项目 17　The empowered teacher for the META future

2022 年全球未来教育设计大赛学生赛道金奖

团队名称：The empowered teachers

团队成员：Jelica Ristić[1], Marija Vorkapić[1], Sanja Čomić[1], Ljiljana Bojanić[1], Dunja Bogićević[1]

([1] University of Belgrade)

[Abstract]The new problem that emerged due to the excessive use of technology and the pandemic of COVID-19 is the alienation of primary school students. There are three types of alienation: from oneself, from others and from tradition. Question arises on how to empower personal, social and cultural identity in a modern age. Application of extended reality, eg. Metaverse stands out as an innovative method that could be implemented. It has a potential to solve alienation problem while connecting users with reality and strengthening social relationships. In education, Metaverse can be used to create a stimulating inclusive digital environment for communication, collaboration, learning and raising awareness of cultural expression and heritage. The project proposed the solution in form of upgraded Edmodo platform with two potential metaverse scenarios for the teaching process.

[Keywords] Metaverse, Serbian educational system, Mixed Reality, In-service and pre-service teachers, Edmodo.

1 Introduction

Traditional teaching represents outdated teaching methods, and thus schooling becomes tedious, not adjusted to individual abilities and interests of students, and thus it stifles internal and external motivation of students and innate curiosity in children. In order to overcome these issues, it is necessary to constantly: innovate educational technology, improve teacher digital and methodological skills and implement the latest technology such as artificial intelligence and extended reality in the process of monitoring, measuring and evaluating students' work. Metaverse has the potential to support specific learning outcomes such as raising awareness of cultural expressions and heritage, promote a culture of peace and non-violence, improve the STEM education and process of understanding abstract context, provide safe, inclusive and effective learning environments etc.

Project *The empowered teacher for META future* was designed with the intention to provide a comprehensive solution and embrace Metaverse in daily teaching in Serbian educational system and in general. In that purpose, three main problems were identified.

First problem, Serbian education system is not supported with one uniform educational platform on a national level as LMS integrated with MR technology. Solution that project provides is upgrading Edmodo platform with Edmodoverse PlugIn which can be used for three educational purposes: first one is delivering lessons online in Metaverse, second is sharing Metaverse scenarios, and the third is monitoring and evaluating students in Metaverse. Benefits of this solution refer to all members of the educational system.

Second problem reflects on teaching methods, or a way of applying Metaverse in specific educational situations to individual students' needs. Project brings solutions in the form of two hybrid scenarios for Metaverse based on a holistic approach. First scenario is designed for a STEM program in a form of problem solving game which would develop cultural identity through raising cultural awareness and heritage. Second scenario develops personal and social identity through inclusive communication and collaboration between deaf and mute students and teachers. Both scenarios are supported with evaluation tools based on Digital Bloom taxonomy.

The third problem is that teachers are afraid. They feel dissatisfied and reluctant in implementing Metaverse because the lack of digital skills. Project solution is in the form of *Teachers' development program for Metaverse* through course design.

2 Theoretical Background

As the fourth wave of computing innovation is unfolding around spatial, immersive technologies such as Extended Reality (XR) which include Virtual Reality (VR), Augmented Reality

(AR) and Mixed Reality (MR) (Yang et al. 2020). XR has the potential to completely transform (online) education. XR has been used to amplify formal learning that happens in the classroom, targeting knowledge prescribed by national or provincial educational standards (Willams et al. 2019).

These immersive technologies have the potential to increase learner motivation and engagement (Martín-Gutiérrez et al. 2017), promote a full student-centered learning experience, support collaborative and situated learning and enable learners more concretely and tangibly access to previously physically inaccessible/invisible content (Wu et al. 2013). The most important fact, XR technology opens the door to a completely new form of education - Metaverse.

According to Mystakidis (Mystakidis, 2022), the second MR iteration of the Metaverse is under construction where social, immersive VR platforms will be compatible with massive multiplayer online video games, open game world and AR collaborative spaces. According to this vision, users can meet, socialize and interact without restrictions in an embodied form as 3D holograms or avatars in physical or virtual spaces (Mystakidis, 2022).

Metaverse is an interconnected web of social, networked immersive environments in persistent multiuser platforms which enables seamless embodied user communication in real-time and dynamic interactions with digital artifacts (Mystakidis, 2022:486). A variety of instructional approaches has adopted the design of XR learning environments, including game-based learning (Rosenbaum et al. 2007), place-based learning (Mathews, 2010), participatory simulations and problem-based learning (Liu et al. 2009), role playing (Yang et al. 2020), studio-based pedagogy (Mathews, 2010), and jigsaw method (Dunleavy et al. 2009).

