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Article

Implementation of modern trends of Ukrainian educational policy in the process of future natural sciences teachers training

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Abstract: The article addresses the issue of educational development policy in Ukraine: the main trends and ways, means, technologies of their implementation. It has been observed that educational policy is developing and changing under the influence of such factors as Russia's military actions against our country, European integration and globalisation. It has been taken into account that globalisation trends in the world integration, according to which globalisation processes should be reflected not only in the foreign economic, political or technological spheres, but also, as a consequence, in the development of technologies for training future teachers. Integration of digital technologies in the educational process is one of the key tendencies in the modern educational policy in Ukraine. The characteristics of the most used technologies of augmented reality in the modern school of Ukraine have been outlined. The algorithm for displaying generalized information about a particular application was proposed, namely: payment, accessibility, language, system requirements; learning opportunities; practical value; website; video about the application. The model of the formation of future teachers' skills to use augmented reality technologies in the process of natural sciences studying has been proposed. We consider it as a component of a holistic system of future teachers' professional training. The conceptual basis for the development of the model is a multi-subject educational paradigm, which is considered to be open, self-developing and self-organizing, causing a fundamental change in the behavior and relationships of the educational process participants. The proposed model is implemented in the authors' methodological system, which ensures the interconnected activities of all participants in the educational process. Its systemic factor is the goal of improving the quality of the future natural sciences teachers' professional training by developing their skills in using AR technology. The end result is an increase in the level of future natural sciences teachers' readiness to use AR technology in their professional activities.

Keywords: educational policy; integration; technology; AR applications; natural sciences education development; talent development policy

1. Introduction

In the 21st century, education is recognized as a key factor in achieving economic, social and cultural development of society. Ukraine continuous to work actively on

improving of its educational policy, taking into consideration challenges and possibilities of the modern world. That is why the National Doctrine of Education Development in Ukraine defines the quality of higher education as a priority of state policy, which is related to the need to form a harmoniously developed, socially active, creative and competent personality. Based on the main principles and provisions of the doctrine, which define the goals, directions, grounds and conditions for ensuring quality education, the category of quality becomes central. The quality of higher education is determined not only by the scope of knowledge, but also by the parameters of personal, ideological and civic development, and the problem of quality is considered from the standpoint of the universal human and social value of education. These provisions intensify the work on policy-making in the field of quality management in higher education and actualize the problem of vocational education development, centering it in the educational policy.

Modern educational policy in Ukraine is characterized by constant changes and adaptation to time requirements. Reforms of the education content, integration of digital technologies, development of inclusive education and international cooperation determine key directions of the education system development in the country. These trends are aimed at the establishing of conditions for the development of creativity, innovations and the competitiveness of future generations of Ukrainian citizens.

One of the key trends in Ukraine's current educational policy is the integration of digital technologies into the learning process. This trend reflects the importance of modern information and communication technologies use for enhancing the quality of education, engaging students into learning and their development stimulation.

It is recognized that modern world is characterized by unprecedented social changes that are taking place under the influence of the latest information and communication technologies. In particular it is related to augmented reality (AR). As practice shows, technological progress, the proliferation of affordable hardware and software have made AR viable and desirable in many fields, including education. Until quite recently AR was one of the newest technologies offering a new way of teaching. However, due to the increasing popularity of mobile devices all over the world, the widespread use of AR on smartphones and tablets has become a commodity. It allows introduction of new models of teaching and learning, which appropriately correspond to the students' needs in the 21st century. Therefore, the leading vector of modernization of the process of educational services providing to the students at higher education institutions in the new socio-cultural reality is to ensure the proper functioning of the educational environment in the context of informatization of society. Since introduction of AR into education is a reality, the problem of rethinking of the content of future natural sciences teachers' professional training at all levels of its constructing is being actualized (Milgram et al., 1995).

