The Impact of the Educational Metaverse on the Future Knowledge Society

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Abstract. The exploration and experimentation of educational metaverse theory have received widespread attention, but no articles have been placed in the context of knowledge society to study knowledge ontology. This article analyzes the impact of the education metaverse on the future knowledge society from the perspectives of knowledge production, dissemination, and application. In the future knowledge society, knowledge and innovation will be the core. In the context of the education metaverse, knowledge production will present a decentralized and boundaryless form, forming a more free and advanced learning field; The dissemination of knowledge is achieved through embodied cognition that 'perception is truth'. In the application training of knowledge, technical support is provided to achieve higher practical training, and the application of knowledge is further explored in the simulation of biochemical research experiments. Based on the application of the metaverse, this article proposes a solution to the problems of technological barriers and educational equity, virtual addiction, and technology dependence, from funding tilt and technological assistance to built-in monitoring and customized systems, and the combination of virtual and real experiences.

Keywords: Educational metaverse, knowledge society, decentralization.

1. Introduction

Driven by the development of digital technology, the metaverse has gradually fallen from the imagination of science fiction literature and become a focal point for cutting-edge laboratories, technology companies, and major platforms.

From the Web 1.0 to the Web 3.0 era, virtual reality, immersive experiences, digital twins and other technologies in the metaverse have provided new possibilities for the development and innovation of education, deeply binding knowledge and innovation with social development. The educational metaverse has the characteristics of immersion, personalization, two-way interaction, and emphasis on innovation and practice [1]. Good data has been obtained from existing experiments, showing a trend of positive government guidance and independent enterprise research and development. The "Three Year Action Plan for Innovative Development of the Metaverse Industry (2023-2025)" jointly issued by the General Office of the Ministry of Industry and Information Technology of China and the General Office of the Ministry of Education and other authoritative departments emphasizes the need to promote the construction of educational and teaching environments such as virtual classrooms and virtual laboratories, encourage the sharing of virtual simulation experiment and training resources through platforms, and expand the coverage of high-quality educational resources. This indicates that the education metaverse is at the forefront of technological development and a new possibility for educational transformation.

In a knowledge society centered on knowledge and innovation, knowledge drives the industrial economy through continuous innovation, accumulation, application, and differentiation. The inherent characteristics of the education metaverse will change the production, dissemination, and application of knowledge in multiple dimensions, thereby influencing the future state of the knowledge society.

In existing literature, some researchers have conducted comprehensive research on the connotation, value, current status, and future of the educational metaverse, while others have combined it with specific educational fields and educational purposes to study the knowledge concept of

"decentralization" in metaverse education. However, these studies do not explore the practical context of placing metaverse education outside of the future knowledge society.

This article focuses on the impact of the educational metaverse on the future knowledge society and defines the concepts of the educational metaverse and knowledge society. In the context of the future knowledge society, capturing that knowledge has the same core position in both, analyzing the transformation of knowledge production and dissemination from a theoretical perspective, and exploring practical knowledge application innovation based on this, combined with the technical architecture and practical application of the educational metaverse for more systematic and in-depth research.

2. Concept Definition

2.1. Educational Metaverse: Connotation and Characteristics

The education metaverse is an educational ecosystem that integrates virtual and real worlds, built with cutting-edge information technologies such as VR/AR/MR, digital twins, 5G, artificial intelligence, and blockchain. It exhibits significant features of deep integration between virtual and reality, comprehensive collaboration between humans and machines, and seamless connection between schools and society [2].

The metaverse is not simply a virtual reality game or 3D virtual space, but a virtual space built on technologies such as digital twins, augmented reality, the Internet of Things, and brain-computer interfaces. In the learning space created by the metaverse, embodied experiential environments and multiple sensory feedback can provide knowledge learners with a more immersive, personalized, and accessible experience, which also has a counter effect on the nature of knowledge from both theoretical and practical perspectives. The creation of embodied experiential environments, sensory interactions, and other methods effectively address many challenges in the field of education, providing authentic immersion and practical learning opportunities.

