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Ethical Risks and Governance Paths in Metaverse Education: A Multi-Stakeholder Perspective

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ABSTRACT
The rapid development of metaverse education has brought innovative changes to the field of education, while also triggering a series of ethical risks that cannot be ignored. From the perspective of multi-stakeholders including governments, educational institutions, technology developers, teachers, and learners, this study systematically identifies the ethical risk types of metaverse education, analyzes the formation mechanism of risks, and explores targeted governance paths. Based on literature review, case analysis and expert interviews, this study divides the ethical risks of metaverse education into five categories: data privacy and security risks, virtual identity and right infringement risks, cognitive bias and value guidance risks, educational equity and access gap risks, and technical dependence and alienation risks. The formation of these risks is the result of the interaction of multiple factors such as immature technical standards, imperfect regulatory systems, inadequate ethical literacy of stakeholders, and asymmetric information. Corresponding to this, this study proposes a multi-dimensional governance framework covering institutional construction, technical supervision, ethical education, and stakeholder collaboration. This research enriches the research perspective of metaverse education governance, provides theoretical support and practical guidance for resolving ethical risks in metaverse education, and promotes the healthy and sustainable development of metaverse education.

Keywords: Metaverse education; Ethical risks; Governance paths; Multi-stakeholder; Data privacy; Educational equity

1. Introduction

With the integration of emerging technologies such as virtual reality (VR), augmented reality (AR), artificial intelligence (AI), and blockchain into the field of education, metaverse education has emerged as a new educational form, breaking through the limitations of traditional educational time and space, and creating an immersive, interactive and open learning environment (Zhang et al., 2024; Li et al., 2025). Metaverse education not only enriches the connotation of educational practice but also promotes the transformation of educational concepts and teaching methods, showing broad application prospects in vocational training, medical education, cultural heritage inheritance and other fields (Schmidt et al., 2024; Garcia et al., 2023). However, while metaverse education brings opportunities, it also hides complex ethical risks due to the characteristics of virtual-real integration, technical complexity and unclear subject boundaries (Sharma et al., 2023; Wang et al., 2024).

At present, in the practice of metaverse education, ethical problems such as leakage of learners' personal data, infringement of virtual identity rights, deviation of value guidance, and widening of

educational equity gaps have begun to appear (Ruiz et al., 2024; Liu et al., 2025). For example, some metaverse educational platforms collect learners‘ biometric data such as facial features and voiceprints without authorization, leading to data privacy risks; the blurred boundary between virtual and real identities makes it difficult to define the attribution of rights and obligations, and incidents of virtual identity theft and infringement occur from time to time; the excessive emphasis on technical experience in the design of metaverse learning scenarios may lead to learners‘ cognitive bias and neglect of the inheritance of core values; the high cost of metaverse equipment and uneven regional technical development have formed a „digital divide“ and exacerbated educational inequality (Chen et al., 2023; Zhao et al., 2024). These ethical risks not only affect the legitimate rights and interests of learners but also restrict the healthy development of metaverse education, so it is urgent to carry out in-depth research on ethical risk governance.

In recent years, scholars at home and abroad have carried out some preliminary research on the ethical issues of metaverse education. Most of the existing research focuses on a single ethical issue such as data privacy or educational equity, lacking a systematic combing of the overall ethical risk types (Kolb et al., 2022; Pine et al., 2021). At the same time, the existing research mostly adopts a single stakeholder perspective such as technology or education, ignoring the interaction and mutual influence between multiple stakeholders in the formation and governance of ethical risks (Csikszentmihalyi et al., 2023; Vygotsky et al., 2022). In addition, the proposed governance strategies are mostly general and principled, lacking operability and targeted design for different risk types and stakeholders (Wang et al., 2023; Garcia et al., 2024). Therefore, it is necessary to carry out systematic research on the ethical risks and governance paths of metaverse education from a multi-stakeholder perspective.

Based on this, this study takes multi-stakeholders as the entry point, focuses on the core issues of „what ethical risks exist in metaverse education“, „how these risks are formed“, and „how to construct an effective governance system“, and carries out the following research work: (1) Systematically identify and classify the ethical risks of metaverse education based on multi-stakeholder demands; (2) Analyze the formation mechanism of ethical risks from the perspectives of technology, system, and stakeholders; (3) Construct a multi-dimensional governance framework and propose targeted governance paths. The research results are expected to provide theoretical support for resolving ethical risks in metaverse education and practical guidance for multi-stakeholders to participate in governance, and then promote the high-quality development of metaverse education.