2. Review of literature

Regarding AR technology, the analysis of literature sources (Tarangul and Romaniuk, 2022; Vizniuk, 2019) revealed that it is becoming the subject of many scholars and teachers' research. Thus, Volynets's research reveals the specifics of virtual reality through the prism of interaction dialectics between technology and

humans as one of the key categories of immersive information technologies (Volynets, 2021). Tymchyna and Tymchyna (2020) singled out the types of AR systems, delimitation of which lies in the plain of ways and regimes of their interaction with a user. The expediency of using AR technology as the method of active learning, the advantages and disadvantages of its use in the educational process was substantiated.

The expediency of AR use as a means of remote learning was substantiated by Tkachuk et al. (2020). He suggested the methodology for the use of Electricity AR mobile application as a means of visualizing laboratory equipment in the home environment. The application of AR which is based on the supplementing of textbooks was proposed by Lytridis and Tsinakos (2018). Using authors' tools, the scholars improved existing textbooks for general secondary school by adding digital content to them. Using a mobile application, they made it possible to view digital content and obtain information from the content of textbooks by asking questions in the form of natural language.

The role and experience of AR technologies application in the educational process at higher education institutions are highlighted in the works of Tarangul and Romaniuk (2022). They found that one of the most important features of AR technology is that it provides space and flexible, student-centered learning. The main areas of AR technology use in the education system were identified, namely: support for scientific research; testing of experimental scientific models, simulation environments that combine learning, teaching, and connection with game elements; acquisition of technological skills. The following advantages of AR technology were highlighted: accessibility, involvement, cooperation, interactivity. At the same time, it has some disadvantages: independent professional teachers' training; dependance on hardware tools (not all the students can own devices, which support AR applications); problems with the content mobility on all platforms and devices. Pedagogical conditions for the formation of an effective information and learning environment in higher education institutions were partly highlighted in the works of researchers (Habrusiev et al., 2023).

Zainal et al. (2023) argue that the integration of augmented reality in natural sciences offers various positive benefits such as experiential satisfaction, perceived learning efficiency, increased engagement, and improved understanding of simulated experiences by learners. However, this technology also faces certain challenges including technological barriers, budget constraints, and compatibility issues. To maximize the benefits of using this technology, users should consider all factors including educational requirements and available resources, as well as possessing adequate hardware. However, the problem of future natural sciences teachers' training to use AR technology in the professional activity was not the subject of research findings. It is only partly highlighted in the context of training teachers to use SMART technologies in the educational process (Stepanyuk et al., 2022).

This article aims to find out the essence of the state of problem realization in the theory and practice of teaching; to develop and substantiate the model of the formation of future teachers' skills to use AR technology in the process of natural sciences teaching.

Scientists define the concept of AR ambiguously. Thus, Volynets (2021) explains AR as the projection of digital information (images, video, text, graphics, etc.) outside

the screen of any device, as a result of which the real world is extended with artificial elements and new information. This technology helps to deepen and complete the user's imagination in the real world with additional information of computer models, which provides the possibility for the user to keep in touch with the real environment. AR can be implemented with the help of applications for ordinary smartphones and tablets, augmented reality glasses, stationary screens, projection devices, and other technologies. Tymchyna and Tymchyna (2020) note that this technology precisely overlays computer virtual images on the physical objects in the real time. Nincarean et al. (2013) states that AR is one of the new technologies that is seen as having the potential for pedagogical application.

A notable example, in our opinion, is the attitude of Milgram et al. (1995) to the problem. They suggest using broad and limited approaches in AR defining. In broad understanding AR means "supplementing of the natural feedback with an operator by simulated clues". The limited approach makes an accent on the technological aspect and defines AR as "a form of virtual reality in which the display mounted on the participant's head is transparent, allowing a clear view of the real world".

