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## IMPLEMENTATION OF VIRTUAL AND AUGMENTED REALITY TECHNOLOGIES, GAME SIMULATORS FOR FUTURE SPECIALISTS' TRAINING

## ВПРОВАДЖЕННЯ ТЕХНОЛОГІЙ ВІРТУАЛЬНОЇ ТА ДОПОВНЕНОЇ РЕАЛЬНОСТІ, ІГРОВИХ СИМУЛЯТОРІВ ДЛЯ НАВЧАННЯ ФАХІВЦІВ МАЙБУТНЬОГО

**Abstract.** The article presents the outcomes of the research of virtual and augmented reality technologies peculiarities and the possibility of their implementation in the educational process. The main reasons and technologies of virtual reality in the field of information technologies are determined. The analysis of virtual reality programs has been carried out. To determine the relevance of the implementation of virtual, augmented reality and game simulator technologies into the educational process the survey was created by the authors and conducted remotely among the population of Khmelnytskyi region on the Google Forms. The results of the conducted survey suggest the answers to a number of questions, including whether our society is ready to implement virtual, augmented reality and game simulators into the educational process of future specialists' training, as the field of virtual reality research continues to expand relentlessly, the integration of VR (Virtual Reality) with various areas of human life continues. In addition to the survey in Google Forms, a survey was also conducted to collect information about currently existing virtual environments, programs and game simulators that can be added to educational components or integrated into other educational systems not only in the field of education (Minecraft, Cooking Simulator, PC Building Simulator 1-2, Google Arts & Culture). It is quite possible to integrate these simulators under the educational components of certain specialized subject areas. The conducted survey makes it possible to assume that users are already ready not only for the integration of virtual environments in the game sphere, but also for the full involvement of virtual technologies and game environments in the application of educational components. VR (Virtual Reality) and AR (Augmented Reality) technologies are gaining popularity in cultural, educational, gaming, business environments and more. The disturbed issues are studied in education, which encourages a deeper insight into the essence of the processes that take place under the influence of the latest information and communication developments.

**Keywords:** VR, virtual environment, virtual reality, artificial (augmented) reality, video games, educational process.

**Анотація.** В статті представлено дослідження технологій віртуальної та доповненої реальності, та можливості впровадження їх в освітній процес для підготовки фахівців майбутнього, ґрунтуючись на сучасному розвитку віртуальних технологій та ігрових симуляторів. Визначено основні причини та технології віртуальної реальності у сфері інформаційних технологій. Здійснено аналіз програм віртуальної реальності. Сформовано опитування, що проводилось дистанційно серед населення Хмельницької області на платформі Google Forms, яке дасть змогу відповісти на низку питань, у тому числі чи готовий соціум до впровадження систем віртуальної реальності, доповненої реальності та ігрових симуляторів у освітній процес – навчання фахівців майбутнього, оскільки сфера досліджень віртуальної реальності продовжує невпинно розширюватися, триває інтеграція VR (Virtual Reality) з різними сферами людського життя. Окрім опитування у Google Forms також було здійснено опитування для збору інформації, щодо існуючих зараз віртуальних середовищ, програм та ігрових симуляторів, зокрема: відеогри жанру «пісочниця» Minecraft; імітаційної

кулінарної гри *Cooking Simulator*; відеоігри із стратегією моделювання *PC Building Simulator 1-2*, що зосереджена на веденні майстерні, яка збирає та обслуговує персональні комп'ютери; онлайн-платформи *Google Arts & Culture*, що дає можливість відвідати віртуальні екскурсії. Ці ігрові стимулятори можна додати у освітні компоненти, або інтегрувати під інші навчальні системи не лише у сфері освіти, але і у певні спеціалізовані предметні області. Проведене опитування дає змогу припустити, що користувачі вже готові не лише до інтеграції віртуальних середовищ в ігрову сферу, а й до повного залучення до використання віртуальних технологій та ігрових середовищ до освітніх компонентів. VR-технології (Virtual Reality) і AR-технології (Augmented Reality) набувають популярності у культурних, освітніх, ігрових, бізнес-середовищах тощо. Порушена проблематика досліджується в освіті, що спонукає до глибшого проникнення у сутність процесів, які відбуваються під впливом новітніх інформаційно-комунікаційних розробок.