Taking the Metaverse School as an example, it has the characteristics of virtual real synchronization and high simulation, encouraging innovation and open source development, and continuous dynamic development. It directly addresses many problems in online learning caused by the separation of time and space, such as the lack of immersion in teaching and learning, loneliness in learning, limited social scope and experience, etc. From this, it can be seen that the application of the metaverse in education can create a fusion of virtual and real learning, parallel to the physical learning space, and jointly promote the development of higher-order thinking to achieve the goal of educating people.

2.2. Future Knowledge Society

The knowledge society is a social form centered on knowledge and innovation. This concept was first proposed by American management scholar Peter Drucker in "Post Capitalist Society". He pointed out that human society is entering a knowledge-based society. The knowledge society is dominated by the knowledge economy, emphasizing the continuous innovation, accumulation, application, and differentiation of knowledge to promote industrial progress and guide the growth and development of individuals, organizations, and society.

In a post-industrial society, knowledge becomes the fundamental dimension, principle, and foundation of political structure. The development of the knowledge society increasingly supports economic capital based on knowledge. Industrial society is based on property and labor, and knowledge has entered today's society as a new principle [3]. In the knowledge society, knowledge capital has become the most important resource for enterprises, and well-educated people have become the mainstream of society. The accumulation of wealth, economic growth, and personal development are all based on knowledge.

In the knowledge society, new collaborative organizational methods such as platformization, socialization, and onlineization are gradually becoming mainstream, and everyone is involved in various aspects of knowledge production, dissemination, and practice.

The essential knowledge ontology in the educational metaverse is consistent with the knowledge core of the future knowledge society. Under the influence of the metaverse, the boundaries between knowledge, knowledge acquisition, and knowledge creation will be bridged, and the production, dissemination, and application of knowledge in the knowledge society will undergo tremendous changes, creating a completely new field of knowledge creation.

3. Impact

3.1. Production of Knowledge

Under the field of the education metaverse, the future knowledge society will present decentralized knowledge network characteristics, breaking the traditional single-item delivery of "teaching and learning", and presenting the characteristics of the ubiquitous, personalized, socialized, and virtual real combination of educational resources.

A decentralized knowledge network means that each subject has higher degrees of freedom, and the central part of the education system is blurred, forming a nonlinear interactive network [4, 5]. It can break free from the limitations of domain types and ways of existence, and release from a limited framework into a dynamic and open network. Starting from the massive information of the metaverse, the knowledge core of the future knowledge society can have even larger resources and books, and personalized learning and generation can be carried out on this basis. The "Industrial Metaverse White Paper" released by the World Metaverse Congress proposes that in the era of the metaverse, no one in the entire world and society can be alone, emphasizing the existence of humans as creators. The metaverse may cross geographic barriers and create a dynamic knowledge community in the edu-metaverse, reflecting teachers, students, and administrators online. It promotes the generation of knowledge communities, making knowledge in the knowledge society no longer a loose and one-way existence, but a living space for people to create and exchange knowledge, and can promote the formation of a knowledge management model of group co-creation, sharing, and co-governance.

The United Nations Educational, Scientific and Cultural Organization proposes that all valuable information, knowledge, and skills can become knowledge. Knowledge is no longer relatively stable and structured in the traditional sense, nor is it limited to the hands of a few people. Every individual can become a creator and learner of knowledge, and as a node of knowledge, become a part of the knowledge society. The metaverse will further break down traditional disciplinary, cultural, and racial boundaries, forming a closer and borderless community space. Virtual reality space provides interdisciplinary and cross-regional learning environments for subject education, allowing participants to acquire higher-level knowledge in a decentralized knowledge system.

3.2. Dissemination of Knowledge: Immersive Experience

With the participation of the educational metaverse, embodied cognition of "perception as reality" will become an important pathway for knowledge dissemination. The comprehensive application of underlying technologies such as sensory transmission, virtual reality, information transmission, and mirrored worlds makes immersive experiences possible, providing an "embodied" knowledge learning process through the simulation of specific environments, greatly improving the efficiency of information transmission in the knowledge society [6].

