



## Research on Challenges and Development under the Construction of Metaverse Ecology of Vocational Education

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**Abstract:** The technical concept of the Metaverse has attracted much attention since its birth. In recent years, with the development of science and technology and social changes, the concept of the Metaverse has gradually entered real life. This article first introduces the key role and influence of the vocational education metaverse in the digital ecological transformation, and elaborates on the concept and elements of the metaverse. Then, it conducts an in-depth analysis of the characteristic advantages of the vocational education ecology brought about by the metaverse. Finally, it comprehensively discussed the practical challenges faced by the vocational education metaverse ecology, and put forward a series of response strategies and suggestions, covering policy regulation, technical support, and risk prevention, aiming to promote the sustainable development of the vocational education metaverse ecology.

**Keywords:** Vocational education; Metaverse; Ecological construction; Challenges and development

### 1 Introduction

The word 'Metaverse' is derived from Neil Stephenson's science fiction 'Avalanche' in 1992, which is translated into Chinese as 'Metaverse'. The prefix 'Meta' contains the meaning of 'transcendence' and 'meta', and the suffix 'verse' is homologous to 'universe', pointing to a virtual space or 'super universe' that is parallel to the real world and highly interactive (Lu Yuzheng & Zeng Tianshan). With the rapid iteration of information technology, especially the breakthrough of core technologies such as virtual reality (VR), augmented reality (AR), blockchain, artificial intelligence (AI) and digital twins, the concept of meta-universe has leaped from science fiction imagination to reality. Its connotation is increasingly rich and is regarded as the key form of the next generation Internet. It is characterized by a high degree of immersion, continuous real-time, open creativity and strong sociality. It aims to build a three-dimensional virtual world in which users can deeply participate, freely create value, conduct social interaction and economic activities. In 2021, Zuckerberg renamed Facebook as Meta and announced his full commitment to the field of meta-universe. This landmark event detonated the upsurge of meta-universe around the

world, highlighting its huge development potential and subversive power. This force is impacting all areas of social production, life and governance with unprecedented breadth and depth, reshaping the structure and ecology of the digital economy, and opening up new imagination and transformation paths for many industries, including education (Zhang Gaomeng, 2023).

As a key link to directly serve industrial development and cultivate high-quality technical and skilled talents, vocational education has extremely high requirements for practicality, situational and cutting-edge. The rise of the cosmos ecology has brought revolutionary opportunities for vocational education. It can break through the rigid constraints of physical time and space and resources, build a highly simulated virtual training environment (such as precision instrument operation, high-risk scene drill, complex process simulation, etc.), provide immersive and interactive learning experience, and greatly improve the efficiency and safety of skill training. At the same time, the meta-universe platform facilitates the integration of global high-quality educational resources, simulates real enterprise workflows and collaboration scenarios, promotes the deep integration of

production and education, and provides students with a closed-loop learning path of ' practicing in virtuality and refining in reality '. This new ecology of vocational education based on the meta-universe indicates that the skill acquisition mode, teaching organization form and even the relationship between industry and education may be profoundly reconstructed. However, this promising ecological construction process is not smooth. It is facing a series of major challenges that need to be further studied and solved in terms of technology landing, resource construction, standard setting, ethical norms, cost input and integration with traditional education system.

