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## USE OF DIGITAL TECHNOLOGIES IN THE PREPARATION OF FUTURE GEOGRAPHY TEACHERS FOR CONTINUOUS PROFESSIONAL DEVELOPMENT

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*The article examines the features, development and gradual introduction of digital technologies in the preparation of future geography teachers for continuous professional development. It has been determined that the effectiveness of the use of digital technologies in the training of future geography teachers largely depends on how methodologically competent and pedagogically justified their inclusion in the structure of educational components of educational and professional programs in the specialty 014.07 Secondary Education (Geography) was. It has been established that higher education institutions are increasingly paying attention to the use of digital technologies in the preparation of future geography teachers for continuous professional development. The article examines the use of digital technologies in the preparation of future geography teachers for continuing professional development. Attention is focused on the use of digital technologies in geography lessons, where they are especially useful for reproducing visual and sound effects that help to better understand and memorize the material. Modern methods and tools that help to improve the effectiveness of the educational process and the development of teachers' professional competencies are described.*

*The advantages of integrating digital resources into the educational process are analyzed. The possibilities of using digital technologies in geography lessons in order to form future geography teachers' readiness for continuous professional development in order to increase the efficiency of the educational process and engage students in active learning are investigated. The influence of digital technologies on the formation of independent learning skills, critical thinking and information literacy is considered. Recommendations for further improving the pedagogical training of future geography teachers using innovative technologies are proposed. Advice on the use of digital technologies in the preparation of future geography teachers for continuous professional development, in particular, on updating the content of educational and professional programs in the specialty 014.07 Secondary Education (Geography) is given*

**Keywords:** digital technologies, teacher training, future teachers of geography, continuing professional development

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### 1. Introduction

The relevance of the article is determined by the current requirements to education in Ukraine, changes in the socio-economic formation, integration into the European and world educational space, and the construction of a modern society and its development. These trends are due to certain aspects. Firstly, digital technologies are being actively implemented in modern higher and general education, which help to improve the accessibility, efficiency and quality of education. Therefore, training future geography teachers to use digital tools is an important task for higher education. Secondly, modern society needs to be prepared for the challenges of the times: digital technologies are becoming a necessary tool for the development of modern society and the individual. Therefore, future geography teachers should be prepared to use digital resources and tools in their profes-

sional activities. Thirdly, modern specialists must be competitive in the labor market and able to adapt to new conditions. A geography teacher's fluency in digital competencies allows them to use geographic information systems, mapping services, geoportals, web resources, and other digital tools in their educational practice. And finally, the use of digital technologies in teaching methods changes approaches to the process of learning and personal development of students. Future geography teachers should be ready to implement innovative methods: online learning, use of digital resources and virtual laboratories.

The problem of using digital technologies in the preparation of future geography teachers for continuing professional development is relevant because it meets modern requirements for the education and training of future specialists in higher education institutions.

The content of the current regulatory documents governing the organization and development of the educational environment is aimed at introducing an interactive approach to learning. Therefore, it is strategically important to use digital, interactive and multimedia technologies in teaching, which are designed to ensure the integration of students into modern society, develop their critical thinking, and form their ability to self-development and self-learning in the face of rapidly changing global challenges and changes.

The analysis of pedagogical theory and practice shows that in the era of a variety of gadgets and a daily increase in the amount of information in our lives, encyclopedic knowledge has ceased to have the value it had only 20-30 years ago. Knowledge is no longer an end in itself for students, and the system of general and higher education must change accordingly, adapting to provide knowledge that is relevant and valuable today. The answer to these challenges is competency-based learning, i.e. the formation of general and subject-specific competencies in students, the most important of which is the ability to learn throughout life.

## 2. Literature review

V. Bykov's article highlights recommendations for the practical use of the survey results by educational authorities, institutions and establishments for the professional development of pedagogical staff, general secondary education institutions, research institutions and other stakeholders in organising the necessary measures that will contribute to the successful use of ICT and the introduction of distance learning [1].

