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The Future of Higher Education: Implementation of Virtual and Augmented Reality in the Educational Process

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Abstract: The introduction of VR and AR into the higher education is a particularly interesting phenomenon for the education of the future. Thus, the aim of the study was to determine the impact of using VR and AR as a possible strategy to enhance teaching in higher education institutions and as a replacement for outdated teaching methods. Virtual and augmented realities are tools that enable dynamic training in a virtual environment by facilitating the management of its components. Virtual

immersion in the process of the information comprehension allows students exploring complex environments and situations by manipulating the elements that make up the environment. The purpose of this study is to analyse the introduction of VR and AR in the learning process as a favourable area of the development of higher education. The analysis of the relevance and effectiveness of virtual artefacts in higher education was obtained using the following methods: a literature review was used in the research to systematically gather, analyse, and synthesize existing published literature on the topic. The next stage was the observation, data analysis and interpretation. The results of the work were obtained through a double analysis. First, the state of the art of the related literature was investigated, and second, the impact on students was assessed, offering an innovative alternative to traditional teaching methods at the pedagogical faculties where the observation was conducted. Search engines revealed 2300 articles on the use of VR and AR in higher education. As a result of the selection and verification process, only 50 state-of-the-art sources from 2018-2023 were selected (taking into account the scientific novelty of the topic). An observation of students obtained data to evaluate the implementation of resources in higher education by key elements: motivation, design, and collaboration. The question of whether the use of educational artefacts in VR and AR is applicable in the perspective of higher education and the values that should guide their strategy is revealed. Conclusions present the scientific and students' opinion in terms of the implementation of VR and AR in higher education. This research questions are revealed, the advantages and disadvantages, concepts and paradigms in this area are identified. The position on the significance of VR and AR as a pedagogical instrument is presented.

Keywords: artificial intelligence, virtual artefact, virtual immersion, motivation, collaboration, design.

Introduction

An ever-growing number of higher education institutions are introducing virtual reality into the educational process. The latest technologies give new openings for students as well as their teachers. Education is becoming "exciting". Virtual and augmented reality transforms education and gives students the opportunity to learn with the help of specific equipment. On the other hand, although virtual and augmented realities are becoming more and more fashionable, their use in education is controversial. Therefore, a two-stage analysis based on theoretical works and practice of use seems to be important.

The three-dimensional space and virtual artefacts in educational achievements

Today, the creation of a three-dimensional space with the help of virtual artifacts makes it possible to achieve educational goals. Manipulating elements and events of the virtual environment is considered useful for achieving educational goals (Chen, Wang, Zou, Lin, Xie & Tsai, 2022). A qualitative change in immersive technologies allows full immersion in a simulation of reality, where the student can interrelate with the virtually word in reality (Tezer et. al., 2019). Virtual immersion is a popularized term to define the features of immersive environments artificially created with the help of digital means. Since the first attempts to develop immersive sensory environments, the perception or acceptance of virtual artefacts by society has also changed (Alam, 2022a). Virtual reality methods are well suited for teaching all disciplines and professions that require specialized equipment, laboratories, and time-space actions, as they facilitate practice in any specialty (Gustiani, 2020). Virtual technologies are not new. In this context, it should be noted that virtual and augmented reality is not new to education. For example, a headset has been used as a peripheral device for quite some time. The headset permitted the user entering the universe created by the computer (Irwanto, Dianawati & Lukman, 2022). The fast expansion of ICT is constantly transforming the ways of searching, selecting, organizing, processing, and transferring knowledge. Among others, higher education, with its traditional methods, has felt the need

to adapt to the increasing changes. In this aspect, teaching strategies can be understood as procedures that teachers flexibly use in their teaching methods. Materials and resources in a broad sense, including teaching materials and resources, are important, but they do not have a special value. Their use is only justified when they are integrated appropriately into the educational process, which must be compatible with the learning process, and in turn, must be compatible with the wider environment (Cabero-Almenara & Roig-Vila, 2019).

Comparison with traditional learning environments

Compared to traditional learning environments, virtual artefacts can offer an additional interactive experience as learners realize and experience the benefits of participating VR and AR education; they advance a more constructive, motivated attitude to learning through equipment and numerical inclusion.