Klopfer notes that the term "augmented reality" should not be defined in a limited way. It can be applied to any technology which meaningfully combines both real and virtual information (Phon et al., 2014). Using a broad approach, Klopfer and Squire define AR as "a situation in which the real-world context is dynamically superimposed on agreed location information or contextual virtual information". In such a situation AR can offer the users technologically mediated experience of immersion, in which real and virtual worlds are combined, while interaction and involvement of users are broadened (Klopfer and Sheldon, 2010). According to the scientists, defining AR in a broad sense is more productive for educators, as it implies that AR can be created and implemented using various technologies, such as desktop computers, portable devices, head-mounted displays, etc. (Azuma, 1997; Nincarean et al., 2013). Thus, AR is not limited to any type of technology. It uses real world capabilities giving supplementary and context information which broadens students' experience in reality. AR can be based on and accompany technologies, but it should be considered more than just a technology. Wu et al. (2013) also states that considering AR as a concept rather than a type of technology would be more productive for educators.

Some researchers define AR through its peculiarities or characteristics. Azuma (1997) explains it as the system, which corresponds to three main characteristics: combination of real and virtual worlds, interaction in real time and exact 3D-registration of virtual and real objects. A similar definition is offered by other researchers who define AR based on its features, which are the following: real and computer information are combined in the physical world, interactively in real time, and the display of a virtual object corresponds to the orientation in the real world. In other words, AR is a technology for expanding the physical world with digital data provided by computer devices (smartphones, tablets, smart lenses and AR glasses) in real time (Lytridis and Tsinakos, 2018; Stepanyuk et al., 2022).

We share the opinion of scientists, who claim that AR is a technology that allows to create and identify a virtual layer of information with any marker or object that exists in the real physical world, using computer applications. The role of a marker can be performed by a graphical visual object that will be added to virtual objects of

various formats using special software. AR technology allows to superimpose an image, a text, video- and audio components on the available image or space. The received information (aura) can be read from the marker by all kinds of digital devices, such as smartphones, tablets, glasses, AR helmets, etc.

3. Methodology

To achieve the aforementioned goal, several methods have been employed, including: theoretical—comparative analysis to explore different perspectives on the problem and identify areas of study, modeling to develop a model of the formation of future teachers' abilities to use augmented reality technologies in the process of natural sciences studying, constructing to develop the course component and criteria for research, and systematization and generalization to formulate conclusions and recommendations for improving the educational process and raising the quality of educational services at higher education institutions. Additionally, empirical methods such as generalization of pedagogical experience, scientific observation, interviews, content analysis, and questionnaires were utilized to assess the implementation of the problem in practice and develop the content of the experimental teaching methodology. The effectiveness of the offered methodology was verified through a pedagogical experiment, which involved expert evaluation of AR educational applications.

The experimental research was conducted at Ternopil V. Hnatiuk National Pedagogical University, Rivne State University of the Humanities and Volyn In-service teacher training institute, focusing on the professional training of future sciences teachers. The effectiveness of the chosen methodology was evaluated during a two-year period spanning the 2022–2023 and 2023–2024 academic years.

The methodology of the experimental research encompassed several stages: introductory and preparatory, organizational and methodological, educational and procedural, reflective and analytical.

Introductory and preparatory stage aimed to study the state of problem implementation in teaching practice at the level of pedagogical activity. The needs of teachers how to organize the effective use of AR in the educational process were analyzed. The existing available information products (AR applications) as for the possibility of their use in education were studied. The criterion apparatus of the research (AR applications selection indicators and methodological system (MS) effectiveness) was established.

Identifying AR applications selection indicators, we took into consideration the selection criteria for AR applications developed by Quandt et al. (2018). These criteria include alignment with educational objectives, content quality, interactivity, usability, technical requirements, personalization and adaptability, motivation and engagement, assessment of learning outcomes, multidisciplinarity, safety and confidentiality, cost, and accessibility. We analyzed and ranked the established scientific criteria according to the needs of Ukrainian students of higher education institutions. These indicators were pre-discussed with second-level higher education learners, teachers, and methodologists in conferences, roundtable discussions, and individual interviews, thus ensuring preliminary adaptation of their generalizations to real educational processes.

