of digital activity within the framework of the future profession	H	0	0	1	0,8
		S	27	24,1	27	25,4
		A	42	37,9	39	36,4
		L	42	38	40	37,4

	Ability to assess the results of the implementation of simulators in the educational process	H	0	0	2	1,7
		S	26	25,0	23	23,7
		A	38	34,5	39	35,6
		L	45	40,5	43	39
	Ability to self-correct digital activity	H	0	0	2	1,7
		S	26	25,0	25	24,6
		A	40	36,2	41	36,4
		L	43	38,8	39	37,3

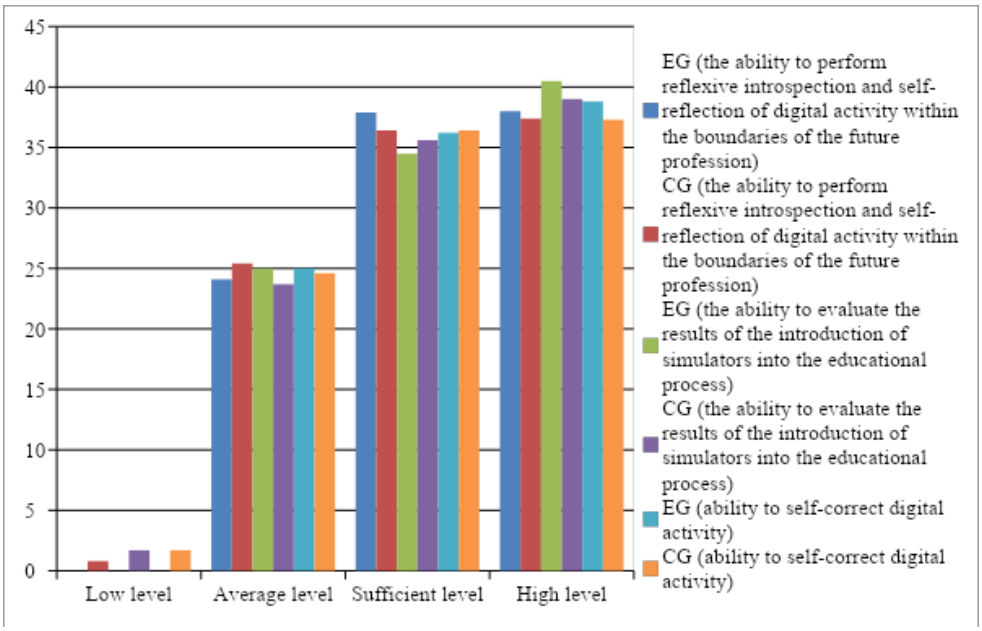

Fig. 7. The results of testing the reflexive-corrective criterion of the formation of digital competence of future teachers of foreign languages at the ascertaining stage

Completely expected at the ascertaining stage of the study was the fact that the students of both groups had a low level of formation of a set of skills to carry out reflexive self-analysis and self-assessment of digital activity within the framework of the future profession.

Based on checking all the criteria on the relevant indicators in the control and experimental groups the generalized data for determining the level of formation of digital competence in teachers at the ascertaining stage of research are allocated. The results are presented in Figure 8.

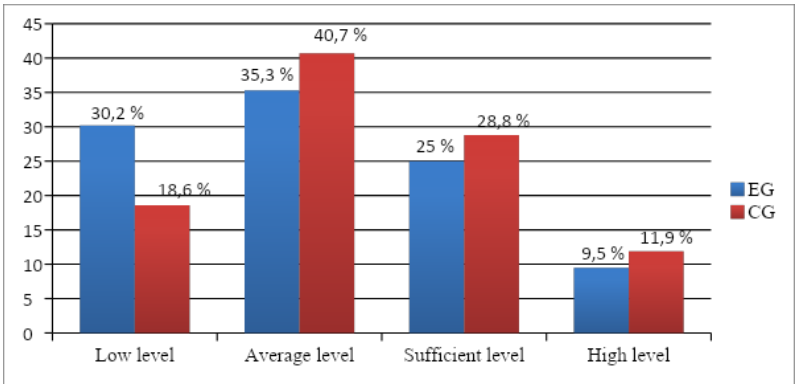

Fig. 8. Summarized data on the levels of formation of digital competence of future teachers of foreign languages at the ascertaining stage

To confirm the correct choice of the experimental and control groups, Pearson's statistical criterion (criterion 2) was used.