Our proposal has relied on several strategic regulations which is adjusted in Serbia and which define the development of the educational system in the direction of the implementation of artificial intelligence and virtual reality. Also, our solution is closely aligned the Sustainable Development Goals of UNESCO SDG4 where teachers are being indicated as the key for achievement all of the SDG4-Education 2030 agenda: As teachers are a fundamental condition for guaranteeing quality education, teachers and educators should be empowered, adequately recruited and remunerated, motivated, professionally qualified, and supported within well-resourced, efficient and effectively governed systems (Sustainable Development Goals of UNESCO SDG4, 2030: 54).

3 Project design

Concept provides an all-in-one solution - one platform for online and hybrid learning, integrated with Metaverse, adjusted to Serbian curriculum and suitable for a specific group of students. The greatest benefit of the project The empowered teacher for the META future can have pre-service and in-service teachers and students (especially children with disabilities), as well as all

the participants of the education system. This project aims to be a leader in promoting the latest technology of Metaverse in the Serbian educational system, mixing Metaverse and innovative concepts and methods, and making a framework for potential future resources designed for specific teaching scenarios in Metaverse.

Project embraces Edmodo as an existing global educational platform that provides constant communication between teachers, students, school administrations and parents on a global level. Since launching, Edmodo has served over one hundred million users with tools that provide creating online classrooms for distance learning, sharing digital assignments and quizzes, etc.

The structure of the final product includes 2 designs: software and course design. Software design provides prospective model of Edmodoverse Plug-In with its primary functions: 1. Virtual avatar for metaverse, 2. Delivering lessons online in metaverse, 3. Integrative themes for teaching and learning in metaverse, 4. Evaluate and monitor students knowledge (Grades, Errors, Badges) in Metaverse, 5. Integrative themes for teaching and learning in metaverse and 6. Run a metaverse. Design of Edmodoverse Plug-in is shown on Figure 1.

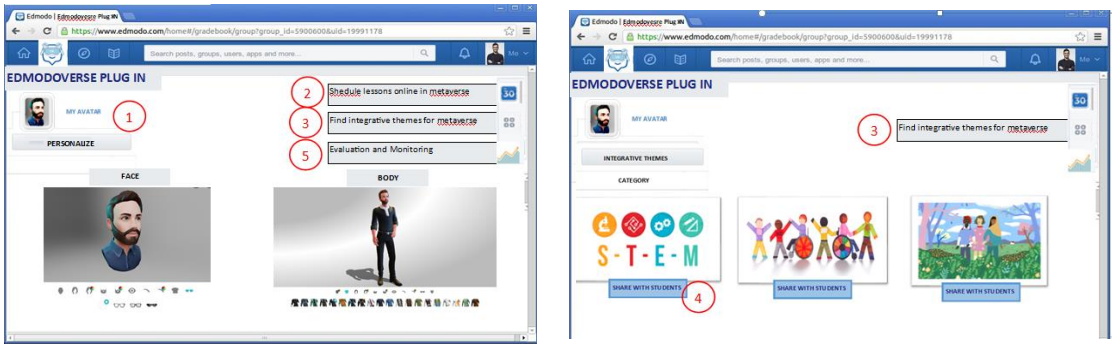

Figure 1. Design of Edmodoverse Plug-In with its primary functions

To run a metaverse, teachers first need to choose integrative themes for teaching and learning. We suggested two possible teaching scenarios for the metaverse: interdisciplinary themes/resources from different subjects in elementary school which gives solutions for STEM education, teaching and learning for children with disabilities. Scenario in a metaverse will be used for students' learning, but also for teachers - to be supported within well resourced teaching materials in metaverse;

First scenario, Fingerspelling is based on Mixed Reality that requires glasses and gloves. Within this scenario, students develop personal and social identity through inclusive communication and collaboration. Deaf-mute child uses glasses and gloves to send input as a sign. Avatar translates Sign language to audio (speech). On the other hand, student without disabilities in metaverse sees avatar that makes moves and gives them audio message. Student without disabilities can answer to deaf and mute, send audio message as input - avatar translates audio to sign for deaf and mute. This scenario could be operated in school, as well as at home. Surroundings of this scenario is realistic

with augment normally accessible content. Some of the benefits that could be provided for teachers are that it makes easier for them to connect students with and without disabilities. Also, teachers can objectively and more carefully evaluate by stepping aside and get the opportunity to create inclusive environment for teaching and learning. In the end, it gives a chance to deaf-mutes to participate completely equal as children without disabilities in educational process. Also, teacher who do not know sign language has opportunity to have a communication with deaf-mutes and to understand answers of deaf-mutes in real time.