To assess the quality of the suggested AR applications, an integrated criterion of "didactic quality" was used, which was determined by the method of expert assessments (Stepanyuk, 1999). We were prompted to choose it by taking into account the following concepts of the modern theory of the formation of the content of education:

1) It is necessary to evaluate the effectiveness and correctness of new ideas, methods and principles, first of all, theoretically;
2) The age-old experience of constructing the content of the basics of science shows that the expert method is the main method for selecting material, namely, the opinions of scientists-specialists.

A group of experts was formed to conduct the research, which included scientists and lecturers of pedagogical higher education institutions from different regions of Ukraine, who agreed to participate in the examination. We deliberately chose a non-homogeneous expert group in terms of composition. It allows to take into account more fully existing opinions on the compliance of the proposed content with the needs and real conditions of practice in teaching and the current state of development of ICT. The quality of experts was high, as all of them were sufficiently characterized by such important features as:

1) Competence, that is they possessed a stock of necessary knowledge, which allowed them to create their own model of the problem under consideration based on the received information; to synthesize extraordinary conclusions. Their field of activity, specialization, and scientific interests border on the field to which the problem under analysis belongs.
2) Interest in the results of the examination.
3) Businesslike character.
4) Objectivity and impartiality.

A group of specialists especially competent in the field of the studied problem (21 people) was selected out of the total number of experts. It comprised Informatics lecturers and lecturers of biology teaching methods, who have gained a scientific degree and teaching experience of more than 10 years.

Indicators, according to which the singled out AR applications had to be assessed, were agreed with this group of experts. As a result of collective discussion, following the condition that, $\sum_{i=1}^{6} K_i = 100\%$, the "weight" ($K_i$) of each of the six selected indicators was determined.

The examination was carried out in May 2020. The available AR applications in Ukraine were evaluated based on the integral indicator of their 'didactic quality,' as well as through 'multifactor ranking. 'The criterion for 'didactic quality' was defined as the degree to which each application presented for evaluation corresponded to the set of suggested indicators.

Invited experts were informed about the objective of the experiment and the rules of its conducting. They were given the information concerning general approaches to solving the problem. After that each expert individually filled in the questionnaire, which included a list of factors that were assessed. The questionnaires were studied and analyzed. Processing of the grades given by experts was carried out using

statistical methods, which were based on the principle that the expert can be considered as a measuring device, the indicators of which have random and systematic errors.

Organizational and methodological stage involved the determination of priority disciplines for special training in the use of AR technology and conducting organizational measures to develop a methodology for introducing AR applications (constructing information about them, a system of tasks to develop skills, using modern forms and methods of teaching to achieve the goal). MS content filling was carried out.

Educational and procedural stage involved conducting of the forming experiment (introduction of the authors' MS) during two academic years (2022–2023, 2023–2024). It involved 56 students at the bachelor's level and master's levels, who formed an experimental group (EG). The obtained results were compared with the control group (CG) which involved 120 teachers.

Reflective and analytical stage of the study involved the analysis of the experimental training results by objective (activity of use during pedagogical practice, adaptability to the requirements of the information society) and subjective (self-analysis of the level of readiness to use AR technology) indicators. The students were asked to respond to the questionnaires after the implementation of experimental training.

4. Findings and discussion

According to the results of the survey (Soroka et al., 2022), it has been observed that in response to the question "Do you use augmented reality in your teaching practice?", the respondents gave the affirmative answer (70.6%), negative answer (26.1%), whenever possible (0.8%), sometimes (0.8%), rarely (1.6%). Answering the question "Choose at which stages of the lesson you use augmented reality", 26.1% of respondents answered that they do not use it. Obtained digital data fully correspond to the results of the previous question answers. AR is used by teachers at different stages of the lesson: checking homework (10.1%), emphasizing basic knowledge (16.8%), motivation of learning and cognitive activity (37.8%), learning new material: perception of information (41.2%), clarification and expansion of information (44.5%), generalisation and systematisation of knowledge (26.9%), lesson summary (15.1%). Thus, most teachers use AR to motivate learning and cognitive activity and for perception, clarification, and expansion of information.