The null hypothesis of statistical unreliability of differences between the distributions of the level of formation of digital competence of teachers utilizing game simulators in the experimental and control groups was put forward.

The alternative hypothesis was the statistical reliability of the difference between the distributions of the level of formation of digital competence of teachers employing game simulators in the experimental and control groups.

The statistical value of criterion 2 was calculated by the formula:

$$\chi^2_{емп} = \frac{1}{n_1 \cdot n_2} \sum_{i=1}^{n} \frac{(n_1 \cdot Q_{2i} - n_2 \cdot Q_{1i})^2}{Q_{1i} + Q_{2i}}$$

where n1 is the number of students in the Cohort;

n2 − number of students in the EG;

Q1i (i=1, 2, 3, 4) − the number of students in the control group who received grades according to the developed levels (low, average, sufficient, high);

Q2i (i=1, 2, 3, 4) − the number of students in the experimental group who received grades under the developed levels (low, average, sufficient, high).

The results of the statistics calculation allow us to state that at the beginning of the experiment the control and experimental groups have insignificant statistical differences. The results obtained are less than the critical value of Pearson, that is, the values of 2 do not exceed the value of 2.64.

To check the effectiveness of using game simulators the implementation of game simulators in the educational process was carried out in the teaching of individual disciplines ("Methods of teaching a foreign language in high school", "Innovative approaches to teaching foreign languages in higher education", "Modern approaches to teaching foreign languages") in the EG.

In the CG the training was carried out according to the traditional methodology with the use of traditional ICT tools. After that, the formative stage of the pedagogical experiment was carried out.

To test the pedagogical feasibility of using game simulators, several measures aimed at measuring the state of formation of digital competence of teachers in the control and experimental groups were carried out. The objectivity of the research results was ensured by using methods of pedagogical observation in the course of control activities. In addition, students were questioned and each student's level of formation of digital competence was assessed by the teacher. Generalized data on the levels of formation of digital competence of teachers are presented in Table 5.

Table 5.

Summarized data on the levels of formation of digital competence of future teachers of foreign languages at the control stage

Levels	EG		CG	
	Quantitative data	%	Quantitative data	%
Low	0	0%	10	9,3%
Average	27	24,8%	48	44,9%
Sufficient	40	36,7%	34	31,8%
High	42	38,5%	15	14, 0%
Total	109	100%	107	100%

Based on the analysis of the generalized experimental data on the levels of digital competence of teachers it was found that a high level of digital competence is demonstrated by

38.5% of students in the experimental group, with an increase of 29.3%. The sufficient level of formation of the investigated competence is characteristic for 36.7% of respondents, accordingly the increase is 11.7%. For comparison, a high level of formation of digital competence was recorded in 14% of students in the control group, the growth is only 2.1%, at an adequate level of formation of investigated competence 31.8% of respondents, the growth of 3%.

Consequently, according to the results of the formative and control stages of the pedagogical experiment on the formation of digital competence of teachers through game simulators, the positive dynamics in the levels of its formation according to certain criteria and indicators were revealed.

To confirm the probability of the results of the experimental work, the statistical processing of the obtained data by $\chi 2$ Pearson criterion was carried out similarly to the data described earlier.

The null hypothesis was taken as statistically insignificant differences between the distributions of the level of teachers digital competence formation by means of game simulators in the experimental and control groups.

The alternative hypothesis assumes that the differences between the distributions of the level of formation of digital competence of teachers in the experimental and control groups are statistically reliable.

As a result of calculating the value of the criterion statistics on the results of the control sections for the developed criteria we have that $\chi 2_{emp} > \chi 2_{0,01}$, for each of them. The recorded data allows us to state that the samples have a statistically significant difference.

3. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

Therefore, summarizing the results of the theoretical views of domestic and foreign scientists regarding the features of professional and pedagogical training of teachers makes it possible to conclude that one of the most important qualities of modern teachers in the context of the New Ukrainian school is their readiness to use digital technologies in future professional activities. It is determined by the formation of digital competence, whose main structural components are motivational, content, operational-activational, personal-refexive.

To determine the levels of formation of digital competence of teachers using game simulators it is advisable to use the developed criteria (motivational, cognitive, operational-activational, reflexive-corrective), appropriate indicators, and levels (high, sufficient, average, low).