**Ключові слова:** VR, віртуальне середовище, віртуальна реальність, штучна (доповнена) реальність, відеоігри, освітній процес.

**Problem statement.** The 21st century is the century of scientific, technical and technological progress, the century when the seemingly fantastic stories of books become reality. Science fiction writer Arthur Clarke "introduced" them into our world decades before the appearance of satellites in his book "The World Without Wires" [1]. According to the author, these are magical objects that can operate only in a magical way, but as we can see, satellite signal technology is being widely used and has become the basis of the Internet, without which we cannot imagine our existence nowadays. The same goes for Kirk's Enterprise mobile devices, "Reception Enterprise" – this phrase was spoken by James Kirk into the device, which is called Bluetooth today. The devices used in Star Trek do not much differ from modern cell phones in terms of design features and principle of operation, except for the possibility of intergalactic roaming [7].

Until recently, you may have only heard about virtual reality technologies, but they are currently evolving and improving. Only our imagination is a barrier to the horizontal ranges of the virtual environment development. A range that will cover all components of contemporary life: education, work, recreation, self-development.

If we could separate the field of education as a independent field for the implementation of virtual technologies, then it would be possible to predict, relying on the speed of technological progress, that virtual learning will soon become a standard educational tool. So, our main task is to keep pace with technological progress in the field of IT technologies.

**Analysis of recent research and publications.** Such scientists as Gruntova T.V., Yechkalo Yu.V., Stryuk A.M., Pikilnyk A. dealt with the issue of the use of augmented reality technology in the educational process [10] and state that the introduction of such technologies into education increases its effectiveness, contributes to the development cognitive activity, increases the quality of knowledge acquisition, provokes interest in learning, promotes the development of research skills and subject competencies of students. Merzlykin O.V., Topolova I.Yu., Tron V. [11] specify that the use of the latest technologies is necessary for the effective education of modern students who have specific educational needs, namely: the use of mobile applications, the organization of joint work, the implementation interactive tasks and content visualization. Klymnyuk V.E. identified the main directions of influence of virtual reality on educational methodology, which can lead to the expansion of types of educational activities, improvement of existing and emergence of new organizational forms, types and methods of training, improvement of interaction between students and the educational space [12]. Mintii I.S., Solovyov V.M. claim that among the problems that arise with the introduction of augmented and virtual reality

in education, first of all, there is a shortage of specialists in the preparation of educational projects and uncoordinated actions of business and education in this direction [13].

The question is little researched and foreign scientists are actively searching in this direction. Thus, Wu H.K., Hsin-Kai Wu, Silvia Wen-Yu Lee, Hsin-Yi Chang, JyhChong Liang study the phenomenon, current state, possibilities and problems of using augmented and virtual reality tools in the educational process [14]. Eric Klopfer, Kurt Squire [15] investigate the issue of designing an augmented reality platform for environmental modeling. Yuen S., Yaoyuneyong G., Johnson E. [16] conducted scientific reviews on the development of virtual and augmented reality. The aspect of teaching students to use AR is disclosed in the works of Lee K. [17]. Communicative aspects of using virtual and augmented reality tools were studied by the authors Yun Zhu, Hui Ye, Shukun Tang [18]. Currently, scientists Giasiranis S. and Sofos L. [19] are raising questions about the quality assessment of educational material with augmented reality. Martin-Gutierrez J., Guinters E., Perez-Lopez D. note that augmented reality can be used for student collaboration.

**The purpose of the research** is to study the main peculiarities of virtual reality technologies, and means of introducing virtual reality into the process of future specialists' professional training, based on the current development of virtual technologies and game simulators, their prospects for progress. We are to investigate the involvement of game simulators and virtual reality technologies in the educational process of future specialists' training.

**Presentation of the main material.** The paradox that everyone is puzzled over: wars bring mass murder, violence, disillusionment with humanity and... scientific progress.

