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STEM Education in Metaverse Environment: Challenges and Opportunities

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As the 21st century progresses, expectations and demands for STEM and STEAM education are increasing (Dönmez et al, 2022). Developed and developing countries are trying to increase the practice of students and teachers in STEM education by revising their education programs. STEM education, which emerged as a result of the increasing global economic and scientific competition, is seen as an educational approach that helps develop individual life skills and increase social welfare (Idin, 2018). One of the ultimate goals of the STEM education approach is to equip the individual with skills that enable the individual to solve real-life problems with a transdisciplinary education approach (Gülen, 2021). STEM education, it is aimed to implement multiple disciplines integrated with each other and within the framework of a common theme. It is known that these disciplines include sciences such as engineering, art, and technology along with many branches of science (Dönmez et al., 2021). It is important that updates and new studies in these sciences are integrated into STEM education and used in coordination. In particular, the rapid acceleration in technology should be reflected in educational environments and integrated with STEM education. As a matter of fact, the most popular of the innovative structures in the technological field is the metaverse.

In the Neal Stephenson 's 1992 “Snow Crash” book, there is the concept of metaverse, which is used as a beyond universe. Although this concept has a fictional meaning, it is considered as a dimension like "the future of the internet" or time. In fact, in theory, it can be called the precious state of real-world life in the virtual environment. It is estimated that the concept of metaverse will exist with its technological infrastructure and the universe it creates. The concepts of software, artificial intelligence, virtual reality, cloud storage, augmented reality, virtual reality and blockchain are related to the metaverse. There is no truly holistic metaverse, but fragmentary examples can be given. Education-based activations in the virtual world, cryptocurrencies and shopping with them, internet-integrated games and digital-based interactions such as virtual concerts, meetings, building a virtual city or buying land in this game, online shopping sites can be perceived as a metaverse. In other words, it is called the new concept formed as a result of the digital integration of these platforms in the virtual world. It is said that you can live in this world by making your own digital face, that is, your avatar, that you can join individually in the Metaverse. To give a few examples; For those who want to do sports at home, having avatars of the same or different sports coaches at the same time, increasing the number of referees in football matches with avatars, relieving the pain of virtual reality during childbirth, being exposed to global warming in the digital environment and being sensitive to the environment and atmosphere in the real environment are some examples (Birer, 2022; Özkahveci et al., 2022).

With metaverse components and the proliferation of metaverse candidate applications, the possibility of metaverse implementation in many areas is increasing. Recently, the Covid-19 pandemic has also severely disrupted the education system. Alternative education

approaches have come to the fore and it is aimed to continue education by making many applications within the scope of digitalization in education. The training made with applications such as remote, (online) meet or zoom could not be productive due to many other factors such as internet infrastructure problems and technological inadequacies. A metaverse environment can provide an important environment for such virtual training. It can also be considered as the avatars of students and teachers, who could not be taken into the classroom environment during the Covid-19 pandemic, to come together in a virtual environment and provide education and this provides real learning. Although platforms are just beginning to be formed by adding the concept of a metaverse in many areas, a similar meta world can be created in the field of education. Concepts such as meta training or meta education may be included in industry 5.0. Similarly, STEM education, which is the trend education approach of the age, can be an alternative environment as an application area (Tekin et al., 2022).

The problems experienced in the application areas for STEM education, such as time constraints, integration, and the high number of students, can be eliminated with the metaverse environment. The technology dimension of STEM education is integrated with the metaverse environment. STEM education can be applied in the metaverse environment by coordinating science, engineering, and mathematics with a transdisciplinary theme. Lesson topics integrated into the "universe" component of Metaverse can be realized with the participation of student and teacher avatars. The metaverse universe provides real-world conditions to be presented at a level close to reality. The transfer of disciplinary issues to the virtual world with real-world applications will enrich the universe. Examples such as learning systems over the human body in science, testing chemical reactions comfortably, mathematical calculations, testing various scenarios and possibilities, designing and making engineering products, enabling practical applications in the field of medicine, drawing and measuring digital or real objects, and creating creative ideas. Examples can be studies that can be done in the metaverse environment of STEM education. As with any approach, there will be challenges and opportunities in STEM education settings.

Challenges in STEM Education in the Metaverse environment;

- Finding the necessary equipment to enter the Metaverse environment,
- Production of software in a specific field,
- Inability to access a strong internet infrastructure,
- Legal loopholes,
- Problems of disconnection from the real world may arise.

Opportunities in STEM Education in the Metaverse environment.

- It will provide the development of cognitive, affective, and psychomotor skills for the learner.
- It will improve cooperation and teamwork.
- Virtual classrooms will facilitate access to hard-to-see experiments and applications.

- It will provide a modelling opportunity.
- It will provide equal opportunity for disadvantaged groups.

Especially the pandemic, war, economic and social problems make the transformation of school environments necessary. During the pandemic period, virtual classrooms came to our rescue. Now, with the digital revolution, we must take steps to move educational environments to virtual environments. However, there seems to be a need for more detailed research on the reflections of the metaverse on education and STEM applications, especially on education researchers. From this point of view, it seems that there is a need for multidimensional studies with researchers, students, teachers, and other stakeholders in the metaverse environment.

Conflict of Interest

The author declares no conflict of interest.

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