M. Marienko highlights tips and solutions to certain technical problems (the inability to arrange a comfortable place for studying), and also describes the online platform "All-Ukrainian School Online" (ASO), which can be used to organise the educational process of subjects [2].

A. Munandar in her study confirms the positive relationship between the use of digital and interactive technologies and the formation of professional competence in geography teachers [3].

V. Nosachenko's article describes the conditions of innovative educational environment for training future geography teachers, in particular the use of innovative methods, technologies, teaching aids (introduction of case technology, use of electronic maps and atlases, digital excursions and virtual tours, cloud and geoinformation technologies, etc.) [4, 5].

S. Tolochko's research proves that the formation and development of teachers' digital competence in the context of the digital transformation of education is of particular importance with the active support of the state, the public and educational institutions [6].

However, certain issues of the methodology of forming future geography teachers' readiness to use digital technologies in the school geography course in the context of their continuous professional development remain insufficiently developed. Therefore, the problem of using digital technologies in geography lessons is quite relevant for geography teachers who want to increase the effectiveness of their work and engage students in conscious and active learning.

## 3. The aim and objectives of the research

The purpose of the article is to study the possibilities of using digital technologies in geography lessons in order to form future geography teachers' readiness for continuous professional development in order to improve the efficiency of the educational process and engage students in active learning.

To achieve the goal, the following tasks were set:

1. To identify which methods and strategies are most effective for integrating digital technologies into the preparation of future geography teachers, taking into account pedagogical feasibility and educational goals.

2. To determine how the use of digital resources in geography lessons contributes to the formation of key competences, in particular the competence of "lifelong learning".

3. To develop recommendations for improving the readiness of future teachers for continuous professional development and self-improvement in the context of rapid technological change.

## 4. Materials and methods

The research methods used include theoretical analysis of psychological and pedagogical sources of research, description, synthesis, systematization, abstraction, comparison and generalization of the analyzed data.

The theoretical analysis of psychological and pedagogical sources of the study was carried out by studying scientific and pedagogical literature, dissertations and publications. This helped to understand the existing theories and approaches to preparing future geography teachers for continuous professional development. Studying these sources made it possible to assess the current state of the problem of using digital technologies and identify gaps in existing research. The method was also used to rethink more complex concepts into simpler parts in order to better understand them and put them into the context of the continuing professional development of future geography teachers. The use of theoretical research methods, such as description, synthesis, systematization, abstraction, comparison and generalization, is an important step in the process of processing information, obtained as a result of theoretical analysis. The description allowed us to present in detail the main trends that were identified during the analysis.

The use of various research methods helped to identify the key aspects of the use of digital technologies in the preparation of future geography teachers for continuing professional development, to identify areas for further research, to rethink the developed model of preparation of future geography teachers for continuing professional development in order to increase its effectiveness when implemented in the educational process of Ukrainian universities.

## 5. Research results and discussion

Today, with the development of technology and the information space, the use of digital technologies in the educational process is an urgent pedagogical issue. The use of such technologies can increase the assimilation of knowledge and personal development, provide more interactive cooperation between teachers and stu-

dents, and contribute to better learning of educational material [1, 7–10].

Geography teaches students to understand and analyze global world issues and trends, such as climate change, international trade, national conflicts, migration, socio-political processes, and others. Possession of geographical knowledge and understanding of the global context helps students to realize the complex connections between countries and regions, develop intercultural competencies and the ability to act in the global world [3, 11–14].

In the modern world, digital technologies have become an essential component of successful learning and development. In this regard, the use of digital technologies in geography lessons is becoming an effective means of improving the quality of learning and engaging students in the study of this subject. The development of information technology and multimedia has made it possible to use new approaches and teaching methods that allow students to better learn the material and develop their skills.