Research Problem

Learning resources provide favourable material conditions for meeting the demands of the modern world and the dynamic development of technology. The problem of introducing VR and AR into higher instruction is to empirically prove their effectiveness in the process of learning the curriculum. Thus, in order to achieve greater efficiency, develop skills, habits, abilities, and form beliefs, education must rethink its goals, objectives, pedagogy, and didactics.

The problem of this study is the lack of scientific justification for the feasibility and safety of using virtual and augmented reality technologies in higher education (Marks & Thomas, 2022). The widespread pandemic has hastened the assimilation of tools into learning (Fauzi, 2022). Today, the integration of virtual artefacts is the norm rather than the exception (Guppy, Verpoorten, Boud, Lin, Tai & Bartolic, 2022). Information is instantaneous and education needs additional technical capabilities to succeed in the future of education (Gustiani, 2020). In light of the flexibility in the practice of VR and AR, the education of the future should accentuate lifelong learning and various types of technological professional development for educators (Pelletier, McCormack, Reeves, Robert, Arbino, Dickson-Deane & Stine, 2022). As a result of the progress, the educational requirements of students have changed dramatically, and they seek a more engaging learning environment that motivates, develops, and teaches teamwork (Zhang, Chen, Hu & Wang, 2022). In addition, the new generation of students does not perceive virtual artefacts as a novelty but readily adapts to progress (Alam, 2022b).

Research Focus

The presented scientific research focuses on the study of virtual artefacts in higher education, both in terms of theoretical work and their practical use to achieve educational goals. An observation of students allowed us to find out their opinion on the introduction of VR and AR in the educational process, and a review of scientific literature made it possible to reveal the general picture of the adaptation of target skills of students in this context.

Research Aim and Research Questions

The resolution of the given revision is to analyse in-depth the implementation of VR and AR in the education of the future by analysing the related literature and working with a students' group. The use of VR and AR in higher training in a collaborative manner is considered. Thus, the purpose of the paper was to conduct a methodical review of scientific literature to explore this topic in more depth. With this in mind, the following research questions were developed in this systematic literature review and description of the empirical experiences of learners:

1: What are the profits of VR and AR compared to traditional methods?

2: What are the key targets of virtual artefacts in higher education?

3: What were the main conclusions of students about the use of VR and AR in higher education?

4: What is the virtual immersion impact on the mental and socio-emotional student's state?

Research Methodology

The methodology of this study included two stages. A literature review was used in the research to systematically gather, analyse, and synthesize existing published literature on the topic. It involved the review and critical evaluation of previous studies, articles, books, and other relevant sources to identify gaps, inconsistencies, and trends in the existing knowledge. The next stage was the observation, data analysis and interpretation of results. The first stage of the research included an explanation of the content of information by topic and keywords: artificial intelligence, virtual artefact, virtual immersion, motivation, collaboration, design. We selected 50 scientific articles and classified them according to the following topics: motivation, design, and collaboration.

The second stage of the research was to assess the impact of the introduction of VR and AR during classes at pedagogical faculties as a resource for strengthening strategies for teaching main subjects at the Master's degree programs in higher education institutions of Ukraine. The aim was to conduct a two-stage study. A detailed evaluation of related literature and observation of student's attitude while working with AR and VR. This two stage analysis was accomplished in order to determine the level of impact of the introduction of VR and AR on the educational process of pedagogical faculties students compared to the use of traditional tools. The variable under study was the impact of VR and AR on students' learning in both dimensions (teaching and learning strategies). The study was conducted during the second semester of the educational year 2023. The group consisted of 40 students from all over Ukraine. The observation was conducted after completing the first semester , using an email sent to the university mailboxes of students and consisted of only 4 questions (which overlap with the questions in the article but are slightly adjusted to the needs of students). The emphasis was placed on the applicants' impressions of working with virtual artefacts (Table 1).

Table 1

Questions for the group

An open survey
1: What do you think are the benefits of VR and AR in comparison to outdated methods?
2: What motivates you more to use virtual artefacts in the classroom ?
3: What do you think about the use of VR and AR in higher education?
4: Do you experience any cognitive and socio-emotional impact during virtual immersion in simulation centres?

Source: author 's own development

General Background

At the first stage, a detailed literature review using the EPPIC investigation method allowed identifying relevant articles as accurately as possible, summarise the collected information by topic, and divide the research into smaller topics: motivation, collaboration, and design.