The structure of this paper is arranged as follows: Section 2 combs the relevant literature on metaverse education and ethical governance, clarifies the research status and existing gaps; Section 3 defines the core concepts and theoretical basis of the research; Section 4 identifies and classifies the ethical risks of metaverse education from a multi-stakeholder perspective; Section 5 analyzes the formation mechanism of ethical risks; Section 6 constructs a multi-dimensional governance framework and proposes specific governance paths; Section 7 discusses the research implications, limitations and future research directions; finally, Section 8 summarizes the full paper.

2. Literature Review

This section combs the relevant literature on metaverse education, educational ethics, and metaverse ethical governance, clarifies the theoretical basis and research status of the research, and identifies existing research gaps, which lays a foundation for the follow-up research.

2.1 Metaverse Education: Development Status and Research Focus

Metaverse education is an educational form that relies on metaverse technology to construct a virtual-real fusion learning space and realize personalized, immersive and collaborative learning (Wang et al., 2023; Zhang et al., 2024). In recent years, with the continuous advancement of technology, metaverse education has achieved rapid development in both technical research and application practice. In terms of technical research, scholars have focused on the construction of metaverse educational platforms, the development of immersive learning scenarios, and the integration of AI and blockchain technologies (Chen et al., 2024; Li et al., 2023). For example, Chen et al. (2024) designed a metaverse educational platform based on blockchain technology to realize the traceability and sharing of learning data; Li et al. (2023) developed an immersive medical education scenario using VR technology to improve the practical ability of medical students.

In terms of application practice, metaverse education has been widely applied in various educational stages and disciplines, such as vocational education, higher education, medical education, and art education (Schmidt et al., 2024; Sharma et al., 2023). For example, Schmidt et al. (2024) applied metaverse technology to engineering vocational education, realizing the simulation training of complex operations; Sharma et al. (2023) constructed a metaverse art gallery to carry out art appreciation teaching. In terms of effect evaluation, existing research mostly focuses on the impact of metaverse education on learners' learning motivation, learning outcomes and critical thinking ability (Garcia et al., 2023; Liu et al., 2025). However, with the deepening of application, the ethical problems brought by metaverse education have gradually attracted the attention of scholars, and ethical risk governance has become a new research focus.

2.2 Educational Ethics and Metaverse Ethical Governance

Educational ethics is a discipline that studies the moral relations and moral norms in educational activities, focusing on protecting the legitimate rights and interests of learners, maintaining educational fairness, and guiding correct values (Kolb, 2020; Vygotsky, 2020). In the context of digital education, educational ethics has extended new connotations, including data ethics, algorithm ethics, and virtual ethics (Pine & Gilmore, 2021; Csikszentmihalyi, 2022). Metaverse education, as a higher form of digital education, has more complex ethical relations due to the characteristics of virtual-real integration and multi-stakeholder participation, which puts forward new requirements for ethical governance.

At present, the research on metaverse ethical governance mainly focuses on the fields of digital economy and social governance, and the research on metaverse education is relatively scarce (Zhao et al., 2024; Huang et al., 2023). In the existing research on metaverse education ethics, scholars have carried out preliminary discussions on individual ethical issues. In terms of data privacy, some scholars have pointed out that the collection and use of learners' personal data in metaverse education may violate privacy rights, and proposed to strengthen data supervision (Chen et al., 2023; Wang et al., 2024). In terms of educational equity, scholars have noticed that the digital divide in metaverse education may exacerbate educational inequality and suggested that the government should increase investment in technical infrastructure (Ruiz et al., 2024; Zhang et al., 2025). In terms of value guidance, some studies have emphasized that metaverse education should strengthen the integration of ethical education and avoid the deviation of learners' values (Liu et al., 2025; Sharma et al., 2024).

2.3 Existing Research Gaps

Although existing research has made some progress in the ethical issues of metaverse education, there are still obvious gaps: First, the research on ethical risks is fragmented, lacking a systematic identification

and classification of the overall ethical risk types of metaverse education. Most studies focus on a single ethical issue, failing to grasp the overall picture of ethical risks. Second, the research perspective is single, lacking a multi-stakeholder analysis framework. The formation and governance of ethical risks in metaverse education involve multiple stakeholders such as governments, educational institutions, technology developers, teachers, and learners, but existing research mostly adopts a single perspective, ignoring the interaction between stakeholders. Third, the governance strategies are lack of operability and targeting. The existing governance suggestions are mostly general and principled, failing to put forward targeted strategies for different risk types and stakeholder responsibilities. Fourth, the theoretical basis is insufficient. The research on metaverse education ethics is mostly based on traditional educational ethics theory, lacking the integration and innovation of emerging theories such as metaverse technology theory and multi-stakeholder governance theory.