Based on the analysis of the results of the pedagogical experiment the difference in the levels of formation of digital competence of teachers employing game simulators in the experimental and control groups was proved. The positive consequences of the conducted research confirmed the correctness of the hypothesis and the goal of the research, as well as the ways of its implementation in the conditions of the educational process, and testified to the success of the work to form the digital competence of teachers utilizing game simulators: the formation of subject skills, when using game simulators, thorough and effective mastering of the students' knowledge of game simulators and their didactic potential in the process of teaching a foreign language.

The conducted research does not exhaust the multifaceted problem of forming digital competence of future foreign language teachers through game simulators. Prospects for further research lie in finding out the pedagogical conditions for the effective formation of digital competence of future foreign language teachers.

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ПЕРЕВІРКА СФОРМОВАНОСТІ ЦИФРОВОЇ КОМПЕТЕНТНОСТІ МАЙБУТНІХ УЧИТЕЛІВ ІНОЗЕМНОЇ МОВИ ЗАСОБАМИ ІГРОВИХ СИМУЛЯТОРІВ

Вакалюк Тетяна Анатоліївна
доктор педагогічних наук, професор, професорка кафедри інженерії програмного забезпечення
Державний університет «Житомирська політехніка», м. Житомир, Україна
ORCID ID 0000-0001-6825-4697
tetianavakaliuk@gmail.com

Осова Ольга Олексіївна
доктор педагогічних наук, доцент, професорка кафедри іноземної філології
Комунальний заклад «Харківська гуманітарно-педагогічна академія» Харківської обласної ради,
м. Харків, Україна
ORCID ID 0000-0001-7316-1196
osova.olga@gmail.com

Черниш Оксана Андріївна
кандидат філологічних наук, доцент кафедри теоретичної та прикладної лінгвістики
Державний університет «Житомирська політехніка», м. Житомир, Україна
ORCID ID 0000-0002-2010-200X
chernyshoxana@gmail.com

Башкір Ольга Іванівна
доктор педагогічних наук, доцент, професорка кафедри освітології та інноваційної педагогіки
Харківський національний педагогічний університет імені Г. С. Сковороди, м. Харків, Україна
ORCID ID 0000-0001-5237-9778
boi83@ukr.net

Анотація. У статті обґрунтовано необхідність формування цифрової компетентності майбутніх учителів іноземної мови як важливої складової їх професійної компетентності. Враховуючи теоретичні наробки вітчизняних та зарубіжних науковців із досліджуваної проблеми та особливості підготовки майбутніх учителів іноземної мови до професійної діяльності в контексті вимог Нової української школи, уточнено поняття «цифрова компетентність майбутніх учителів іноземної мови», визначено її основні структурні компоненти (мотиваційний, змістовий, операційно-діяльнісний та особистісно-рефлексивний). Серед засобів, що забезпечують формування цифрової компетентності майбутніх учителів іноземної мови, виокремлено ігрові симулятори, які розглядаються в контексті здобуття професійного досвіду, умінь і навичок. З метою визначення рівня сформованості цифрової компетентності майбутніх учителів іноземної мови було розроблено критерії (мотиваційний, когнітивний, операційно-діяльнісний, рефлексивно-корекційний) та показники, відповідно до яких визначено рівні її сформованості (низький, середній, достатній, високий). Для підвищення рівня сформованості цифрової компетентності майбутніх учителів іноземної мови дібрано ігрові симулятори, що є доцільними для застосування під час їх професійно-педагогічної підготовки; удосконалено зміст дисциплін «Методика викладання іноземної мови у середній школі», «Інноваційні підходи до викладання іноземних мов у вищій школі», «Сучасні підходи до викладання іноземних мов»; розроблено та впроваджено форми, методи та засоби використання ігрових симуляторів у підготовці майбутніх учителів іноземної мови з метою оволодіння ними методикою використання ігрових симуляторів у системі навчання, а також для підвищення залученості студентів до процесу навчання. На основі аналізу результатів педагогічного експерименту доведено різницю в рівнях сформованості цифрової компетентності майбутніх учителів іноземної мови засобами ігрових симуляторів у експериментальній і контрольній групах, що підтверджує ефективність формування цифрової компетентності майбутніх учителів іноземної мови засобами ігрових симуляторів.

Ключові слова: компетентнісний підхід; компетентність; цифрова компетентність; ігрові симулятори; майбутні вчителі іноземної мови.

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