At the second stage, the group variable distinguished between students who had experience in using virtual reality as a learning resource and those who used traditional technologies as a resource

to enhance teaching and learning strategies (books, models, video presentations). It is important to clarify that not all participants who experimented with VR and AR had the opportunity to manipulate the equipment in the software environment offered for the study of the subjects. The time allocated for studying the virtual course was approximately thirty minutes, which is a limitation given the time available for technology integration. The impact was measured using a survey (see Table 1).

Sample / Participants / Group

At the first stage, databases were selected (Google scholar, Research Gate, Scopus, ERIC), and searched in English or Ukrainian using descriptive operators selected for each database. 2300 non-repeating articles were found.

The variable of the next phase of the investigation was the focus group work (40 representatives) and the formulation of a hypothesis after processing the answers of the applicants. The hypothesis can thus be formulated as follows (Fig. 1):

Hypotheses based on applicants' answers

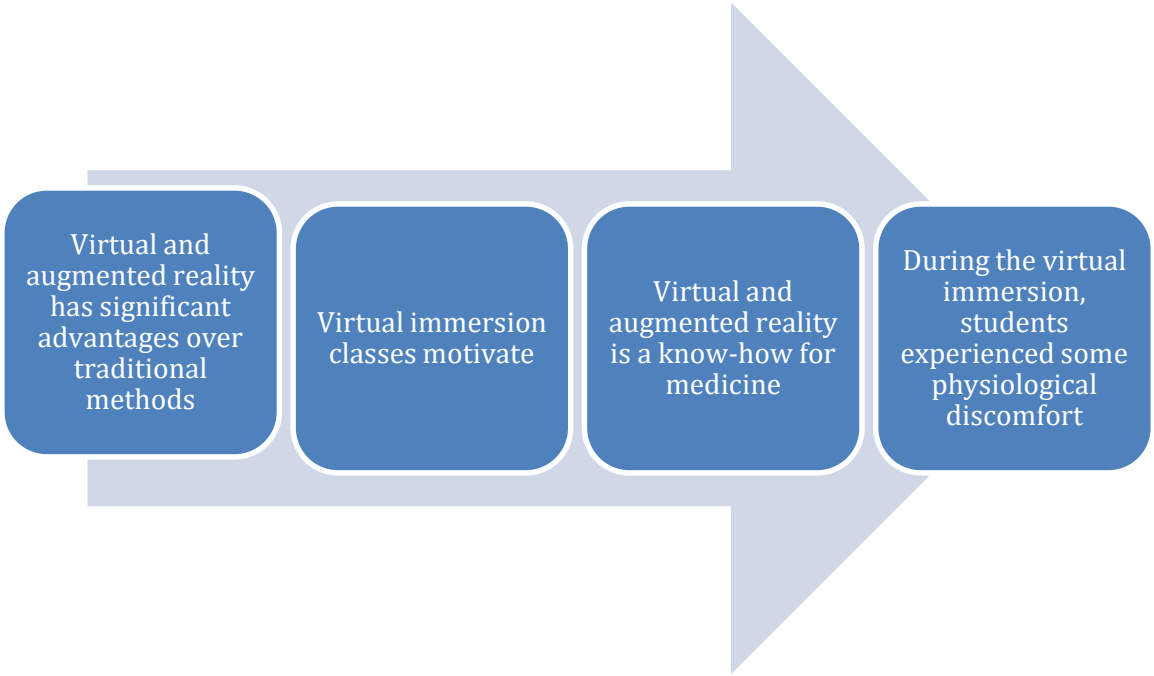

Figure: author's own development

The study was explanatory in nature, as it aimed to determine the level of influence of the introduction of VR and AR on students, as well as the impact of the introduction of VR as a technological resource that enhances teaching and learning strategies.

Instrument and Procedures

In order to answer the research question, a systematic review was conducted using the content analysis. The logical evaluation of the scientific literature expansively identified, evaluated and synthesized all applicable studies concerning the subject. The sum of papers found in the identified files and the descriptors used (Table 2):

Table 2

Determination by descriptors

Database and key terms	Number of sources
Google scholar - higher education, VR and AR in higher education, students' motivation	575
Research Gate - education, virtual artefacts, VR and AR, and higher training	292
Scopus - virtual reality in higher education. Designing classes with elements of virtual immersion	1027
ERIC - the latest technologies in education, virtual or augmented reality, higher education and training, virtual reality in medicine	406
Total	**2300**

Source: author 's own development

Data Analysis

The corpus of 2300 articles was reduced by the following selection criteria:

Table 3

Selection criteria

Criteria	Quantity
Years of publication 2018-2023	1000
Achievements in the field of immersive technologies	178
Peer-reviewed research in an academic context	50

Source: author 's own development

The total number of articles restricted to 50 made it possible to prove the theoretical part of the work.