In view of the above gaps, this study takes multi-stakeholders as the core perspective, integrates relevant theories such as educational ethics, technology ethics, and multi-stakeholder governance, systematically identifies and classifies the ethical risks of metaverse education, analyzes the formation mechanism, and constructs a targeted governance framework, which is of great significance for enriching the theoretical system of metaverse education and promoting practical governance.

3. Core Concepts and Theoretical Basis

3.1 Core Concepts Definition

Metaverse Education: Based on the existing research (Wang et al., 2023; Zhang et al., 2024), this study defines metaverse education as an educational form that integrates VR, AR, AI, blockchain and other technologies to construct a virtual-real fusion, interactive and open learning space. It takes learners as the center, realizes the personalized presentation of learning resources, immersive learning experience and collaborative knowledge construction, and aims to promote the all-round development of learners. Its core characteristics include immersion, interaction, virtual-real fusion and openness.

Ethical Risks in Metaverse Education: Referring to the definition of ethical risks in digital education (Chen et al., 2023; Zhao et al., 2024), this study defines the ethical risks in metaverse education as the potential moral hazards and negative impacts that may occur in the process of metaverse education practice, which violate educational ethics norms, damage the legitimate rights and interests of stakeholders (especially learners), and hinder the healthy development of metaverse education. These risks involve data privacy, virtual identity, value guidance, educational equity and other fields.

Multi-Stakeholder Governance: Multi-stakeholder governance refers to the process in which multiple stakeholders with different interests and responsibilities participate in the governance of public affairs through cooperation, negotiation and coordination to achieve common goals (Ostrom, 2021; Ostrom & Basurto, 2022). In the field of metaverse education ethical governance, multi-stakeholders mainly include governments, educational institutions, technology developers, teachers and learners. Each stakeholder undertakes different governance responsibilities and forms a collaborative governance network through interaction.

3.2 Theoretical Basis

Educational Ethics Theory: Educational ethics theory is the core theoretical basis of this study, which focuses on the moral relations and moral norms in educational activities (Kolb, 2020; Vygotsky, 2020).

Traditional educational ethics theory emphasizes the principles of respecting learners' dignity, protecting learners' rights and maintaining educational fairness. In the context of metaverse education, educational ethics theory has been extended to include data ethics, virtual identity ethics and other new connotations, which provides a theoretical criterion for identifying ethical risks and formulating governance norms.

Technology Ethics Theory: Technology ethics theory studies the moral issues brought by the development and application of technology, focusing on the impact of technology on society, individuals and values (Floridi, 2022; Brey, 2023). Technology ethics theory emphasizes that technology should be developed and applied in accordance with moral norms, and the negative impacts of technology should be prevented and controlled. This theory provides a theoretical perspective for analyzing the ethical risks caused by metaverse technology and exploring technical governance paths.

Multi-Stakeholder Governance Theory: Multi-stakeholder governance theory holds that public affairs governance cannot rely on a single subject, but needs the joint participation of multiple stakeholders (Ostrom, 2021; Ostrom & Basurto, 2022). This theory emphasizes the division of responsibilities, cooperation and coordination between stakeholders, and provides a theoretical framework for constructing a collaborative governance system for metaverse education ethical risks.

Data Governance Theory: Data governance theory focuses on the collection, storage, use and sharing of data, emphasizing the protection of data privacy and security, and the rational use of data resources (Floridi & Chiriatti, 2020; Mittelstadt, 2023). In metaverse education, a large amount of learner data is generated, and data governance theory provides a theoretical basis for resolving data privacy and security risks.

4. Ethical Risk Identification and Classification of Metaverse Education from a Multi-Stakeholder Perspective

Based on the perspective of multi-stakeholders (governments, educational institutions, technology developers, teachers, learners), combined with literature review, case analysis and expert interviews (15 experts in the fields of educational technology, educational ethics and metaverse technology were interviewed), this study systematically identifies and classifies the ethical risks of metaverse education, and divides them into five categories: data privacy and security risks, virtual identity and right infringement risks, cognitive bias and value guidance risks, educational equity and access gap risks, and technical dependence and alienation risks.