Major changes in educational mechanisms took place during the COVID-19 pandemic: conversion to distance learning, introduction of educational cases and mastering of software environments. Fundamental changes are proceeding in educational material delivering to improve the quality of students' knowledge even in remote mode. But as soon as effective educational mechanisms were developed, for a quality educational process in quarantine conditions, the military invasion began. And it became clear that the existing funds are not enough to ensure a high-quality educational process, because the future of the nation depends on how we train specialists now.

But first, let's figure out what virtual technologies are, give their definition, classification and methods of application.

Virtual reality (VR, artificial reality) is a world created by technical means, which is transmitted to a person through his senses: sight, hearing, touch, and others. Virtual reality simulates both exposure and reactions to exposure. To create a convincing complex of sensations of reality, computer synthesis of properties and reactions of virtual reality is carried out in real time [2].

Virtual reality and augmented reality are similar at first glance, but if you dive into the structure of perception and their construction, it becomes clear that they are completely different environments. Their fundamental difference is that virtual reality constructs a new artificial world, and augmented reality only introduces individual artificial elements into the perception of the real world.

There are devices that more completely simulate human interaction with the virtual environment compared to ordinary computers and computer devices. This interaction takes place through the influence on all human senses. Such devices are considered to be virtual reality systems.

Unfortunately, full-fledged virtual reality systems that simultaneously interact with all the senses do not exist yet, but when creating virtual reality, developers try to achieve the following goals:

- support the user in the reality of events in the simulation;
- ensure maximum interaction with the environment;
- provide an opportunity to independently explore the developed environment (world);
- involve in the process not only the brain, but also the user's body, affecting all possible senses.

Obviously, the achievement of these goals is possible only by using high-performance hardware and software [2].

The potential, as well as the scope of application of virtual technologies, is limitless, in every industry this technology can become an indispensable tool. From military to industrial, from infrastructure and services to education, the only limitation is our imagination.

To determine **the relevance** of the implementation of virtual, augmented reality and game simulator technologies, a corresponding survey has been carried out by the

authors. The survey was conducted remotely among the population of Khmelnytskyi region on the Google Forms platform. It contained a number of questions that made it possible to find out the relevance and possibility of involving virtual reality technologies and game simulators in the educational process of future specialists' training [3].

The conducted research revealed that almost all respondents have at least a superficial idea of what virtual reality is (Figure 1). A significant part of the population (72.7%) considers to have a sufficient level of knowledge about virtual reality, a third of respondents (27.3%) suggests to have a superficial idea of virtual reality, which was formed on the basis of science fiction, films, books, etc.

The majority of respondents support the introduction of virtual reality technologies into the educational process of specialists' training. If we evaluate the attitude to the implementation of VR technologies in the educational process, it is as follows (Figure 2): *positive* attitude, with the prospect of global research of the subject area – 81.8%, and 18.2% – *so far*, respondents are cautious about the possibility of new technologies introduction, but they are not opposed; *negative* (0%), which indicates that virtual reality technologies have a future in the field of education.

A more positive situation of integration into the educational process of specialists' training is proceeding with game simulators, which may have been influenced by the age of the respondents – they range from 16 to 27 (Figure 3). 90.9% of respondents feel positive about such an idea, the other 9.1% are skeptical, but they allow such an educational mechanism, which is not typical in the system of similar surveys; not a single respondent expressed any objection.

As for the question "Do you believe the educational process will improve if a part of the material of one or another

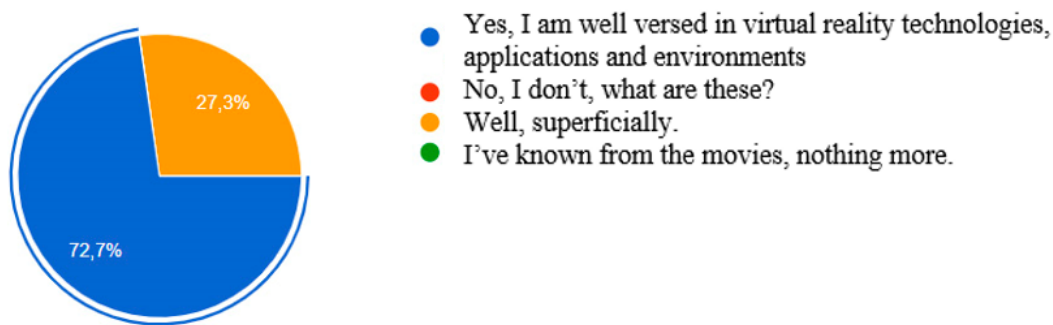


Figure 1 – Do you know what virtual reality technologies are?