## **2 Connotation Concept and Core Elements of Vocational Education Meta Universe**

### **2.1 Concept of Connotation**

When we explore the essence of the meta-universe, its core is to build a virtual space that can transcend the constraints of physical reality and is highly simulated. The most significant feature of this space is that it completely breaks the traditional time and space constraints. Learners can achieve real-time or asynchronous connection and interaction across geographical barriers without visiting a specific place or participating in a fixed period of time. More importantly, meta-universe technology is committed to the deep integration of space-time and the natural flow of virtual and real. (Wang Youmei, Wang Dan, Tang Hao, Liu Chen & Mao Congcong, 2023] This blending is not a simple juxtaposition or superposition, but through advanced information technology (such as sensor networks, Internet of Things, digital twins, etc), the real-world state, data, processes and even social relations are mapped and synchronized to the virtual space in real time ; at the same time, learning activities, skill operations and collaboration results in virtual space can effectively feedback, influence and even guide the practice of the real world. This mutual integration and two-way interaction between the virtual and the real world has created an unprecedented and new dimension of experience. In such an environment, learners can use highly immersive sensory simulation (vision, hearing, and even possible future touch, smell, etc) to obtain the same authenticity and vivid perception as in the real workshop, laboratory, and work site, as if ' immersive '. It is the core feature of this virtual and real fusion and the realization of the interactive experience of the virtual and real world, which

constitutes the fundamental symbol of the meta-universe different from any previous digital learning environment (Li Lin, 2024).

When the meta-universe, a subversive technology, is deeply integrated with the field of vocational education, its potential lies in the fundamental empowerment of the vocational education system. The meta-universe of vocational education is essentially the application form and value embodiment of this technology in the field of specific education. It combines the interaction and information analysis capabilities of the virtual world and the real world, and places the core links of teaching, learning, practice, evaluation and creation of vocational education in a composite space that integrates the virtual simulation environment and real physical elements. As a result, a composite ecology of vocational education that integrates virtual and physical, intelligent and technological integration has been derived. In this ecosystem, learners become the center, and they can make full use of the technical characteristics of the meta-universe. In particular, augmented reality (AR) technology superimposes virtual information on real devices or scenes to provide real-time guidance. Artificial intelligence (AI) technology provides personalized learning paths, intelligent tutoring and instant feedback, as well as other comprehensive technologies such as virtual reality (VR), blockchain (to ensure that learning results are credible), and cloud computing (to provide powerful computing power) to jointly build a digital learning and practice environment. Learners can accurately simulate expensive, dangerous or difficult to obtain real equipment operations through virtual simulation. Repeated process training through virtual experiments without consuming real materials or taking risks ; through the virtual scene into any required work situation (such as modern factory assembly line, operating room, construction site, international conference, etc.). These methods enable learners to efficiently and safely acquire vocational skills knowledge that is similar to the real world or even beyond the reality in some dimensions ( uch as repeatability, scalability, security). In the end, the meta-universe of vocational education aims to provide learners with a highly personalized (adapting to individual learning rhythms and abilities), immersive (deep involvement in learning situations), and interactive (real-time collaboration with virtual objects, intelligent tutors, and other learners) vocational education experience, thereby greatly

improving the efficiency, depth, and breadth of skill acquisition (Wang Xia, et al, 2024).

## 2.2 The Core Elements of the Meta-cosm Ecology of Vocational Education

The realization of meta universe ecology needs to integrate network computing power, artificial intelligence, game technology, imaging technology (such as AR and VR) and blockchain resources, and rely on advanced equipment hardware, powerful technology platform and external digital economy environment as support. The core elements such as resources, equipment, platform and external environment affect the ecological establishment of the meta-universe of vocational education, as shown in Figure 1. Resources provide the content of ecological learning of vocational education, including the content of virtual learning, virtual teaching tools and teaching materials. The device is a digital product with diverse functions and high user acceptance, ensuring that learners enter the meta-universe ; the platform is responsible for managing learners and realizing social needs, including learner management, virtual experiment development platform, online course market and learning community ; the external environment includes policy and regulation environment, market demand, social and cultural background and industry technology development trend (Wang Qing & Kan Zhonghua, 2024 ).

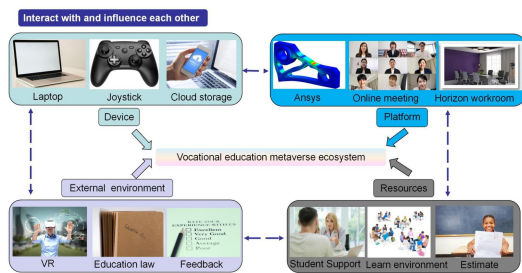


Fig.1 The composition of the meta-cosm ecology of vocational education

The characteristics and advantages of meta-universe technology in building a new ecology of vocational education

The meta-universe technology has a series of characteristic advantages in constructing the new ecology of vocational education, including the transformation of learning subjectivity, the perception of group openness, the integration of virtual and real practice, and the integrated construction of process.

