



# Using Virtual Learning Objects in Educational Content

Zhanat Nurbekova  
Abai Kazakh National Pedagogical  
University, BMS  
nurbekova\_zhk@digitalexgroup.com

Bakyt Nurbekov  
L.N. Gumilyov Eurasian National  
University  
bakyturbekov67@gmail.com

Mira Maulsharif  
S.Asfendiyarov Kazakh National  
Medical University  
miramaulsharif@gmail.com

Dinara Naimanova  
Toraighyrov University  
dinarasakenkyzy83@gmail.com

Aigerim Baimendiniva  
Abai Kazakh National Pedagogical  
University  
aigerim.nurlankyzy93@gmail.com

## ABSTRACT

Today, virtual learning objects and virtual learning environments are influencing changes in educational content as well as the emergence of new learning models. The improvement of teaching methods and the integration of information technology into education are priorities today. The research conducted a systematic review of available articles published in the Web of Science, Google Scholar, and Scopus databases. The main result of the research shows that virtual objects can be teaching aids that help students learn better. In addition, during the pedagogical experiment based on augmented reality technologies, digital educational resources were developed, the impact of the developed virtual learning objects on the learning content and learning outcomes were studied. The adaptation of teaching methods to the modern digital generation by improving the content of teaching and the introduction of information technologies in education reflects the perspective of the research direction, which today is a priority task of a pedagogical science and the EdTech industry. In this context, virtual and augmented realities were concretized not only as an object of learning but also as a mechanism of the carrier of the learning content, as a means of assessing the acquired knowledge, as directions for future research of approaches to the modernization of the learning content.

## CCS CONCEPTS

• Applied computing; • Education; • E-learning; • Additional Keywords and Phrases: Virtual learning object, Virtual learning environment, Digital educational resources;

## ACM Reference Format:

Zhanat Nurbekova, Bakyt Nurbekov, Mira Maulsharif, Dinara Naimanova, and Aigerim Baimendiniva. 2022. Using Virtual Learning Objects in Educational Content. In *International Conference on Computer Systems and Technologies 2022 (CompSysTech '22)*, June 17, 18, 2022, University of Ruse, Ruse, Bulgaria. ACM, New York, NY, USA, 5 pages. <https://doi.org/10.1145/3546118.3546138>

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*CompSysTech '22, June 17, 18, 2022, University of Ruse, Ruse, Bulgaria*

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ACM ISBN 978-1-4503-9644-8/22/06...\$15.00

<https://doi.org/10.1145/3546118.3546138>

## 1 INTRODUCTION

Today, virtual learning objects and virtual learning environments are influencing changes in educational content as well as the emergence of new learning models. The great possibilities of virtual environment, and its use in education arouses great interest to researchers.

The purpose of this study is to analyze the best practices for the use of virtual learning objects in the student-centered learning process.

In our research, first a systematic review of available articles published in digital libraries was conducted. To conduct a bibliographic review, articles published in peer-reviewed journals and conferences by keywords from the Web of Science, Google scholar, and Scopus databases were reviewed. Of the selected 74 sources of scientific research [1] - [74], 41 (55%) articles on the concept of "virtual learning environment" and 33 (45%) articles on the concept of "virtual learning object" were reviewed. Two main questions were addressed in our review. The research conducted a quantitative and descriptive analysis of the questions. Also, in the study virtual objects in education were considered not only as a means of education, but also as an object of learning. Aspects of the use of virtual learning objects and their use in secondary education have been analyzed. As a result, objects based on virtual reality showed the effectiveness of their use in the learning process and increased student motivation for learning.

The improvement of teaching methods and the integration of information technology into education are priorities today. In order to modernize the education system and popularize science, in recent years virtual and augmented reality technologies have been actively used in teaching, and research is being conducted. Virtual learning objects are used at different levels of the learning process. They emerged in 1994 due to the need to reuse and share information resources in the field of education. Virtual learning objects are one of the solutions to ensure reuse, accessibility, durability, and compatibility of educational resources. These objects constantly guide the student to the learning process, encourage self-education, and enhance the teacher's role as a leader and evaluator in the learning process [17].