Source: created by the authors based on [3]

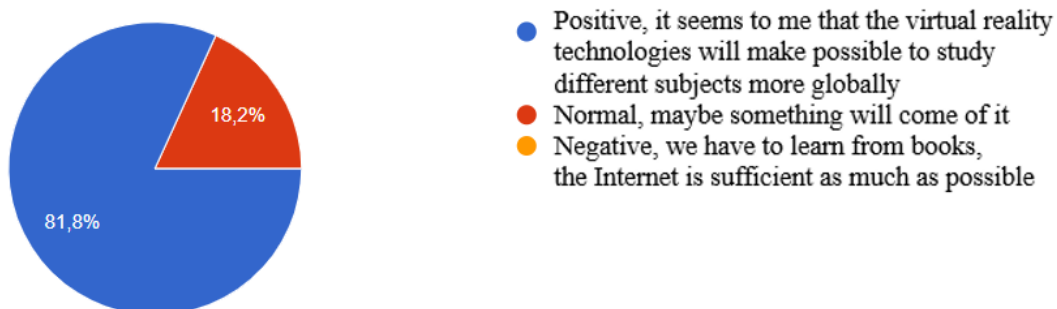
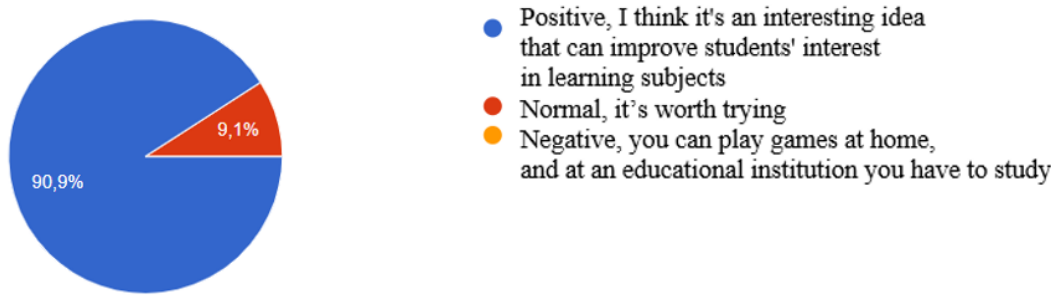


Figure 2 – What is your attitude to the introduction of virtual reality technologies into the educational process?

Source: created by the authors based on [3]



**Figure 3 – What is your attitude to the introduction of game simulators into the educational process?**

Source: created by the authors based on [3]

discipline is taught in a virtual simulator or environment?" the opinions of the respondents were different, but the attitude towards improving the educational process with virtual reality technologies is identical (Figure 4). 100% of respondents are convinced that if educational material is taught in a new environment, such as a virtual simulator, the success of the material learning will increase. 54.5% believe that only new technologies and the environment are sufficient to improve the successful educational outcomes due to increased interest. In turn, 45.5% of respondents believe that everything depends on the motivation, interest and discipline of the students.