The feasibility of introducing VR and AR into higher education of the future was determined by means of an open survey. However, the variable that made it possible to build the scale was one key closed question: "Are virtual artefacts more effective than traditional teaching methods?"

The gauge used oscillated from 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

Thus, the group consisting of 40 students from all over Ukraine was conducted via email questioning. Classes were held in parallel with the traditional approach/inclusion of virtual reality in turn. The alternation made it possible for students to understand the advantages and disadvantages of both approaches. An observation was conducted after the course. Students were asked to submit all their ideas and answers to the above-mentioned questions After collecting the data, the authors had the opportunity to compare the overall picture of the group's impressions. It should be noted that the issues or preferences identified in the responses are virtually identical to those raised by scholars in the field and the paper hypothesis.

The hypothesis based on the literature analysis was as follows: virtual and augmented reality should be introduced into higher education, especially in the study of medicine, maths, automobile and highway engineering. Virtual artefacts that would replace traditional teaching methods would primarily motivate students to learn and achieve better results. In this aspect, the goal was to establish the opinion of students and to find similarities or differences with the hypothesis.

Research Results

All carefully chosen articles on VR and AR in higher education mainly concentrated on 3 significant aspects connected with the knowledge assignment: motivation, involvement, and collaboration. Also articles that dealt with the design of educational VR and AR artefacts were retained. Additionally, the article marks mentions to preceding investigation to sustain the presented models and concepts. First, it was advisable regroup the papers by topic and then briefly summarise the main aspects of educational artefacts in VR and AR (Table 4).

Table 4

Generalization of the main profits of educational artefacts in VR and AR

Aspects related to knowledge transfer	Authors
Motivation The main profits of VR and AR in education are linked to educating students and motivating them.	(Khan, Johnston & Ophoff, 2019); Chen, 2019) Wenk, Penalver-Andres, Buetler, Nef, Müri & Marchal-Crespo, 2023).
Motivation increases attention that is an important mental purpose for learning.	(Cabero-Almenara & Roig-Vila, 2019); Tezer, Yıldız, Masalimova, Fatkhutdinova, Zheltukhina & Khairullina, 2019).
Educational artefacts, particularly educational games, have a constructive influence on motivation and learning awareness. For example, immersive games in the education. Virtual reality helps to improve observation skills, develops scientific competence, and motivates students, pointing to the prospective of VR and AR adoption during learning, which not only motivates but also pushes students to develop their own technological developments in this area.	Acosta, Navarro, Gesa & Kinshuk, 2019); Matovu, Ungu, Won, Tsai, Treagust, Mocerino & Tasker, 2023); Chen, Huang & Chou, 2019); Chen, Wang, Zou, Lin, Xie & Tsai, 2022); Lin & Yu, 2023) Obeid & Demirkan, 2023).
VR and AR have a constructive outcome on motivation, but it does not have a positive effect on student engagement. According to scientists, virtual reality does not have a noticeable advantage in skill development.	(Low, Poh & Tang, 2022); Javornik, Marder, Barhorst, McLean, Rogers, Marshall & Warlop, 2022) Lin & Hou, 2022); Wang, Hu, Hwang & Yu, 2022)
Design VR and AR propose a beneficial immersive experience in higher education. The augmented reality offered by new technologies, is appropriate to constructivist educational methods and simulation-based learning	(Guerra-Tamez, 2023); Ateş & Garzón, 2023); Guaya, Meneses, Jaramillo-Fierro & Valarezo 2023); Yang, Lai & Wang, 2023); Khodabandeh, 2023); Rojas-Sánchez, Palos-Sánchez & Folgado-Fernández, 2023).
Cyberkinetosis is a shared problem in VR and AR. It manifests itself in the form of sensory conflict and neural shifts. The main symptoms of cyberkinetosis are seasickness, migraine, faintness, spatial perplexity, as well as vertigo.	(Iwanaga, Muo, Tabira, Watanabe, Tubbs, D'Antoni & Tubbs, 2023); Najmi, Alhalafawy & Zaki, 2023); Alkhabra, Ibrahem & Alkhabra, 2023); Agbafe, Jazayeri, Baker & Cederna, (2023); (Fillipova, 2021); Uriarte-Portillo, Ibáñez,