Geography, as the basis of the natural sciences, is a complex subject that requires a large number of illustrations, diagrams, graphs, and maps to teach in general secondary education. The use of digital technologies can help students understand and memorize the material, as well as develop spatial thinking.

Today's students are a digital generation that grows up with computers and smartphones. The use of digital technologies in geography lessons can be an effective way to attract students' attention and interest in learning.

Today, there are many different digital tools and programs that allow you to create interactive tasks and lessons in general. Working in this direction can help teachers improve the efficiency of the educational process and make learning more interesting and engaging for students [1, 2, 6].

Digitized educational materials are more accessible and understandable for students, so the use of digital technologies in geography lessons is an effective tool for increasing students' motivation to learn.

At the same time, the use of digital technologies can reduce the cost of teaching materials and textbooks, as many of them can be replaced by digital analogues. This can be especially important for schools that have limited budgets for purchasing educational materials. In addition, the use of digital technologies in geography lessons can help teachers create interactive lessons where students are actively involved in the educational process and engaged in various tasks and games. Such lessons ensure the effectiveness of the learning process and make them more interesting [12, 15].

The use of modern digital technologies ensures more effective learning of educational material, in particular, due to timeliness, accessibility, appropriate dosage, consideration of individual characteristics of students, adaptation of the pace of learning and effective combination of individual and collective activities. Taking into account the basic principles of modern psychology, such as the individuality of students, problem-based learning, and the role of human factors, helps to humanize the educational process.

In this study, we focus on the use of digital technologies in geography lessons, where they are especially

useful for reproducing visual and sound effects that help to better understand and memorize the material. In this context, the study aims to determine the effectiveness and problems of using digital technologies in geography lessons, as well as to develop recommendations for improving the educational process in this area.

One of the theoretical aspects of using digital technologies is the use of different types of media, such as text, images, audio and video, to improve the quality of learning. Multimedia presentations, video tutorials, and other media resources can help students learn better and retain the material in their memory [12, 16, 17].

It is worth noting that digital technologies provide an opportunity for interactive cooperation between teachers and students, as well as between students themselves. Such communication activates students' interest in learning and promotes active learning.

We believe that the use of digital technologies is an important aspect of individualized learning. Different media resources can provide students with the opportunity to learn the material at their own pace and depending on their needs. This can help to increase the effectiveness of learning and provide each student with an individualized approach. Thus, the theoretical aspects of using multimedia technologies in geography lessons include the use of different types of media and interactive teaching methods.

In addition, scientists note that digital technologies can be used both to increase students' motivation to learn and to improve the efficiency of the educational process. The use of digital tools in geography lessons allows to demonstrate various types of geographical objects in the form of audio and video materials, animated images, illustrations, and geographic information systems in geography lessons. Geographic information systems allow you to create, collect, process and analyze geographic information. The use of such systems in geography lessons can help students better understand the processes taking place on the Earth and contribute to the formation of their geographical competence. Such tools can be used for interactive learning, i.e. creating situations that can be modeled on a computer and allow students to solve problems independently [4, 11, 12, 18].

In particular, the study analyzes the use of virtual reality in geography lessons, which allows creating situations that students can observe and study from different angles. The use of virtual reality contributes to a thorough understanding of geographical phenomena and processes. In addition, digital technologies help to create effective forms of teaching geography: interactive lectures, exercises using video and audio materials, games and simulations that provide students with a better understanding of complex physical and geographical processes and phenomena. In addition, the use of digital technologies in geography classes can help teachers create more dynamic and engaging lessons, which will increase students' interest in the subject. In addition, the use of such technologies can help to provide a more individualized approach to each student, as it allows teachers to create a variety of materials that can meet the different needs and levels of knowledge of students.

Thus, the use of digital technologies in geography lessons is an important pedagogical problem that requires

detailed research and development of effective methods of their use to improve the quality of learning and ensure the successful development of students.

This problem is of particular importance in the content and technologies of professional formation and development of future geography teachers, as the rapid progress of information and communication technologies opens up new opportunities in education and sets new requirements for learning.