Virtual Learning Objects are understood as a tool of learning, a facilitator of knowledge and considered as potential aids to the innovative learning process. They are one of the most widely used solutions to ensure the reuse, availability, durability and interoperability of educational resources. Virtual Learning Objects promotes

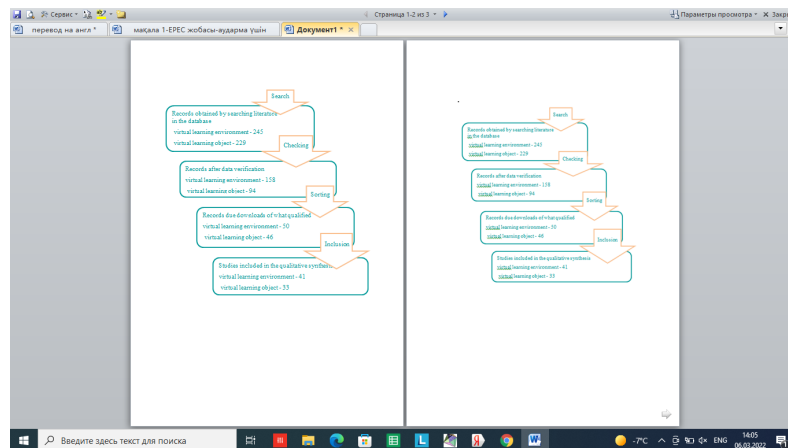


Figure 1: Process used to conduct bibliometric and content analysis

learner autonomy [24] and to a higher level of interactivity. As Arango et al notes that learners are more active, independent and dynamic, they take on new responsibilities for mediation and motivation in the learning process, facilitating the role of the teacher as a mentor, guide and evaluator of the teaching-learning process [17]. This advantage can solve problems associated with the lack of concentration, confidence, and basic knowledge of students in the educational process. Virtual learning objects that copy real objects and their use in education plays an important role. The use of virtual objects allows teachers to explain a large amount of theoretical material quickly and affordably, and it allows students to learn effectively. At the same time, they develop their creative thinking and increase motivation to learn.

However, despite the use of features of virtuality in order to improve education and teaching materials by teachers and textbook authors, designers of educational content, their didactic, ergonomic aspects, advantages and disadvantages still need to be studied.

## 1.1 RESEARCH METHODOLOGY

The research conducted a systematic review of available articles published in the Web of Science, Google scholar and Scopus databases. A systematic review is a methodology for collecting, critically evaluating, and analyzing the original literature on a particular research topic. The review is performed according to the following algorithm.

- 1) Articles and research papers were collected from electronic databases using keywords related to the research questions.
- 2) The data has been verified. Repeated and other studies with a different study area were excluded.
- 3) The collected data is selected according to criteria, and available articles are uploaded.
- 4) The answers to the research questions from the selected data are synthesized, the results are summarized.

The data collection process of our research work is shown in Figure 1

The following questions were addressed in the study:

- \* What are the main advantages of using virtual objects in education?

\* What is the impact of the virtual environment on the learning process?

The next step of the study was a comparative analysis of the results of a systematic review of best practices with the results of our own experimental observation on the use of virtual learning objects in the learning process.

The main criteria in the study are conference materials, reviews of journals and literature related to the use of augmented reality, virtual reality and objects in education and learning. Other criteria used in this process are recurring articles, full-text articles, and accessibility. All the criteria helped to select the main research articles.

## 1.2 RESEARCH RESULTS

A selection of studies was conducted and data from the articles were published to answer the research questions mentioned above.

The purpose of data publication is to produce results for a systematic review of the literature based on the research problems.

1. What are the main advantages of using virtual objects in education?

Virtual learning objects are highly valued as a limited digital resource that can be reused as part of pedagogical practices and strategies. Virtual learning objects are tools characterized by reusability, adaptability, concreteness, modularity, interactivity, conceptuality, accessibility, tolerance, and durability [24]. When used in the learning and cognitive process with a technological base, it includes a variety of didactic materials (pictures, videos, games, websites, etc.). After collecting several data from sources, the use of virtual objects has been proven to be effective.