	Zatarain-Cabada & Barrón-Estrada, 2023); George, Foster, Xia & Jacobs, 2023), Mystakidis & Lympouridis, 2023); Babakr, Mohamedamin & Kakamad, 2019) Sonntag, Albuquerque, Magnor & Bodensiek, 2019); Williams, 2022); Huang, 2022) Frewen, Oldrieve & Law, 2022).
Collaboration Virtual artifacts enable interaction and collaboration, providing space for the development of kinesthetic, visual, and spatial skills. Dialogue allows higher education students to expand their understanding through interaction with others. VR and AR learning environments are able to allow students solving difficulties as a team anyplace in the world. VR and AR are more communicating and engaging for learners than using conservative resources, as they allow deepening the understanding by problem solving in team. VR and AR permit the consumer communicating in real-time with a distant tutor. VR and AR improve students' mental procedures and their practical actions, particularly, by engaging with invisible, abstract, and complex concepts.	(Khodabandeh, 2023); Iwanaga, Muo, Tabira, Watanabe, Tubbs, D'Antoni & Tubbs, 2023); Guerra-Tamez, 2023). (Cabero-Almenara & Roig-Vila, 2019); Chen, Wang, Zou, Lin, Xie, & Tsai, 2022) Tezer et. al., 2019). Huang (2022); Lin & Yu,2023); Mystakidis & Lympouridis, 2023); Seufert, Oberdörfer, Roth, Grafe, Lugrin & Latoschik, 2022); Uriarte-Portillo, Ibáñez, Zatarain-Cabada & Barrón-Estrada, 2023). Babakr, Mohamedamin & Kakamad, 2019); (Bogusevschi, Muntean & Muntean, 2020); Matovu, Ungu, Won, Tsai, Treagust, Mocerino & Tasker, 2023); Najmi, Alhalafawy & Zaki, 2023); Rojas-Sánchez, Palos-Sánchez & Folgado-Fernández, 2023).

Source: author's own development

The literature analysis indicates that the introduction of VR and AR in the future of higher education is more motivating for students, followed by the importance of designing virtual artefacts, and thirdly, the increased collaboration due to the above advantages (Chart 1).

Chart 1.

The impact of the VR and AR introduction in learning

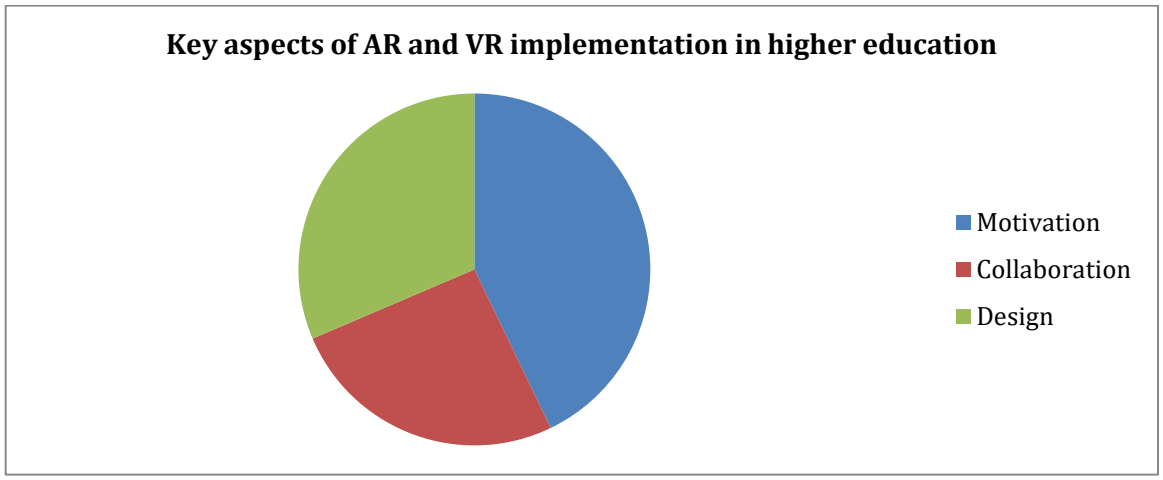

Diagram: authors' own development

The results of the paper can be summarized by summarizing the applicants' opinions. That is, to briefly describe their impressions and responses.