In addition, we provide a possible learning scenario: Teacher can read poem or tale, ask questions and require answers about experience, characters, fabula etc. Edmodoverse PlugIn evaluates students' answers. It can be also used for everyday and classroom communication.

Fingerspelling develops personal and social identity through inclusive communication and collaboration. In this way the problem of alienation from oneself, from others and from tradition could be solved. Figure 2 shows learning outcomes/identified design results for Fingerspelling scenario.

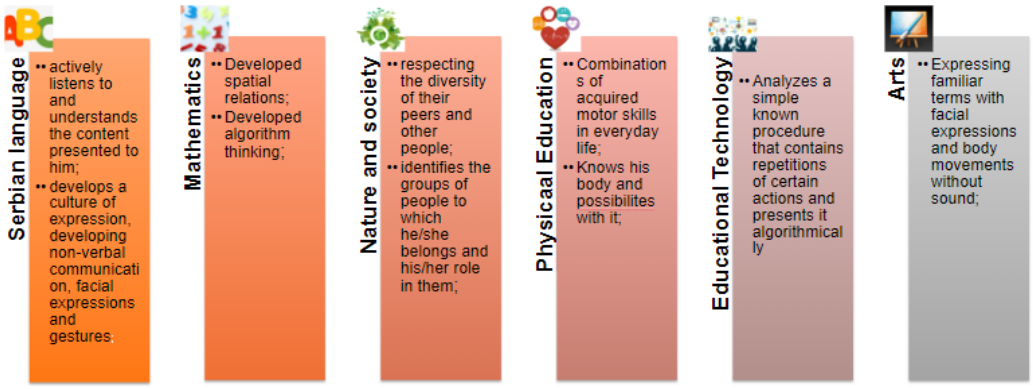

Figure 2. Learning outcomes for Fingerspelling

Second scenario, Ancientcraft is appropriate for STEM education and developing cultural identity through raising cultural awareness and heritage. Type of technology as Mixed Reality requires glasses and gloves. Students are immersed in a historical environment, seeing avatar as a tutor who teaches them about the manufactured products and how to make them. This scenario is based on problem solving game - students have a specific task to do. Tutor gives special hints and feedback. When students get back to reality in Edmodoverse plugin, teacher and students can see a statistical report of achievements in metaverse. As well as Fingerspelling, this scenario could be operated in school or home where students/children are seen as 3D holograms or avatars in physical or virtual spaces that can see avatar as a tutor. This scenario allows learners to travel in the time to experience different historical periods about manufacturing with problem-solving, learning by doing and making, role-playing, and/or game-based learning. Some of the benefits reflect on teachers who

have the opportunity to create historical environment in classroom/or in online learning, and students have the opportunity to experience how to make certain ancient craft. Also, teacher can objectively observe students and promote an individual approach while objectively and more carefully evaluate the whole class by stepping aside. One of possible learning scenarios could be: Avatar teaches students how to make a specific Serbian rug named „ćilim“ (a type of carpet made on a loom and usually made of wool) and students practice making it. For the possible competition scenario, students should compete to see who will make it faster and who did more precisely procedure. For every correct step, students get an extra point. Figure 3 shows learning outcomes/identified design results for Ancientcraft scenario.

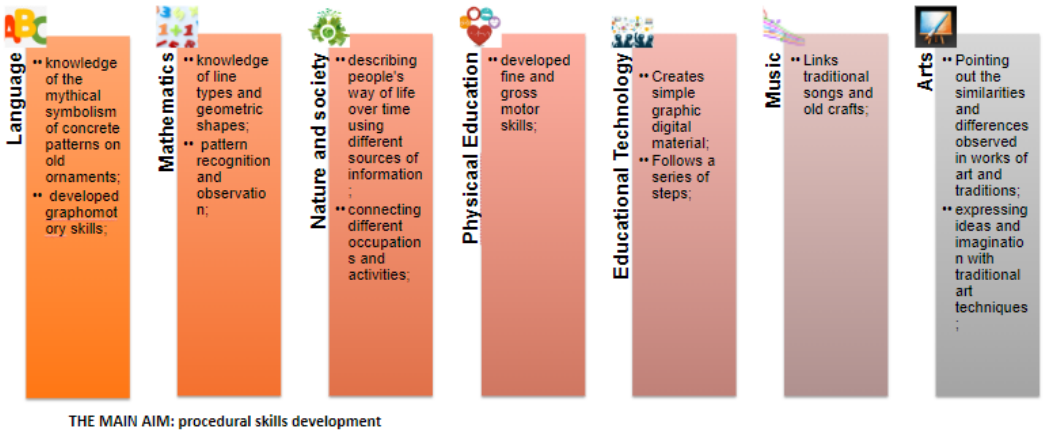

Figure 3. Learning outcomes for Ancientcraft

After running one of the integrative programmes provided with Edmodoverse Plug-In, teachers and students can see monitoring and evaluation process in metaverse (online/hybrid scenario) with Digital Bloom's Taxonomy as a main tool (Figure 4).