In the studies, students were surveyed about the effectiveness of using virtual learning objects, and most of the participants stated that they could increase creativity, improve language learning, mechanical skills, and spatial abilities. In learning concepts, virtual objects are also very effective in enhancing student-centered learning. Analysis of current research on virtual objects in education, their aspects related to the student and the educational process are shown in the figures 2 and 3

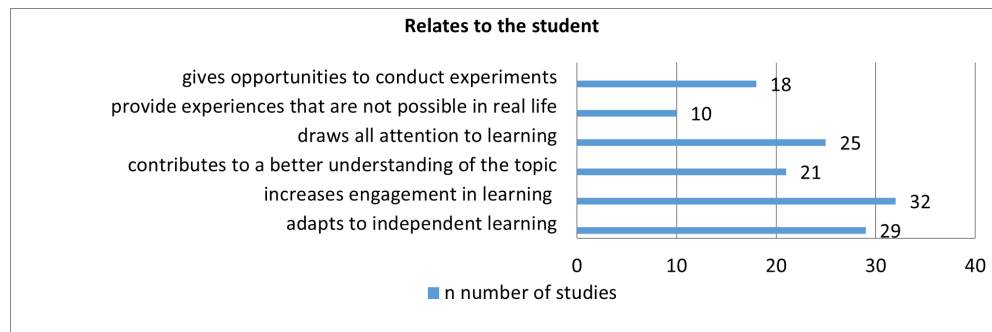


Figure 2: Aspects relating to students in the use of virtual objects in education

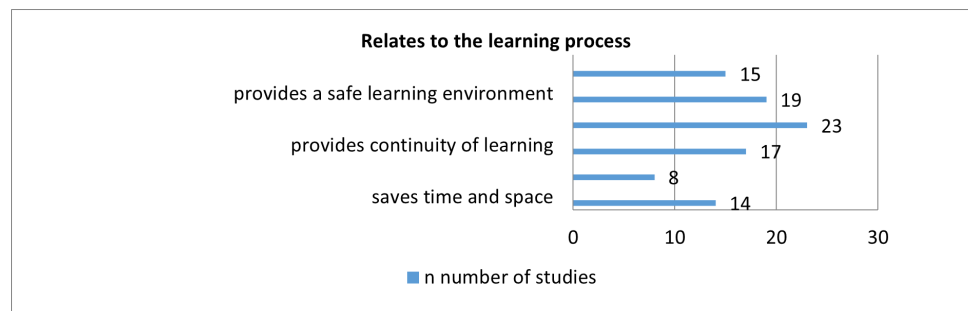


Figure 3: Aspects relating to educational process in the use of virtual objects in education

2. What is the impact of the virtual environment on the learning process? The virtual environment allows us to use a constructivist approach to learning. Students are free to interact with virtual objects and other students. Teachers, wishing to offer students interesting activities, must plan their learning activities very carefully and pay special attention to working together. In addition, student interaction with the content of the virtual environment and student interaction in the classroom seem to have a strong influence on student activities when using hybrid methods [20].

### 1.3 DISCUSSION

The main result of the above research shows that virtual objects can be teaching aids that help students learn better. In addition, during the pedagogical experiment based on augmented reality technologies, digital educational resources were developed, the impact of the developed virtual learning objects on the learning content and learning outcomes were studied. To test the effectiveness of the learning outcomes, the learning cone scores [75] were taken as a benchmark. As an experiment, two groups of students were observed. The control group underwent passive learning without the use of virtual learning objects. When studying the educational material created for listening, viewing based on simple text materials, it was found that residual knowledge is only 10-15% of the amount of training material needed for students to assimilate. In the experimental group, mastering was carried out with active learning of virtual and augmented reality as a result of simulating real experience when working with built-in educational material, and as a result it turned out that the residual knowledge of students

amounted to 85-88% [41]. This clearly demonstrated the effectiveness of embedded learning content with virtual learning objects different from traditional format learning content.

As it was noted in the studies discussed above during the literature review, students responded mostly positively to the use of virtual objects during experiments, and it was also proved that their use in the educational system improved student academic performance. Changes, adjustments may be made to incorporate the virtual environment in the curriculum. Virtual objects open the way to deeper study of any subject, and reality can expand the paradigm of learning. Currently, the technology is developing rapidly. Inexpensive and easy-to-use virtual and augmented reality devices for the use of virtual objects are being produced. Based on this, it can be stated that a comprehensive study of their use in the learning process becomes very relevant.