According to the variable that made it possible to build the scale: "Are virtual artifacts more effective than traditional teaching methods?" the results were as follows (Chart 2):

Chart 2

The expediency of replacing traditional methods with virtual artifacts according to the students' answers

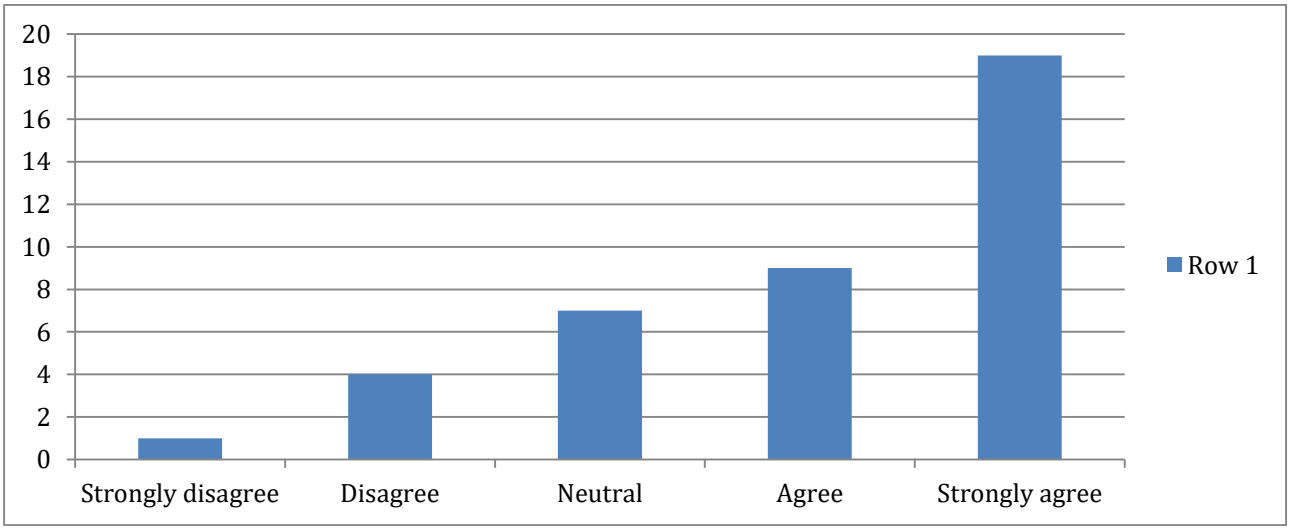

Diagram: authors' own development

Students' awareness in the virtual content

Students who had the opportunity to manipulate the equipment exhibited awareness in the virtual content exploring, which indicates that the content seen during the classes interested and motivated them. According to the responses, the latest technologies contribute to the in-depth study of the subjects and facilitate the learning.

It was found that students compare the VR and AR use with the use of models or drawings (traditional methods). According to the students' opinion, it is necessary to get rid of outdated teaching methods, and virtual immersion classes create a positive impact when considering the material (33). Eight participants complained about the impact of VR and AR (from a psycho-emotional and physiological point of view). These students (8 responses) believe that new virtual reality submissions could be advanced in teaching, but there are risks, including for short-term and long-term health. After all, being in the virtual world should not fuel certain unhealthy social impulses. The majority of students (36) believe that VR and AR are perceived by experts as the technologies of the future of higher education.

The answers' analysis

According to the answers, we can group the main advantages and disadvantages mentioned by the applicants.

The main advantages **of VR and AR**

VR and AR allow for the safe handling of objects in dangerous environments, VR and AR offer the ability to track complex areas in science, VR and AR increase the ability of students to control their learning and provide sensory engagement, VR and AR improve three-dimensional perception, inspiration and mental processes of scholars, VR and AR allow for real-time remote communication with a teacher, VR, and AR promote motivation, engagement and knowledge transfer, VR and AR facilitate interaction and improve cooperation between students and teachers.