The next question required them to indicate the advantages of augmented reality use in the process of learning. An analysis of the answers revealed that AR helps to develop creative thinking (41.2%), model and simulate natural processes (60.5%), students' interaction and active participation (29.4%), develop problematic thinking (30.3%), ability to visualize abstract or complex conceptions (47.9%), increase cognitive interest to the process of cognition (0.8%).

The following difficulties can be faced when using AR in the professional activities: technical problems (69.7%), necessity of additional training (31.9%), distraction of students' attention (10.1%), limited access (34.5%), futurism (5.9%), high cost (20.2%), a large number of students in classes (0.8%), none (0.8%).

In response to the question "Do you think that the use of augmented reality improves students' academic achievements?", the teachers gave affirmative answer (89.1%), negative answer (6.7%), difficult to give a definite answer (4.2%). Answering a clarifying question "Choose what positive changes have you noticed at the lessons with use of augmented reality?", the respondents noted the following: increased cognitive interest (agree—80.8%, disagree—1.7%, difficult to answer—17.5%); increased motivation to learning (agree—66.7%, disagree—3.3%, difficult to answer—30.0%); increased level of academic achievement (agree—55.0%, disagree—7.5%, difficult to answer—37.5%). The obtained answers to this question partly are not consistent with the answers to the fifth question, where only 0.8% of the respondents noted increased cognitive interest to the subject.

Answering the question "Do you think that augmented reality has the potential to become an important part of the educational process?", 89.9% of teachers believe that it has, 6.7% do not believe and 3.4% don't know. It is surprising that the teachers did not answer the question "What resources, educational materials or support would you like to have to implement augmented reality into your studying?" at all. They were offered to choose from the following list: visual aids, technical support, AR platforms, consultations, courses, free resources, any support materials. Sufficient access to the technologies, which are necessary for the use of augmented reality have 29.4 % teachers, 62.2 % of them do not have it and 8.4 % sometimes. At the same time, 98.0% of respondents expressed a desire to receive additional support or training in the use of augmented reality.

To determine the level of teachers' ability to use AR in professional activity, we offered the following task "Evaluate the level of your ability to use AR in professional activity". The teachers had to categorize their answers as "very low", "low", "medium", "sufficient", "high". The obtained results showed that the majority of the teachers assessed their own level of the relevant skills development as low and medium (79% in total), and only 21% as sufficient and high. This made us come to the conclusion about the expediency of purposeful future teachers' training to use AR technology.

Taking into consideration the analysis of literature sources, the state of problem realization in teaching practice and our own pedagogical experience we developed the model for the formation of skills to use AR in the educational process (MFSUAR). We consider it as a component of a holistic system of future teachers' professional training. It includes two subsystems, which, based on a combination of direct and indirect ways of skills formation, ensure its emergence: I—special formation of relevant skills for students at the first (bachelor's) level of higher education (direct way); II—application of acquired skills by students at the second (master's) level of higher education who act as subjects of both learning and teaching activities (indirect way). The indirect way was implemented in combination with the use of contextual technology during the compulsory academic disciplines of professional training learning. The teachers used the complex of tasks, doing of which involved the use of AR technology. For example, when using the Stellarium app, students were asked to complete the following tasks: "Using a moving map of the starry sky and the Stellarium virtual planetarium, for the two brightest stars of the constellation, determine their equatorial 6 coordinates and conditions of sunrise and sunset at the

latitude of Ternopil (compare the results and draw a conclusion)"; "If these two stars rise and set, determine their azimuth and time of sunrise and sunset on the day of your birth. If the constellations do not set or do not rise, do the same task for the stars specified by the teacher"; "Determine the azimuth and time of sunrise and sunset on the day of your birth".

The systemic factor of the MFSUAR is the goal of improving the quality of the future natural sciences teachers' professional training by developing their skills in using AR technology. The end result is an increase in the level of future natural sciences teachers' readiness to use AR technology in their professional activities.