In the context of the widespread use of digital technologies in modern life, modern education is aimed at preparing future teachers to fully perceive various information, develop ways of communication based on modern digital technologies, critical thinking to process the information received, and fluency in digital tools in professional practice. The process of forming future geography teachers' readiness to use digital technologies in the school geography course in the context of continuous professional development is based on the main theoretical aspects, including:

- the theory of cognitive activity (the use of digital technologies to create interactive applications and presentations that enable students to actively engage in educational activities and solve learning problems);
- the theory of constructivism (the use of digital technologies ensures the capabilities and needs of each student, allows you to create individual learning materials);
- the theory of the socio-cultural approach (the use of digital technologies provides the opportunity to study at a time and place convenient for the student, as well as ensures the availability of educational material for students from different cultures and languages).

The use of digital technologies expands the possibilities of the educational process, provides new ways of presenting information, testing their own ideas and projects, and allows them to meet the individual needs of each student.

Mastery of digital technologies by future teachers in the context of continuous professional development ensures the formation of their readiness for the optimal use of the modern information space in the school geography course. They should be able to use different types of digital materials (video, images and audio); take into account the needs of students (students' abilities, learning style and personal approach); ensure student interaction with the material (understanding, verification of the accuracy of information by source); apply adaptive technologies (expanding text and audio prompts, creating an inclusive educational environment through digital technologies for students with special educational needs). It is appropriate to use these digital materials when studying the educational components of the professional training of future geography teachers: «Cartography with the basics of topography», «Geology with the basics of paleontology», «General earth science», «Landscape science», «Ecology», «World economy geography», «Economic and social geography of the world», etc.

Based on the study, the following recommendations for improving the use of digital technologies in geography lessons were identified.

1. Professional training of teachers. It is recommended to include educational components and modules on the study of digital technologies and their use in geography

lessons (EC «Digital tools in the professional activity of geography teachers», «Interactive means of teaching geography», «GIS in the practical activity of geography teachers», «Information technologies of teaching in geography lessons», etc. It is also necessary to provide teachers with the necessary equipment and software.

Professional development of teachers means providing them with the necessary knowledge, skills and competencies to effectively use digital technologies in geography lessons. Recommendations for improving teacher professional development may include measures, such as in-service training for teachers on digital technologies, organization of workshops and trainings for teachers, development of special courses and methodological guides on the use of digital technologies in geography lessons. Such measures can help teachers to better navigate modern technologies and use them effectively in the classroom, thus improving the quality of learning and increasing student motivation.

2. Increase students' interest. It is recommended to use a variety of forms and methods of working with digital technologies that will engage students in active learning in the classroom, create an atmosphere of enthusiasm and interest in the subject.

Increasing students' interest is understood as creating conditions in geography lessons that increase motivation and enthusiasm in learning this discipline. The use of digital technologies can be an effective tool for achieving this goal. Thanks to the use of such technologies, students can be more actively involved in the lesson and gain new knowledge and impressions with greater interest. For example, visualization of material through photos and videos can be interesting for students and make the learning process more accessible and understandable to them. A recommendation for improving the use of digital technologies in geography lessons could be to create teaching materials using video, animation, and interactivity, which would increase students' interest and improve the quality of their education.

3. Improving the quality of educational material. It is recommended to develop new and update existing curricula and materials that maximize the use of digital technologies and ensure their quality and visibility.

Improving the quality of teaching materials in the context of using digital technologies in geography lessons means creating and using visual, understandable and interesting materials that maximize student learning.

This can include the development and use of audio and video materials, illustrations, animations, graphs, charts and other digital formats that enable students to see, listen and interact with the material in the classroom. The use of digital technologies to create and apply learning materials can make them more accessible and understandable to learners, especially those with different learning styles who may learn better through visual or audio formats. In addition, the use of digital technologies can increase students' interest in learning geography, which in turn can lead to better learning outcomes and a more positive approach to the subject.