### 1.4 CONCLUSIONS

In conclusion, it should be noted that the virtual learning environment in a general pedagogical context includes several types of virtual learning objects. Using these objects allows the teacher to explain a large amount of theoretical material quickly and easily, while providing students with effective assimilation of knowledge, develops creative thinking and increases motivation to learn.

A study of virtual education objects, as well as a study of the use of laboratories for educational purposes, has shown their value. There are many reasons and advantages of using virtual objects, and the teacher can determine at what stage it should be used in his subject. Virtual and augmented reality technologies allow

to interact with different areas of science, from creating virtual laboratories and objects to research in physics, biology, chemistry, astronomy, etc.

In addition, the results of our study allowed us to gain a deeper understanding of the use of virtual environments in education. Virtual learning environment includes several types of virtual learning objects in the general pedagogical context.

The adaptation of teaching methods to the modern digital generation by improving the content of teaching and the introduction of information technologies in education reflects the perspective of the research direction, which today is a priority task of pedagogical science and the EdTech industry. In this context, virtual and augmented realities were concretized not only as an object of learning, but also as a mechanism of the carrier of the learning content, as a means of assessing the acquired knowledge, as directions for future research of approaches to the modernization of the learning content.

## ACKNOWLEDGMENTS

This research was possible due to the co-financing and support of the Ministry of Education and Science of the Republic of Kazakhstan as part of the program-targeted financing of the research OR 11465474 "Scientific foundations of modernization of the education system and science". The authors would like to thank all the partners and especially to Ministry of Education and Science of the Republic of Kazakhstan.