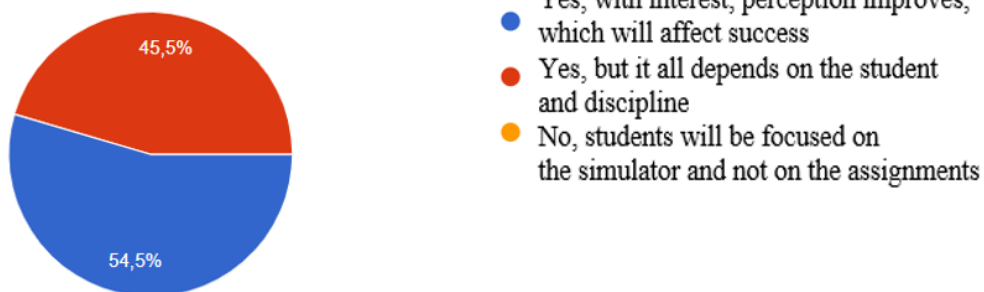
In order to clarify the personal attitude of each respondent, the last question of the survey was formulated as follows, "Do you personally see the possibility of introducing virtual reality technologies and game simulators into the educational process?" (Figure 5). To which 72.7% of respondents answered with confidence that the future is

based on virtual reality technologies, 27.3% – assumed the possibility of introducing virtual reality technologies and game simulators into the educational process.

In addition to the survey on Google Forms platform, one more survey was conducted to collect information about currently existing virtual environments, programs and game simulators that can be added to educational components or integrated into other educational systems not only in the field of education:

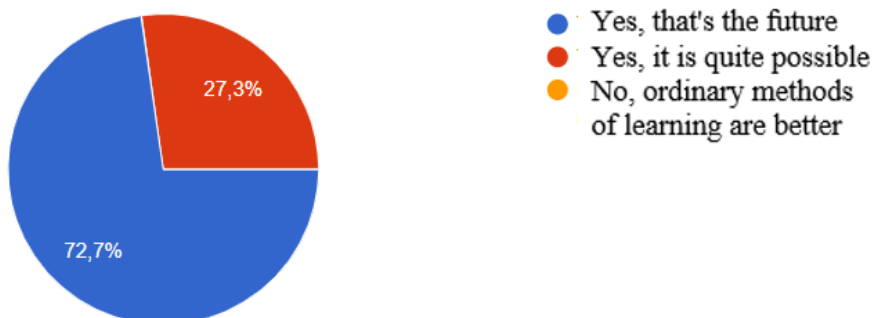
– **Minecraft** is a 2011 open-world first/third-person sandbox video game by Mojang. The game started a series of the same name, all of which are characterized by a minimalist cubic design [4].

– **Cooking Simulator** is a simulation cooking game developed by the Polish team Big Cheese Studio and published by PlayWay S.A. June 6, 2019 for Microsoft Windows. The Nintendo Switch version was released on May 14, 2020, published on the system by Forever



**Figure 4 – Do you think the educational process will be improved if a part of the material of a particular discipline is taught in a virtual simulator or environment?**

Source: created by the authors based on [3]



**Figure 5 – Do you think that the educational process will improve if part of the material of one or another discipline is taught in a virtual simulator or environment?**

Source: created by the authors based on [3]

Entertainment. The Xbox One version was released on August 14, 2020. A mobile port called Cooking Simulator Mobile was launched on Android devices on October 20, 2020. It is available on iOS in several countries and the global release is available for pre-registration through PlayWay S.A. The PlayStation 4 version was released on May 20, 2021 exclusively in Europe and Australia, with plans to eventually release it worldwide [5].

– **PC Building Simulator 1-2** is a simulation strategy video game produced by The Irregular Corporation and Romanian indie developer Claudio Kiss. The game focuses on owning and running a workshop that assembles and maintains PCs, mostly gaming ones [6].

– **Google Arts & Culture** is an online platform, using which network users can access high-definition images of works of art stored in museums – partners of the initiative, as well as visit virtual tours [8].

It is quite possible to integrate these simulators under the educational components of certain specialized subject areas.

**Conclusions.** Virtual and augmented reality systems are being developed and integrated, albeit at a primitive level, in various fields but very confidently. Perhaps in the nearest future, similar to distance education, we will see a virtual form of education. In an environment that will be similar to reality. Recalling the fantastic stories of the past, which are now commonplace for us, we can state with confidence that virtual reality can very soon become real, real not at the level of augmented reality, but at the level of artificial intelligence with its own world.

The survey conducted above allows us to assume that users are already prepared not only for the integration of virtual environments in the game sphere, but also for the complete involvement of virtual technologies and game environments as addition to educational components.

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