The conceptual basis for the development of the MFSUAR is a multi-subject educational paradigm (student, teacher, information educational environment), which is considered to be open, self-developing and self-organizing, causing a fundamental change in the behavior and relationships of the educational process participants. The innovativeness of the offered system is ensured by the dominant approaches used in its design: competence-futurological, andragogical, narrative-digital and student-centered.

The competence-futurological approach is based on the idea of the expediency of the MFSUAR modelling on the basis of combining the key competences of the 21st century "4 Cs" (critical thinking, creativity, collaboration, communication) with digital competence. The necessity of this particular approach is conditioned by the entry of modern life into the so-called "regime with exacerbations". It requires the design of all components considering the possible specifics of their modification in the future educational process in accordance with the likely needs of professional activity.

The andragogical approach to the MFSUAR modeling involves the priority of independent learning, as well as taking into account the principles of: cooperative activity; reliance on life experience; individualization of learning; systematic learning; contextual learning; updating learning outcomes; elective learning; development of educational needs; reflexivity.

The use of narrative-digital approach contributes to the application of digital narratives, which are an integrated combination of a narrative (storytelling) with information and communication technologies. Creation and application of digital narratives in professional activity holds a significant place in its realization.

It was also taken into account that the need to adhere to the most important methodological principles of knowledge—a holistic and systematic approach to the object of study—requires consideration of the problem not in isolation, but in the context of the holistic educational process in modern higher education institutions. The use of the above-mentioned approaches in the complex will allow to provide a holistic MS functioning and gain the increase of the positive result, its emergent manifestation.

Model for the formation of skills to use AR in the educational process was implemented in the corresponding authors' MS. The MS comprises motivational-target, operational-content, activity-reflexivity and resultative-motivational components.

We started our experimental study with the identification of the criterion of "didactic quality" for the suggested AR applications. The results are presented in **Table 1**.

Table 1. The weight of indicators of the AR applications' didactic quality.

№	Indicators	Weight
1	Clear interface structure	10
2	Degree of popularisation in Ukraine	25
3	Significance for the organization of interactive pedagogical cooperation of the educational process participants	25
4	Technical accessibility	10
5	Quality of program content	20
6	Correspondence to the age peculiarities of school students	10

The results of the expert assessment demonstrated the possibility and relevance of including information about the following AR applications in the operational-content component of MS, namely: astronomy—Stellarium (http://surl.li/kbzxv), Star Walk 2 Free (http://surl.li/kbzxw); physics—Book'VAR (http://surl.li/kbzxy), HP Reveal Aurasma (channel FizykaAR); natural sciences—LiCo.STEM (http://surl.li/kbzya), Education 4D + (http://surl.li/kbzyb); biology—Anatomy AR—A view of the human body in real life (http://surl.li/kbzye), Quiver—3D Coloring App (http://surl.li/kbzyg); chemistry—Atom Visualizer (http://surl.li/kbzyi), LiCo.Organic (http://surl.li/kbzya). According to the experts, they are generally accessible to students and are important for improving their professional competence.

The algorithm for displaying generalized information about a particular application was suggested, namely: payment, accessibility, language, system requirements; learning opportunities; practical value; website; video about the application.

Comparing the goal and tasks of learning compulsory academic disciplines with the peculiarities of AR educational applications content, allowed us to single out a list of academic disciplines during which it is advisable to form the necessary skills in different ways ("Digital Technologies in Education and Science", "Digital Technologies in Professional Activity", "Innovative Teaching Technologies", "Theory and Methodology of Teaching").

After the experimental introduction of the authors' methodological system, we conducted a survey of natural sciences teachers and students again (**Figure 1**). The survey (Soroka et al., 2024) results indicated that answering the question "Do you use augmented reality in your teaching practice?" 64.3% of respondents answered "yes" and 35.7% answered "no". We explain the reduction of the students' positive responses number in comparison with the teachers (−6.3%) by the fact that most students had their teaching practice in rural areas, where the necessary technical teaching tools were not always available. Answering the question "Choose the stages of the lesson at which you use augmented reality" students showed a more appropriate choice of the following stages of the lesson: checking homework—17.9% (CG 10.1%); updating basic knowledge—19.6% (CG 16.8%); motivation of learning and cognitive activity—28.6% (CG 37.8%); learning new material: perception of information—41.2%

(CG 41.2%), clarification and expansion of information—42.9% (CG 44.5%), generalization, systematization of knowledge—17.9% (CG 26.9%); lesson summary—8.9% (CG 15.1%).