History Dates: Received March 2022; revised May 2022; accepted June 2022

## REFERENCES

- [1] Yavich R., Starichenko B. Design of Education Methods in a Virtual Environment. *Journal of Education and Training Studies*. 2017.
- [2] Mayrose J. Active Learning Through the Use of Virtual Environments. *American Journal of Engineering Education*. 2012.
- [3] Agbo F.J., Sanusi I.T., Oyelere S.S., Suhonen J. Application of Virtual Reality in Computer Science Education: A Systemic Review Based on Bibliometric and Content Analysis Methods. *Educ. Sci.* 2021, 11, 142.
- [4] Osipova N., Kravtsov H., Hniedkova O., Lishchuk T., Davidenko K. Technologies of Virtual and Augmented Reality for High Education and Secondary School. 2020.
- [5] Guevara C., Aguilar J. The Model of Adaptive Learning Objects for virtual environments instanced by the competencies. *Advances in Science, Technology and Engineering Systems Journal*. 2017.
- [6] Nurbekov B. Theory and practice of distance learning. - Pavlodar, 2009. – 220.
- [7] Gustavo Salvador-Herranz. Manipulating Virtual Objects with Your Hands: A Case Study on Applying Desktop Augmented Reality at the Primary School. *System Sciences (HICSS)*, 2013.
- [8] Surrego. A virtual learning object (VLO) as a tool to teach reading for specific purposes to communication. 2017.
- [9] Muirhead B., Haughey M. Evaluating learning objects for schools. *IEEE*. 2005.
- [10] D. Dickey. Brave New (Interactive) Worlds: A review of the design affordances and constraints of two 3D virtual worlds as interactive learning environments. *Interactive Learning Environments*. pp. 121 – 137. 2005.
- [11] Jiang Liangfu. Virtual Reality Action Interactive Teaching Artificial Intelligence Education System. Volume. 2022.
- [12] Chen Chwen Jen. Theoretical Bases for Using Virtual Reality in Education. *Themes In Science And Technology Education*. 71-90.
- [13] Fonseca L.M., Medeiros M.J., Goés F.S.N., Zamberlan-Amorim N.E., Scochi C.G.S. Evaluation of the digital learning object taking care of the sensory environment in neonatal units: noise, light and handling. *Procedia Soc Behav Sci.* 2012; 46: 509-14.
- [14] Brazley M.D. Virtual Reality and Distance Education. *Global Journal of Engineering Sciences*. 2019.
- [15] Porter D. A. Designing Learning Objects for Online Learning. *Commonwealth of Learning*. 2017.
- [16] Bisol C.A., Valentini C.B., Braun K.C.R. Teacher education for inclusion: can a virtual learning object help?. 2015.
- [17] Arango J., Gaviria D., Valencia A. Differential Calculus Teaching through Virtual Learning Objects in the Field of Management Sciences. *Procedia - Social and Behavioral Sciences*. 2015.
- [18] Anaya AR, Luque M, Peinado M. A visual recommender tool in a collaborative learning experience. 2016
- [19] Pattanasith S, Rampai N, Kanperm J. The development model of learning through virtual learning environments for graduated students, department of educational technology, faculty of education. 2015.
- [20] Athanasios Christopoulos, Marc Conrad, and Mitul Shukla Research Article Objects, Worlds, and Students: Virtual Interaction in Education. *Hindawi Publishing Corporation Education Research International Volume*. 2014.
- [21] Veronica S. Pantelidis. Reasons to Use Virtual Reality in Education and Training Courses and a Model to Determine When to Use Virtual Reality. *Themes in science and technology education*. 59-70.
- [22] Agbo, F.J.; Oyelere, S.S.; Bouali, N. A UML approach for designing a VR-based smart learning environment for programming education. In *Proceedings of the 2020 IEEE Frontiers in Education Conference*, 2020. 1–5.
- [23] Jokonya, O. The significance of mixed methods research in information systems research. In *Proceedings of the Midwest Association for Information Systems Conference (MWAIIS)*, Springfield, IL, USA, 19–20 May 2016.