Figure 4. Evaluate and monitor students knowledge-according to Digital Bloom's Taxonomy (Grades, Errors, Badges) in metaverse

Implementation of Edmodoverse PlugIn could be follow with a detailed plan for course design eg. Teachers Professional development program which includes skill sets for metaverse (6

categories in three levels of complexity: basic level, intermediate level and advanced level), training plan for pre-service and in-service teachers and online and hybrid scenario for daily teaching in metaverse. In this way, pre-service and in-service teachers have opportunity for better understanding of all benefits of metaverse, especially because learning through the MR technology has a great potential to create inclusive, equitable quality education; to get required digital skills for implementing metaverse in daily teaching; to be introduced with online and hybrid constructivist teaching scenario (and learning outcomes); to be supported within well resourced teaching materials in Metaverse;

In this way, Edmodo platform, known as a standard asynchronous online learning tool with learning management system (LMS), could become the synchronous e-learning system which enables the online meeting of educators (teachers) and students at the same time in a digital, virtual space - Metaverse.

4 Feasibility Analysis

We did a swot analysis to explain the feasibility of the project and in order to determine the strengths and weaknesses, to reveal the opportunities and risks of the project. Based on a SWOT analysis, 9 major risks are identified:

(1) programming algorithm in Edmodoverse Plug-In that is adjustable for individual student needs;

(2) cyber harassment and/or data misuse;

(3) insufficient participants' motivation;

(4) increased financial requirements and/or lack of financial support in the Serbian education system;

(5) internet connection;

(6) possibility of creating a metaverse addiction in students;

(7) teachers' resistance when introducing innovations such as metaverse;

(8) transition from free to chargeable platform;

(9) insufficient interest of stakeholders.

Risk assessment is performed using risk ranking method FMEA (Failure mode and Effects Analysis). According to the RPN score, which is calculated by multiplying individual scores of severity, occurrence and detection for every individual risk, all risks can be categorized in two groups. The first group refers to risk reduction and elimination actions that need to be identified for the first, second, third, fifth, sixth and eighth risk. The second group refers to risks with the highest scores or the risks that signify the catastrophic risks that have the highest priority in risk management.

In this group are the following risks: increased financial requirements and/or lack of financial support in the Serbian education system, teachers' resistance when introducing innovations such as metaverse; insufficient interest of stakeholders.

5 Conclusion

The main advantages of the Project - it can provide reflection of potentials and benefits of metaverse which are suitable for creating a new environment for teaching in 21s century. Also, the Project provides all-in-one solutions which unite Metaverse scenarios, Metaverse meeting and Metaverse evaluation in one platform. Described resources, as well as the user interface are suitable for Serbian curriculum and Serbian speaking area, which further facilitates teaching process in Serbia. All of these properties ensure a raised level of awareness among the teachers about the need of constant care for quality of teaching, improvement of study programs and implementation of new metaverse technologies and innovative work programs.

Disadvantages of the project are identified in Swot Analysis as a negative factor. If the Edmodo platform would be implemented as an educational platform on a national level, that would imply that all schools in Serbia need to be highly equipped with appropriate hardware and software for metaverse, and conduct training for pre-service and in-service teachers as efficiently and quickly as possible. Besides, standards for quality, control and distribution of Metaverse scenarios for realization teaching in online model need to be clearly defined. The process of creating Metaverse scenarios for education must include programmers and web designers who are familiar with purposes of education. All these aspects require detailed planning of the process of digitization of teaching and learning with metaverse from the managerial and management sides.

Project The empowered teacher for the META future gives one comprehensive solution to embrace Metaverse in daily teaching and include:

(1) Teachers' Professional development programme for metaverse (with defined a digital skill sets which encompasses knowledge and skills that are crucial for a teacher to use metaverse, plan and create an authentic and stimulating digital learning environment in metaverse);

(2) Two teaching scenarios for the Metaverse: interdisciplinary themes/resources from different subjects in elementary school which gives solutions for STEM education, teaching and learning for children with disabilities. Scenario in a metaverse will be used for students learning, but also for teachers - to be supported within well resourced teaching materials in metaverse;

(3) Ancientcraft is appropriate for STEM education and developing cultural identity through raising cultural awareness and heritage. Second scenario, Fingerspelling, develops personal and social identity through inclusive communication and collaboration. In this way the problem of

alienation from oneself, from others and from tradition could be solved.