The disadvantages of VR and AR

The disadvantages mentioned by students also coincide with scientific opinion: VR and AR require significant financial investment to implement the technology and training, the unwell planned presentations and lowly instructor preparation, insufficient research to study the impact on the psyche, additional intellectual capacity for the applicant, absence of collective acceptance of new technologies, distractions, and the possibility of suffering from cybernetic malaise.

Thus, along with the undoubted advantages of using VR and AR in learning, there is always a risk of its inappropriate use.

Summarizing the key conclusions and facts of the given research information, it can be stated that the hypothesis of the paper is confirmed. The answers of the students almost completely coincide with scientific sources. Particularly that the use of VR and AR can lead to positive results and benefit for students if virtual artefacts are adequately designed. If used with suitable scholastic methods and approaches as well as taking into account understanding, benefits, exclusive features, and personality qualities, they will significantly contribute in education, increase the educational process efficacy and enable the advancement to technology-assisted education.

Discussion

Giving the literature examination, scholastic artefacts developed in VR and AR could increase attention and perception. Nevertheless, their effectiveness should not only comprise education methods reformed to the target audience but also use the suitable environs for the extent of acquaintance that is being taught. A connected opinion is taken by Mulders, Buchner & Kerres (2020), who accentuate that the technique used and the select of VR and AR artefacts should be constant, as these two elements balance each other. Indeed, the presented research approves that more emphasis needs to be positioned on the design of educational artefacts to strike an equilibrium between the desire of operating the tool

and its aptitude to diffuse knowledge. VR and AR permits collaboration and teamwork, offers innovative space, and increases kinaesthetic, optical, and three-dimensional skills. As the limitation of the study show regrettably, existing technologies limit the use of VR and AR, not to mention the prices related to hardware assimilation and the restricted number of solicitations in the context of higher education. Additionally, there is still the problem of their social tolerability.

This paper also raises the issue of the risks related to the VR and AR use. Giving to Smutny (2022), virtual reality can lead to alterations in human behaviour caused by psychological or neurological changes. Indeed, the lack of research on the risks posed by immersive technologies, especially for young children, makes us thoughtful. One can find similar opinions in this field. To diminish the risks connected with VR and AR, their use in higher education should be gradual and periodically reviewed in accord with the results of investigation and analytical tests that were laid down when they were created (Sholihin, Sari, Yuniarti & Ilyana, 2020).

In this paper the significance of hastening researches on phenomena that disturb users of VR and AR and thus permit inventors to generate educational artefacts that are harmless and better modified to users is also highlighted. So, this literature deepened the research findings in knowledge about the organization of important components that affect the efficiency of instructive artefacts, namely VR and AR, particularly, the development of an environment that does not carry a cognitive load on learners, the drawbacks related to the use of immersive artefacts and their significance in the perception of material, especially in the exact sciences (Fillipova, 2021).

The examination of the obtained data presented the fact that the introduction of VR and AR in higher education is a powerful tool for influencing both teaching and learning strategies for the education of the future. As the literature shows, although the data obtained from the observation revealed some negative responses about the impact of VR and AR on students, with the right tools, it is possible to create effective virtual learning scenarios. In this context, Checa & Bustillo (2020) highlight the enthusiasm with which students explore virtual environments for learning purposes.

The most common response in pedagogical research observations was a surprise when navigating and exploring the functionality of the virtual environment, with learners emphasizing the quality of the presentation of anatomical images (Pelletier, McCormack, Reeves, Robert, Arbino, Dickson-Deane & Stine, 2022). Such manifestations are perceived as an encouragement to further improve learning environments and strategies, with the main goal of providing the best learning opportunities (Alam, 2022a). Without denying the obvious benefits of using virtual immersion in learning, Wenk, Penalver-Andres, Buetler, Nef, Müri & Marchal-Crespo (2023) consider that both the needs and challenges of virtual communication are too often ignored. The needs of learners, who are ultimately the ones who should benefit from these tools, are often ignored (Williams, 2022). In this aspect, the results of the study suggest that new technologies such as VR and AR are “more than desirable in the design of environments that facilitate learning” (Ateş & Garzón, 2023).

Based on the fact that motivation was at the top of the list in this study, it should be noted that as learners' motivation increased, their engagement, participation, and cooperation increases. Additionally, the great motivation is an important forecaster of deep involvement, which can have a progressive influence on students' educational enactment, time spent on educational accomplishments, higher-level groundwork, and evocative education, as well as on behaviour and arrogances toward education.