## 3 Meta-Verse Vocational Education: Transformative Learning

### 3.1 The Change of Subjectivity in Learning

The meta-universe of vocational education leads to the concepts of "learner-centered" and "learner-centered." (Lyu Donggang & Tan Weizhi, 2023) In the immersive virtual learning scene, learners have autonomy. In the meta-universe, learners enjoy an autonomous learning experience. They can freely explore, interact and create, interact with the virtual environment, and accumulate knowledge and skills through practice and experience. This kind of autonomous learning experience promotes learners to change from passive acceptance to active participation, thus improving the depth and effect of learning. At the same time, meta-universe technology can formulate personalized learning plans for learners, explore various learning scenarios, shape their own learning space, and make learners ' learning process in the meta-universe of vocational education more independent and personalized.

### 3.2 Openness Perception of the Group

Meta-universe technology connects learners to a global learning community in which learners can interact and communicate with classmates, mentors and experts from different cultural backgrounds and regions. This open perception expands learners ' horizons, promotes cross-cultural communication and cooperation, and cultivates the spirit of openness, inclusiveness and cooperation. Learners can form learning groups, participate in project cooperation, and hold activities in the meta-universe virtual space to explore and learn together, which enhances the sociability and interactivity of learning.

### 3.3 The Integration of Virtuality and Reality of Practice

The virtual practice environment simulates the scenes and situations of the real world through meta-universe technology, providing learners with practical learning opportunities. Learners can use virtual reality technology to participate in simulation experiments, actual combat exercises and complex situations, thereby improving practical operation skills while reducing learning costs and risks. Meta-universe technology realizes the seamless connection between practice and reality, and the knowledge and skills acquired by learners in virtual environment can be directly applied to real life and work. This integration of virtuality

and reality makes learning closer to the actual needs and improves the practicability and applicability of learning.

### **3.4 Integrated Construction of Process**

Integrated learning process is a major feature of meta-universe technology.

It integrates and optimizes all aspects and processes of learning, breaking the discipline barriers and time and space constraints in traditional teaching. Learners can complete knowledge acquisition, practical exploration, social interaction and other learning activities in the same virtual space, and realize the integrated construction of learning process. In addition, meta-universe technology also provides intelligent learning support through intelligent algorithms and data analysis, providing learners with personalized learning support and guidance. The system can intelligently adjust the learning content and path according to the feedback and performance of learners, and provide a customized learning experience, thereby enhancing the efficiency and effectiveness of learning.

## **4 Risks and Challenges in the Construction of Metacosm Ecological Reality in Vocational Education**

The deep integration of the meta-universe of vocational education has brought a breakthrough point for the reform and innovation of vocational education. Its four types of connotation characteristics : the transformation of learning subjectivity, the perception of group openness, the integration of virtual and real practice, and the integrated construction of process have brought new possibilities for the meta-universe ecology of vocational education. However, the meta-universe of vocational education also faces some practical difficulties and ethical risks.(Wang Zhuxin, et al, 2023)

### **4.1 Lack of Top-level Design and Evaluation Mechanism**

One of the main challenges facing the meta-cosm ecology of vocational education is the lack of top-level design and evaluation mechanisms. Because the meta-universe technology is still in the early stage of development, the education industry has not yet established perfect norms and standards, which leads to the lack of unified guidelines and evaluation standards for the construction of educational meta-universe ecology. The lack of top-level design makes it difficult for educational institutions to grasp the direction in the process of

meta-universe ecological construction, and it is easy to fall into a scattered process of trial and error, which wastes a lot of human, material and financial resources. At the same time, the lack of evaluation mechanism also makes it difficult to quantify and evaluate the effect of education meta universe ecology, and it is impossible to find and solve the existing problems in time, which affects the improvement of education quality and effect. Therefore, it is very important to establish a perfect top-level design and evaluation mechanism to promote the healthy development of the meta universe ecology of vocational education.