- [24] Salvador P., Bezerril M., Mariz C., Fernandes M., Martins J., Santos V. Virtual learning object and environment: a concept analysis. *Revista brasileira de enfermagem*. 2017.
- [25] Parmar, D.; Isaac, J.; Babu, S.V.; D'Souza, N.; Leonard, A.E.; Jörg, S.; Daily, S.B. Programming moves: Design and evaluation of applying embodied interaction in virtual environments to enhance computational thinking in middle school students. In *Proceedings of the 2016 IEEE Virtual Reality (VR)*, Greenville, SC, USA, 19–23 March 2016; 131–140.
- [26] Ortega, F.R.; Bolivar, S.; Bernal, J.; Galvan, A.; Tarre, K.; Rishe, N.; Barreto, A. Towards a 3D virtual programming language to increase the number of women in computer science education. In *Proceedings of the 2017 IEEE Virtual Reality Workshop on K-12 Embodied Learning through Virtual Augmented Reality (KELVAR)*, Los Angeles, CA, USA, 19 March 2017; 1–6.
- [27] Segura, R.J.; Del Pino, F.J.; Ogáyar, C.J.; Rueda, A.J. VR-OCKS: A virtual reality game for learning the basic concepts of programming. *Comput. Appl. Eng. Educ.* 2020.
- [28] Banic, A.; Gamboa, R. Visual Design Problem-based Learning in a Virtual Environment Improves Computational Thinking and Programming Knowledge. In *Proceedings of the 2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, Osaka, Japan; 1588–1593. 2019.
- [29] Nurbekova, Z., Grinshkun, V., Aimicheva, G., Nurbekov, B., Tuenbaeva, K. Project-based learning approach for teaching mobile application development using visualization technology. *International Journal of Emerging Technologies in Learning*, 2020, 15(8), 130–143.
- [30] Toni Amorim, Leandro Tapparo. A multiple intelligences theory-based 3D virtual lab environment for digital systems teaching. *Procedia Computer Science*. 1413–1422.20147
- [31] Özden Karagöza, Ahmet Zeki Saka. Development Of Teacher Guidance Materials Based On 7E Learning Method In Virtual Laboratory Environment. *Procedia - Social and Behavioral Sciences*. 810 – 827. 2015.
- [32] Aussama K. Nassar, Farris Al-Manaseer, Lisa M. Knowlton, Faiz Tuma. Virtual reality (VR) as a simulation modality for technical skills acquisition. 2019.
- [33] Bacca J., Baldiris S., Fabregat R., Graf S. Mobile Augmented Reality in Vocational Education and Training. *Procedia Computer Science* 75. 49 – 58. 2015.
- [34] Radianti J., Majchrzak Tim A., Fromm J., Wohlgenannt I. A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*.2020.
- [35] Constan M, Ciubotaru N. Virtual Reality And Augmented Reality In Education. *Virtual Reality and Augmented Reality in Education*. 1-12. 2017.
- [36] Dalim C.S.C, Kolivand H., Kadhim H., Sunar M.S., Billingham M. Factors influencing the acceptance of augmented reality in education: A review of the literature. *Journal of Computer Science*. 581- 589. 2017.
- [37] Patricio J.M., Costa M.C., Manso A. A Gamified Mobile Augmented Reality System for the Teaching of Astronomical Concepts. 2019 14th Iberian Conference on Information Systems and Technologies (CISTI). 2019.
- [38] Byrnes J., Wasik B.A. Picture This: Using Photography as a Learning Tool in Early Childhood Classrooms. *Childhood Education*. pp. 243-248.2019.
- [39] Arcos C., Fuertes W., Villacis C., Zambrano M., Noboa T., Tacuri A., et al. Playful and interactive environmentbased augmented reality to stimulate learning of children. 2016 18th Mediterranean Electrotechnical Conference (MELECON). 2016.
- [40] Hantono B.S., Nugroho L.E., Santosa P.I. Meta-review of augmented reality in education. *Proceedings of 2018 10th International Conference on Information Technology and Electrical Engineering: Smart Technology for Better Society, ICITEE 2018*. 312-315. 2018.
- [41] Sembayev, T., Nurbekova, Z., Abildinova, G. The Applicability of Augmented Reality Technologies for Evaluating Learning Activities. *International Journal of Emerging Technologies in Learning*, 2021, 16(22), 189–207