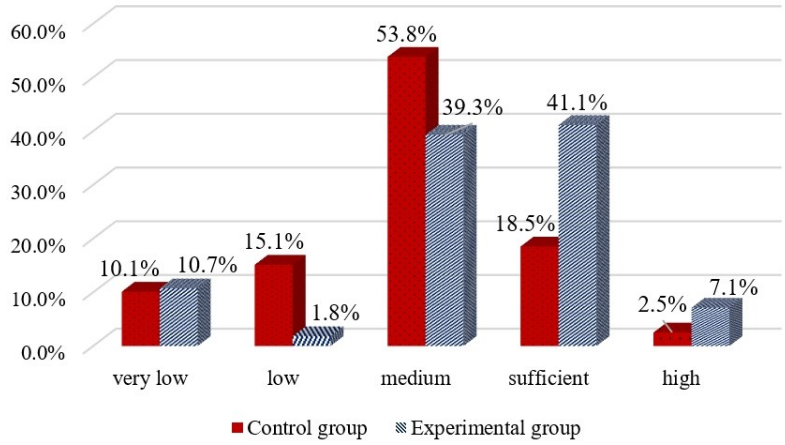

Figure 1. Results of self-assessment of the level of AR skills formation by the respondents of the control and experimental groups.

Among the advantages of AR use during learning process were: development of critical thinking—69.6% (+28.4%); modelling and simulation of natural processes—69.6% (+9.1%); interaction and active participation of students—50% (+20.6%); development of problematic thinking—35.7% (+5.4%); ability to visualize abstract or complex concepts—48.2% (+0.3%).

Students mentioned the following problems they have while using AR in professional activity: technical problems—73.2% (+3.57%); the need for additional training—30.4% (−1.5%); distraction of students' attention—16.1% (+6.0%); limited availability—41.1% (+6.6%); futurism—5.4% (−0.5%); high cost—19.6% (−0.6%).

The results of self-assessment of the level of AR skills formation by the respondents of the control and experimental groups are shown in **Figure 1**. Their analysis revealed that introduction of MS contributes to 13.3% reduction in the low level of the formation AR skills among EG respondents compared to CG (15.10% and 1.80%, respectively). At the same time, the number of respondents performing sufficient and high levels of their formation increased in 22.60% and 4.60%, respectively. We explain high indicators of the medium level of AR skills in the control group (53.80%) by the fact that its participants specifically developed the relevant skills in the system of non-formal and informal education.

5. Conclusion

Integration of digital technologies into the educational process in Ukraine gives new opportunities to improve the quality of education, develop students' competencies and prepare them for the challenges of the modern world. Constant support and development of this trend with the aim to ensure accessibility and quality of education for all citizens is very important.

The use of augmented reality in the educational process contributes to the proper functioning of the educational environment in the context of the informatization of society, which is becoming a key vector for the modernizing of educational services and preparing future generations for the challenges of the 21st century. The essential characteristic of this technology is its ability to enrich the real world with digital information, thus providing a new level of interaction between the user and the technology, and a transition to a multi-subject educational paradigm.

Introducing of the given methodological system of the formation of future natural sciences teachers' skills to use AR technology will increase the quality of education, the training of competent and technologically oriented teachers. It will also ensure progressive changes in approaches to teaching and development of a new generation of students who will be able to successfully function in the variable models of the modern and future information society.

The prospects for further study consist in modelling the content and activity filling of the methodological system for the formation of skills to use AR based on the combination of the key competencies of the 21st century "4 Cs" with digital competence.

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