### **4.2 The Technology is not Mature Enough and the Application Threshold is High.**

One of the main challenges faced by the meta-cosm ecology of vocational education in technology is that the technology is not mature enough and the application threshold is high. At present, the meta-universe technology is still in the early stage of development, and related technologies including virtual reality, augmented reality, artificial intelligence and so on need more research and development and improvement. The application of these technologies requires high cost investment, including the procurement of hardware and software equipment, the training of technical personnel, etc., which is a huge challenge for many educational institutions and individuals. In addition, due to the immaturity of technology, there are certain uncertainties in its stability, performance and learning experience, which increases the risk and hesitation of educational institutions and institutions in adopting meta-universe technology.

### **4.3 Lack of in-depth Exploration of Teaching Application**

The meta-universe ecology of vocational education is facing the challenge of insufficient in-depth exploration in teaching application. Although meta-universe technology has brought new possibilities for teaching, due to the relative novelty and complexity of technology, educational practitioners often lack in-depth exploration and application when using meta-universe for teaching. Teachers and educational institutions may be more willing to adopt traditional teaching methods, while they are conservative about the exploration and application of meta-universe technology. At present, some colleges and universities have configured the meta-universe teaching platform, but the

teaching concept is old, the shortage of resources and the lack of motivation are still troubled. More than half of the college teachers are not familiar with the use, it is difficult to imagine its application in classroom teaching, still can not really touch the real problems and needs of vocational education. In addition, the possible costs and risks of educational institutions in investing in meta-universe technology also make them reluctant to conduct more in-depth exploration.

#### **4.4 Risks of Capital Speculation and Kidnapping**

In the metacosm ecology of vocational education, there are risks of capital speculation and kidnapping. With the rise of meta-universe technology, it has attracted an influx of capital, but some of it may focus more on hype and marketing than on the value and quality of education itself. In this case, some educational institutions or platforms may over-pursue profitability, ignore the essence of education and teaching, and even attract customers with low-quality content and services to obtain higher returns. In addition, some capital may try to monopolize the education market of the universe by means of large-scale investment and acquisition, and then kidnap the market, affect the fair competition environment of the market and limit the development space of other competitors. Therefore, there is a risk of capital speculation and kidnapping in the meta-universe ecology of vocational education. It is necessary for regulatory authorities and relevant agencies to strengthen supervision to ensure that the development of meta-universe technology can truly benefit education and promote the healthy development of education.

##### **Ethical Risks Exist in 3.5 Yuan Cosmic Technology**

In the meta-cosm ecology of vocational education, there are ethical risks in the application of meta-cosm technology. First of all, the construction and operation of virtual environment may involve the collection and use of personal privacy information. If privacy protection is not in place, it may lead to the leakage and abuse of personal information. Secondly, virtual reality technology may bring physical and psychological discomfort, such as dizziness, dizziness and other adverse reactions, especially for learners who use it for a long time, which may have an impact on physical and mental health. In addition, there is a risk of virtual fraud and false information in the virtual environment. If the authenticity and credibility of the virtual scene are not high, it may mislead learners and affect their learning and judgment.

## **5 Development Measures of Vocational Education Meta Universe Digital Ecology**

In the digital ecological transformation of vocational education, meta-universe technology can provide many advantages for the digital transformation of vocational education, but it also brings a series of practical challenges. In essence, these challenges are due to the lack of clear policy guidance and cross-sectoral and interdisciplinary coordination. Therefore, it is urgent to explore the rational application of meta-universe to solve the problems and risks in vocational education, and to escort the sustainable development of the meta-universe of vocational education.