The limitations of the presented work are time and human resources. Since the paper analyses the works of 2018-2023 (in light of their relevance), it would be advisable to devote future research to the

historical paradigm of the development of the introduction of VR and AR in higher education with the involvement of a survey of students of different graduation years. Like in a similar study it is demonstrated, the dynamics of the efficacy of the usage of the modern technologies in the education of the future (Sholihin, Sari, Yuniarti & Ilyana, 2020). The scientific thought is that the purpose of virtual learning in the education of the future is to achieve educational goals by transferring new knowledge and skills. In order to formulate learner-friendly goals and to adapt their target skills, media and methods should be coordinated. In this aspect, scripts and well-designed artefacts are very important and should be adapted to the critical expertise that the teacher is trying to convey. An in-depth analysis of the related literature has shown that instructive technologies are tools that serve human beings and that their development should be based primarily on motivational models as well as learning schemes to achieve the pedagogical goals of learning. Educational theories should be taken into account when using VR and AR in higher education. This will make it possible to achieve the pedagogical goals of learning. Most studies on this topic authorise that if instructive artefacts are well-designed, they are beneficial for learning. However, they need to be shaped taking into account learners benefits and aptitudes. The paper notes that the goal in higher education is to increase the knowledge assignment, not promoting tools.

Conclusions and Implications

The obtained results in the study lead to the conclusion that VR and AR are recommended resources to teaching enhancing and learning strategies in maths, pedagogical sciences, engineering and in higher education in general. The impact caused by VR and AR indicates the need to replace traditional teaching methods. The results of the paper were in line with scientific opinion that postulated that the introduction of VR and AR in the higher schooling of the future makes it easier for teachers to teach by demonstrating more interactive content of subjects.

Although the results showed the benefits of implementing virtual and augmented reality, like virtual artifacts enable interaction and collaboration, providing space for the development of kinesthetic, visual, and spatial skills; the virtual dialogue allows higher education students expanding their understanding through interaction with others; VR and AR learning environments are able to allow students solving difficulties as a team anyplace in the world; VR and AR are more communicating and engaging for learners than using conservative resources, as they allow deepening the understanding by problem solving in team; VR and AR permit the consumer communicating in real-time with a distant tutor; VR and AR improve students' mental procedures and their practical actions, particularly, by engaging with invisible, abstract, and complex concepts, it is recognised that there is a need to allocate time and resources to integrate this technology, given that it requires a certain period of training that is well worth the investment. Looking ahead, the medical simulation centres in Ukraine where the work was conducted are currently designing more modern space and equipment that will allow them to become virtual reality laboratories for Ukrainian higher medical education institutions. Thus, the education of the future has to offer the preeminent implements in order to attain the educational objective. The paper also emphasises the importance of taking into account the risks associated with virtual and augmented reality. After all, according to the analysis of scientific papers and students' opinion, their use can lead to changes in human behaviour by causing psychological or neurological changes. The risks of side effects in virtual reality, such as cybernetic malaise, have been identified. This work allowed us to identify the possible pedagogical benefits of VR and AR and their limitations. It turned out that virtual technologies have certain advantages and limitations, but they need to be used with caution. There are always particular risks of abuse or wrong manipulation, or even risks of inappropriate design for students. It is important for further research to assess the risks associated with

the misuse of these technologies. Researches in the field of VR and AR in higher education need to be significantly increased.

Suggestions for Future Research It would be interesting to take into consideration the strategies for implementing VR in education and its impact on the cognitive and psycho-emotional students'. Moreover, the analysis their investment worth and the highlighting of the benefits of these technologies for education is worth mentioning in the future researches.

Limitation of the study the limitations of the work were, first of all, the lack of skills of the students in working with virtual artefacts. Despite the fact that their generation is technologically advanced, in practice, it was in the educational process that the relevant skills were lacking. The next limitation was the small focus group in the study. This is due to the fact that at the moment, Universities in Ukraine are not fully equipped with virtual artefacts, so access to them during classes is provided to small groups. The final limitation is the financial aspect. The introduction of virtual and augmented reality into the educational process is expensive, and due to a lack of funding, its progress in education is slow. Therefore, focusing on investing and financing virtual artefacts in education is a promising area for future research.

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