(4)Prospective model for Edmodoverse Plug In on Edmodo platform based on representative pedagogical tools *Digital Bloom's taxonomy* - what can be used as evaluation criteria and for collecting feedback and for fostering holistic early childhood development.

(5)The Serbia Education System needs one uniform educational platform on a national level. Because of it, we give a proposal on how to use Edmodo and Metaverse integration for preparing and sharing materials for class in Metaverse (make a library with educational resources), delivering lessons online in Metaverse, but also for evaluation in Metaverse (as a monitoring system which will provide effective feedback based on pedagogical tools - Digital Bloom's taxonomy).

(6)Edmodo platform, known as a standard asynchronous online learning tool with learning management system (LMS), would become the synchronous e-learning system enabling the online meeting of educators (teachers) and students at the same time in a digital, virtual space - Metaverse.

Future research should contain pilot study observations of the application of Edmodoverse Plug-In in the teaching and learning process. Based on the results of teaching practice, well-trained teachers who took an active part in the implementation of teaching with Metaverse and Edmodo can provide suggestions for improving the plug-in, and ideas for new content in Metaverse scenarios. The results of observations can provide possible insights into the assessments of the quality of interaction and cooperation between teachers and students. Based on these results, new implications and innovative approaches can be offered in terms of integration of Metaverse and Edmodo platform (LMS).

References:

[1] Strategy for the development of artificial intelligence in the Republic of Serbia for the period 2020-2025 (Official Gazette of the RS, No. 96/2019), Strategy for the development of digital skills in the Republic of Serbia for the period from 2020 to 2024 ("Official Gazette of RS", No. 21/2020) and Strategy for the development of education in the Republic of Serbia until 2030 ("Official Gazette of RS", No. 63/2021)

[2] James M Mathews (2010). Using a studio-based pedagogy to engage students in the design of mobile-based media. EnglishTeaching: Practice and Critique, 9(1):87–102, 2010.

[3] Eric Rosenbaum, Eric Klopfer, and Judy Perry (2007). On location learning: Authentic applied science with networked augmented realities. Journal of Science Education and Technology, 16(1):31–45, 2007.

[4] Tsung-Yu Liu, Tan-Hsu Tan, and Yu-Ling Chu (2009). Outdoor natural science learning with an rfid-supported immersive ubiquitous learning environment. Educational Technology & Society, 12:161–175, 10 2009.

[5] Matt Dunleavy, Chris Dede, and Rebecca Mitchell (2009). Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. Journal of science Education and Technology, 18(1):7–22, 2009.

[6] Jorge Martín-Gutiérrez, Carlos Efrén Mora, Beatriz Añorbe-Díaz, and Antonio González-Marrero (2017). Virtual technologies trends in education. EURASIA Journal of Mathematics, Science and Technology Education, 13(2):469–486, 2017.

[7] Hsin-Kai Wu, Silvia Wen-Yu Lee, Hsin-Yi Chang, and Jyh-Chong Liang (2013). Current status, opportunities and challenges of augmented reality in education. Computers & education, 62:41–49, 2013.

[8] Kexin Yang, Xiaofei Zhou, and Iulian Radu (2020). XR-Ed Framework: Designing Instruction-driven andLearner-centered Extended Reality Systems for Education. Retrived 20 May 2022 https://arxiv.org/pdf/2010.13779.pdf

[9] Stylianos Mystakidis. (2022). Metaverse. Encyclopedia, 2(1), 486-497.

[10] Rick Williams, Anahita Ayasoufi and Golbou Makki (2019). Using augmented reality to eliminate common misconceptions for students in core mechanical engineering courses. In 2019 ASEE Annual Conference & Exposition, number 10.18260/1-2–33495, Tampa, Florida, June 2019. ASEE Conferences. https://peer.asee.org/33495.

[11] Natsuhiko Hirabayashi, Nami Fujikawa, Ryohei Yoshimura, and Yoshinori Fujisawa (2019) Development of learning support equipment for sign language and fingerspelling by mixed reality. In Proceedings of the 7th ACIS International Conference on Applied Computing and Information Technology, pages 1–6, 2019.

[12] Sustainable Development Goals of UNESCO SDG4 2030, Retrived 20 June 2022 https://www.sdg4education2030.org/the-goal