### **5.1 Policy Regulation and Theoretical Practice are Equally Important**

The construction of policy regulation is particularly urgent under the background of the digital ecological transformation of vocational education. At the national level, it is necessary to clarify the needs of vocational education personnel training, teaching mode and learner characteristics. This requires policy makers to conduct extensive research, in-depth analysis, and full communication and consultation with relevant departments and stakeholders to formulate policy guidance that meets the needs of the times. Especially for the emerging field of vocational education meta-universe, due to the lack of relevant experience and guidance, local government agencies should do a good job in policy guidance for the digital transformation of vocational education, provide feasible research support for the digital transformation of meta-universe education, and provide theoretical support and guidance for future development. The government also needs to provide corresponding support and guidance at the practical level, and promote the innovation and development of the meta-universe ecology of vocational education by formulating incentive policies and funding projects.

At present, there are great differences in the development status of the meta-cosm ecology of vocational education in various regions across the country, and differentiated development strategies can be adopted according to specific conditions. On the one hand, we can learn from the experience and practices of developed provinces to promote the development of underdeveloped regions ; on the other hand, through the establishment of cross-regional cooperation mechanisms and professional market counterparts, resource sharing and complementary

advantages can be realized, and the healthy and sustainable development of the vocational education universe can be promoted.

### **5.2 Strengthen Technical Support, Reduce the Threshold Cost**

First of all, strengthening meta-cosmic technology support means investing in advanced virtual reality and augmented reality technologies to provide a more immersive and efficient learning experience. Secondly, reducing the price of hardware and software equipment can popularize the application of meta-universe technology in teaching. Through online training and resource sharing, it can provide more flexible and convenient learning methods and reduce the threshold of technical learning. These measures will help to solve the dilemma in the construction of the meta-universe ecology of vocational education, provide high-quality meta-universe teaching services, and provide more learners with the opportunity to participate in the digital ecological construction.

### **5.3 Pay Attention to Individual Learners, Take a Variety of Measures to Avoid Risks.**

The mission of vocational education is to comprehensively cultivate the knowledge, skills and professional ethics required by learners to obtain specific occupations, emphasizing the importance of individuals. In the construction of the meta-universe ecology of vocational education, learners may face problems such as addiction, privacy security and educational equity. For the problem of addiction, a hierarchical management mechanism can be established and the use time of learners can be limited. For privacy security issues, we should always take people as the core principle and do a good job in data confidentiality ; in view of the fairness of digital education in the universe, it is necessary to clarify the development logic, formulate unified standards for digital teaching evaluation, and promote the fairness of education. At the same time, it is necessary to strengthen the popularization of theoretical knowledge, technical protection and privacy security of meta-universe technology, maintain vigilance, discover potential risks in time, and strengthen management and standardization.

### **5.4 Vigilance against Capital Monopoly, Cooperation has Boundaries**

The construction of the meta universe ecology of vocational education involves many stakeholders, including social politics, economy and culture. Capital has a dual nature. On the one hand, it promotes the construction of the meta-universe ecology of vocational education. On the other hand, it may also bring monopoly risks due to the pursuit of profits. Since the construction of meta-cosm ecology involves the participation of colleges and enterprises, the relationship between schools, enterprises and market capital needs to have boundaries. In the early stage of the co-construction of the meta-universe ecology by both schools and enterprises, enterprise executives and college managers should establish a management mechanism for capital anti-intervention monopoly, and provide economic and legal support for diversified cooperation, so as to ensure that all parties can achieve mutual benefit and win-win results in ecological construction.

## **6 Conclusion**

As a virtual space that transcends the real world, the integration of the universe and vocational education provides a broad development prospect, but also faces many challenges and difficulties. In the construction of the meta-cosm ecology of vocational education, it is necessary to construct the meta-cosm ecology of vocational education through the implementation of a series of measures, such as paying equal attention to policy regulation and theoretical practice, strengthening technical support, reducing threshold costs, paying attention to individual protection of learners, and preventing capital risks, so as to realize the sustainable development of the digital ecology of vocational education.

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