- [42] Nurbekova, Z., Baigusheva, B. On the issue of compliance with didactic principles in learning using augmented reality. *International Journal of Emerging Technologies in Learning*. 2020, 15(15), 121–132
- [43] Cabero Almenara J, Barroso Osuna J. The educational possibilities of Augmented Reality. *Journal of New Approaches in Educational Research*. 2016.
- [44] Pirker, J., Dengel, A., Holly, M., Safikhani, S. Virtual Reality in Computer Science Education: A Systematic Review. In *Proceedings of the 26th ACM Symposium on Virtual Reality Software and Technology*; Association for Computing Machinery. 1–8. 2020.
- [45] Yanfang Zhou. VR Technology in English Teaching from the Perspective of Knowledge Visualization. *Digital Object Identifier*. 2020.
- [46] Tubelo R.A., Branco V.L., Dahmer A., Samuel S.W., Collares F.M. The influence of a learning object with virtual simulation for dentistry: A randomized controlled trial. *Epub*. 2015.
- [47] Conrad M., Shukla M. Objects, Worlds, and Students: Virtual Interaction in Education. *Education Research International*. 2014.
- [48] Soroko N.V., Soroko V.M., Mukasheva M., Tkachenko V.A. Using of virtual reality tools for the development of steam education in general secondary education. 2021.
- [49] Peng L., Yen Y., Siswanto I. Virtual reality teaching material - virtual reality game with education. *Journal of Physics: Conference Series*. 2022.
- [50] Valencia H.G., Villota J.A., Agredo P.M. Strategies Used by Professors through Virtual Educational Platforms in Face-To-Face Classes: A View from the Chamilo Platform. 2017.
- [51] Hickey Daniel T., Adam A., Ingram-Goble, Ellen, M. Jameson. *Designing Assessments and Assessing Designs in Virtual Educational Environments*. 2009
- [52] Garzón J, Baldiris S, Gutiérrez J, Pavón J. How do pedagogical approaches affect the impact of augmented reality on education? A meta-analysis and research synthesis. *Educational Research Review*. 2020.
- [53] Dr.Fidelis T.Suorineni. Virtual/augmented reality technology in mining applications – school of mining. *Research newsletter*. 2020.
- [54] I.Moisi. A Model of the Student Behaviour in a Virtual Educational Environment. *Suppl. issue: Proceedings of ICCCC 2008*. 108-115
- [55] Christopher B., Grace C., Joel S., Jason K., Fred M. MYR: A Web-Based Platform for Teaching Coding Using VR, *SIGCSE '19*, 2019
- [56] Klimova B. Use of Virtual Reality in Non-Native Language Learning and Teaching. *International Conference on Knowledge-Based and Intelligent Information & Engineering Systems*. 2021.
- [57] AlAwadh S., Alhabib A.S.N., Murad D., AlDeei F., AlHouti M., Beyrouthy T., Al-Kork S. Virtual Reality Application for Interactive and Informative Learning. *Conference: 2017 2nd International Conference on Bio-engineering for Smart Technologies (BioSMART)*. 2017.
- [58] Smutny P., Babiuch M., Foltynnek P.. A Review of the Virtual Reality Applications in Education and Training. *Conference: 2019 20th International Carpathian Control Conference*. 2019.
- [59] Reisner B.A., Stewart J.L., Williams B.S., Goj L.A., Holland P.L., Eppley H.J., Johnson A.R. Virtual Inorganic Pedagogical Electronic Resource Learning Objects in Organometallic Chemistry. *Chemical Education*.
- [60] Muirhead B., Haughey M. Evaluating learning objects for schools. *IEEE*. 2005.
- [61] Martn J., Carlos M. Virtual Technologies Trends in Education. *Eurasia Journal of Mathematics Science and Technology Education*. 2017.
- [62] Vasylevska K., Podkosova I., Kaufmann H.. Teaching Virtual Reality with HTC Vive and Leap Motion. *Conference: SIGGRAPH Asia 2017 Symposium on Education*. 2017.
- [63] Salvador-Herranz G., Pérez-López D., Ortega M., Soto E. Manipulating Virtual Objects With Your Hands: A Case Study on Applying Desktop Augmented Reality at the Primary School. *Hawaii International Conference*. 31,39. 2013.
- [64] Kerawalla L., Luckin R., Seljeflot S., Woolard A., "Making it real: exploring the potential of augmented reality for teaching primary school science". *Virtual Reality* 10, 163–174. 2006.
- [65] Restrepo E.G., Benavidez C., Gutiérrez H. The challenge of teaching to create accessible learning objects to higher education lecturers. *Proceedings of the 4th International Conference on Software Development for Enhancing Accessibility and Fighting Info-exclusion (DSAI)*. 371-381. 2012.
- [66] Carruth, D.W. Virtual reality for education and workforce training. In *Proceedings of the 2017 15th International Conference on Emerging eLearning Technologies and Applications (ICETA)*, Stary Smokovec, Slovakia, 26–27 October 2017; 1–6.
- [67] González-González I., Jiménez-Zarco A.I. Using learning methodologies and resources in the development of critical thinking competency: an exploratory study in a virtual learning environment. *Comput Human Behav [Internet]*. 2015.
- [68] Elledge R, McAleer S, Thakar M, Begum M, Singhoti S, Grew N. Use of a virtual learning environment for training in maxilla facial emergencies: impact on the knowledge and attitudes of staff in accident and emergency departments. 2016.
- [69] Pesare E, Roselli T, Rossano V, Di Bitonto P. Digitally enhanced assessment in virtual learning environments. *JVLC*. 2015
- [70] Martin C., Urquía A., Dormido S.. Object-oriented modeling of virtual laboratories for control education. *Triennial World Congress*. 2015.
- [71] Dumitrescu C., Olteanu R.L., Gorghiu M., Gorghiu G., State G. Using virtual experiments in the teaching process. *Procedia - Social and Behavioral Sciences*. 776-779. 2009.
- [72] Carlos G. Model of adaptive learning objects for virtual environments. *proceedings of the 2016 42nd Latin American Computing Conference, CLEI 2016*. 2017.
- [73] Böving, R., Bleimann, U., Wentzel, C., Walsh, P. High level Semantic networking - Using k-infinity to build a multiontological learning environment. *Proceedings of the 8th International Network Conference, INC 2010*. 361-370. 2010.
- [74] Remolar, I., Rebollo, C., Fernández-Moyano, J.A. Learning history using virtual and augmented reality. *Computers* 10(11). 2021.
- [75] Kiyosaki, R. The conspiracy of the rich / translated from English. S.E. Borich. -3-ed. -Minsk: Potpourri. 2013. 294-296.