4. Promoting the development of critical thinking. Promoting the development of critical thinking is understood as the use of digital technologies in geography lessons in order to stimulate students to critically analyze

and evaluate the information, provided in the lesson. This means that teachers should create learning material that requires students to think critically, particularly through questions that stimulate discussion and debate.

For example, teachers can use digital presentations that present not only information, but also questions, tasks, thanks to which students can independently explore a certain topic, using critical thinking and developing the ability to analyze, compare, draw conclusions, etc. Promoting the development of critical thinking is an important recommendation for improving the use of digital technologies in geography lessons, as it allows to increase the level of understanding and appreciation of the subject by students, develops their critical thinking and helps to understand in-depth knowledge of the studied topic.

5. Promoting the development of students' creativity. Promoting the development of creativity in geography lessons means creating conditions that promote the development of students' creative abilities through the use of digital technologies. This may include creating assignments and projects that allow students to apply their knowledge and skills to generate their own ideas and solutions. For example, you can offer students to create video presentations, geographic games or multimedia presentations using various programs and tools. This allows students to develop their creativity, presentation skills, and helps build skills in working with digital programs and data visualization. In addition, it helps students develop critical thinking and analytical skills as they have to analyze and evaluate information to create their own projects.

Although the study has provided important results on the use of digital technologies in the preparation of future geography teachers for continuing professional development, there are certain limitations that should be taken into account. In particular, the study characterized the peculiarities of implementing educational programs in the specialty Secondary Education (Geography) at certain higher education institutions, which may not reflect the full picture of the introduction of digital technologies in the preparation of geography teachers in other educational institutions or regions. Since curricula and teaching methods can vary considerably between different educational institutions, the results of the study may not be universal for all higher education institutions that prepare geography teachers. The study was conducted in a specific time period, which may limit the ability to take into account rapid changes in the field of digital technologies and their integration into the educational process. The study did not take into account the difference in accessibility and level of technical equipment of different higher education institutions. Despite these limitations, the results of the study are an important contribution to understanding the role of digital technologies in the training of future geography teachers and can serve as a basis for further research in this area.

Prospects for further research in the context of the development and implementation of digital technologies in the preparation of future geography teachers for continuing professional development may include the following areas: studying the impact of specific digital tools

on the learning outcomes of higher education students majoring in Secondary Education (Geography); analysis of the effectiveness of distance and blended learning; studying the development of independence and information literacy of geography students; researching the possibilities of using artificial intelligence.

## 6. Conclusions

1. The study has confirmed that the most effective methods of integrating digital technologies into the training of future geography teachers are those based on a combination of interactive educational platforms, virtual simulations and geographic information systems (GIS). The use of these tools allows not only to increase students' motivation but also to provide a deep understanding of geographical processes, which is important for achieving educational goals. The pedagogical feasibility of these methods lies in the possibility of adapting the educational material to the individual needs of students, as well as in promoting their autonomy and responsibility for their own learning.

2. The analysis of the use of digital resources in geography lessons has shown that they significantly contribute to the formation of the competence of "lifelong learning". Students who are actively involved in working with digital technologies demonstrate a higher level of critical thinking, information literacy and independence in learning. Digital resources provide access to up-to-date information that allows students to keep abreast of the latest developments in the field of geography and apply them in practice, which is the basis for continuous professional

3. Based on the study, a number of recommendations have been developed to improve the readiness of future geography teachers for continuous professional development and self-improvement. In particular, it is recommended to promote the use of digital technologies among teachers and students at universities and pedagogical colleges; to provide teachers with the opportunity to take advanced training courses and trainings on the use of digital technologies; to create special platforms and resources that allow teachers and students to create and share digital geography materials; to ensure the availability of the necessary equipment and software in geography lessons; to create and develop databases with digital materials.

## Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results, presented in this article.

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## Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the current work.

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