The existing curriculum has shifted from traditional graphic and textual courses to video courses, providing a learning experience through the teacher's image, voice, and optimized teaching environment. However, there is still a lack of real communication and authentic environmental experience. The virtual reality technology of the metaverse creates a zero-distance knowledge exchange environment, allowing knowledge to circulate in specific contexts. The digital avatar

technology applied in the field of education has enabled individuals to project into virtual educational spaces. Let the subject integrate and connect in the real experience.

The efficiency of knowledge dissemination is greatly improved through embodied experience. For learners, immersive learning can deepen the depth of knowledge and broaden the breadth of learning, achieving a learning mode of "from practice to practice". For the overall knowledge society, this knowledge dissemination method has become a bridge between knowledge production and application, which can accelerate the speed of knowledge transmission, promote the updating of knowledge in various fields, and reduce the probability of knowledge loss and misreading, which is conducive to the overall development and innovation of society.

3.3. Application of Knowledge: Training Methods and Scope of Application

Beyond the forms of knowledge production and dissemination, the educational metaverse will also have a significant impact on the practical layer of the future knowledge society, resulting in a change in the focus of knowledge application training and application.

The digital twin technology of the metaverse can reproduce specific scenarios in reality, providing support for technical knowledge application training. The research at the University of Copenhagen focuses on the application of metaverse in maritime training. Maritime training in metaverse simulation scenarios can reduce irrelevant cognitive load, while greatly promoting learners' perceived interest, intrinsic motivation, knowledge learning, and behavioral change [7]. From this, it can be seen that the education metaverse has a significant effect on practical training with high requirements for the external environment, which will further strengthen the role of practical knowledge in the knowledge society.

In future knowledge education, the education metaverse provides new avenues and possibilities for scientific research experiments in the knowledge society. The fields with high experimental requirements such as chemical engineering, physics, and biology can break through the limitations of experimental space, opportunities, and materials, and be applied in scientific research innovation and education teaching. In 2021, the Korea Institute of Technology launched an electromagnetic course in the "Future VR Laboratory" of engineering education practice in the metaverse, which improved the practicality and intuitiveness of the course.

The education metaverse fever not only requires the support of theoretical knowledge and practical technology but also positively promotes the application and innovation of knowledge in various fields in the metaverse. The main body of the future knowledge society neglects the exploration of knowledge related to the education metaverse,

4. Suggestions

4.1. Technical Barriers and Educational Equity

The application of educational metaverse requires highly developed hardware equipment and software support, which often means high initial investment. Students who cannot afford or access the metaverse platform will face the risk of marginalization. The technological barrier may become an obstacle for them to enjoy high-quality educational resources, leading to the exacerbation of educational inequality.

To address the issue of technological barriers and promotion, the government should establish special funds for the education metaverse, so that remote areas and economically disadvantaged students can receive corresponding assistance, software equipment, and resources [8]. In addition, further digital skills training can be provided to educators and learners, lowering the threshold for the use of metaverse technology at the forefront of education and enabling knowledge to be acquired. The subject truly benefits from the educational metaverse.

4.2. Virtual Addiction and Technology Dependence

The immersive experience of knowledge dissemination carries the risk of excessive addiction to the virtual world, which can affect learners' real life and learning status, and even lead to social barriers, attention span, and other problems. In the absence of advanced metaverse technology, conflicts between perception and cognition, as well as prolonged use of virtual technology, can cause physiological and psychological discomfort. Nathan Schneider from the University of Colorado Boulder pointed out that the authenticity, immersion, and interactivity of the metaverse may lead teachers and students to overly rely on virtual environments, resulting in problems such as escapism, aggressive personality, and impulsive behavior [9].

Relevant education departments should develop corresponding standards for the use of educational metaverse, set up monitoring and auxiliary adjustment systems, develop personalized plans based on different usage scenarios, usage times, and users, provide application suggestions for users, and take restrictive measures when necessary [10]. In the process of virtual knowledge dissemination and application, the experience and practice of the real world are also an indispensable part,

The problem of virtual addiction can be avoided to the greatest extent through physical experiences such as offline activities, interest cultivation, and interpersonal interaction.

5. Conclusion

The education metaverse provides a new perspective for the construction of knowledge models in the future knowledge society, which deeply affects the production, dissemination, and application of knowledge.

The production of knowledge presents characteristics of decentralization, personalized learning, and dynamic openness. In the education metaverse, knowledge production is no longer a one-way transmission but has formed a decentralized knowledge network. Every individual can become a creator of knowledge, breaking the traditional teacher-centered model in education. Among them, learners can engage in personalized learning based on their interests and needs, obtaining richer and more diverse knowledge resources. In addition, the educational metaverse provides a dynamic and open learning environment, where knowledge production can intersect and integrate across different fields and cultures, breaking down barriers between knowledge entities.

The dissemination of knowledge revolves around immersive experiences, using technologies such as virtual reality to create a learning environment that provides a tangible experience. This enables learners to learn and communicate knowledge in real-life situations, thereby improving the efficiency of knowledge dissemination. The interaction of multiple senses provides a prerequisite for immersive experience, enhancing the sense of participation and experience in knowledge dissemination. Under this influence, knowledge in the future knowledge society can be rapidly disseminated and updated.

The application of knowledge in application training and scope will be influenced by the education metaverse. It provides a new platform for the application and training of technical knowledge, enabling high-difficulty practical training in virtual environments. Meanwhile, by breaking through the spatial and material limitations of traditional experiments, the intuitiveness of theoretical knowledge experiments has been improved, promoting innovation and development in scientific research.

The educational metaverse will have a huge impact on the production, dissemination, and application of knowledge, promoting the transformation and upgrading of the knowledge society. What's more, all parties need to pay attention to potential technological barriers, educational equity, virtual addiction, technology dependence, and other issues, and maximize the role of metaverse technology through reasonable and systematic policy guidance and technological settings.

References

[1] Pu Q, Xiang W. Metaverse and its impact and transformation on human society. Journal of Chongqing University (Social Sciences Edition), 2023, 29 (02): 111-123

[2] Liu G, Gao N, Hu H, Qin Y. Edu metaverse: Characteristic, mechanism, and application scenarios. Open Education Research, 2022, 28 (1): 24-33

[3] Stehr N, Adolf M T, Mast J L. Knowledge society, knowledge-based economy, and innovation. Encyclopedia of Creativity, Invention, Innovation and Entrepreneurship, 2020.

[4] Zhai X, Chu X, Gu J, et al. From knowledge sharing to knowledge co-creation: A decentralized knowledge view of the education metaverse. Journal of East China Normal University (Education Science Edition), 2023, 41 (11): 27-37.

[5] López-Belmonte J, Pozo-Sánchez S, Moreno-Guerrero A J, et al. Metaverse in education: a systematic review. Revista de Educación a Distancia (RED), 2023, 23 (73).

[6] Shen X, Xu L, Yuan D. Metaverse and future learning society: Innovative supply model of lifelong learning resources. Education and Career, 2023, (08): 22-28.

[7] Makransky G, Klingenberg S. Virtual reality enhances safety training in the maritime industry: An organizational training experiment with a non-WEIRD sample. Journal of Computer Assisted Learning, 2022, (4): 38.

[8] Li H, Wang W. Metaverse + Education: A new form of educational development for the integration of reality and reality in the future. Modern Distance Education, 2022, (01): 47-56.

[9] Anthony M C. Metaverse applications in education: a systematic review and a cost-benefit analysis. Interactive Technology and Smart Education, 2024, 21 (2): 245-269.

[10] Kye B, Han N, Kim E, et al. Educational applications of metaverse: possibilities and limitations. Journal of Educational Evaluation for Health Professions, 2021, 18.