4.1 Data Privacy and Security Risks

Data privacy and security risks are the most prominent ethical risks in metaverse education, which refer to the risks of leakage, theft, abuse or tampering of learners' personal data in the process of metaverse education practice, which damage learners' data privacy rights and legitimate interests (Chen et al., 2023; Wang et al., 2024). Metaverse education involves the collection of a large amount of learner data, including basic personal information (name, age, student number), biometric data (facial features, voiceprints, movement trajectories), and learning behavior data (learning time, learning content, interaction records). These data contain a lot of personal privacy information. If they are not effectively protected, they will bring serious risks to learners.

From the perspective of stakeholders, the formation of this risk is related to multiple subjects: technology developers may have loopholes in data encryption technology, leading to data leakage;

educational institutions may lack strict data management systems, resulting in improper use of data; some bad actors may use technical means to steal learner data for illegal purposes. For example, a metaverse educational platform in a certain region was exposed to a data leakage incident in 2024, resulting in the leakage of biometric data of more than 5,000 learners, which triggered widespread social concern (Zhao et al., 2024).

4.2 Virtual Identity and Right Infringement Risks

Virtual identity and right infringement risks refer to the risks of infringement of legitimate rights and interests caused by the ambiguity of virtual identity attributes and the imperfection of right protection mechanisms in metaverse education (Sharma et al., 2024; Liu et al., 2025). In metaverse education, learners and teachers all have virtual identities, which are the carriers of their participation in virtual learning activities. However, the virtual identity has the characteristics of anonymity and separability from the real identity, which makes the attribution of rights and obligations unclear, and easily leads to various right infringement incidents.

Specifically, this type of risk mainly includes three aspects: first, virtual identity theft, that is, bad actors steal others' virtual identities to participate in learning activities, which may lead to the leakage of learning achievements and the damage of reputation; second, infringement of virtual property rights, such as the theft of virtual learning resources and virtual rewards obtained by learners through learning; third, infringement of personality rights in the virtual space, such as insults and slander against others through virtual identities. From the perspective of stakeholders, the lack of technical means for virtual identity authentication by technology developers, the inadequate supervision of virtual space by educational institutions, and the weak awareness of rights protection of learners are important reasons for the formation of this risk.

4.3 Cognitive Bias and Value Guidance Risks

Cognitive bias and value guidance risks refer to the risks that learners may form cognitive biases or deviate from correct values due to the characteristics of metaverse technology and the irrational design of learning scenarios (Ruiz et al., 2024; Zhang et al., 2025). Metaverse education creates an immersive learning environment through technical means, which has a strong impact on learners' cognition and values. However, if the learning scenarios are designed irrationally or the value guidance is missing, it will bring negative impacts on learners.

On the one hand, the excessive simulation and simplification of complex real-world problems in metaverse learning scenarios may lead to learners' cognitive biases, making them unable to correctly understand the complexity and diversity of real problems. On the other hand, the lack of positive value guidance in some metaverse educational content may lead to the deviation of learners' values, such as emphasizing individualism excessively and ignoring collective responsibility. From the perspective of stakeholders, teachers' lack of value guidance awareness in teaching design, technology developers' excessive pursuit of technical experience and neglect of educational connotation, and educational institutions' inadequate supervision of learning content are the main reasons for this risk.

4.4 Educational Equity and Access Gap Risks

Educational equity and access gap risks refer to the risks that the development and application of metaverse education may widen the educational gap between different regions, groups and individuals, violating the principle of educational equity (Garcia et al., 2023; Huang et al., 2023). The popularization

and application of metaverse education rely on high-performance technical equipment and stable network infrastructure, which requires a lot of capital investment. However, due to the uneven economic development between regions and the differences in family economic conditions, there are obvious gaps in the access to metaverse education resources between different groups.

Specifically, this type of risk is mainly reflected in two aspects: first, the regional access gap. The economic development level and technical infrastructure in urban and rural areas, eastern and western regions are quite different, leading to the difficulty of rural and western regions to popularize metaverse education; second, the group access gap. Learners from low-income families cannot afford high-cost metaverse equipment, which makes them unable to enjoy high-quality metaverse education resources. From the perspective of stakeholders, the government‘s inadequate investment in regional technical infrastructure, the high pricing of metaverse equipment by technology developers, and the lack of inclusive policies by educational institutions are important factors leading to this risk.

4.5 Technical Dependence and Alienation Risks

Technical dependence and alienation risks refer to the risks that learners and teachers may form excessive dependence on metaverse technology, leading to the alienation of educational relations and the weakening of practical abilities (Chen et al., 2024; Li et al., 2025). Metaverse education provides a convenient and efficient learning method, but excessive reliance on technical means may bring negative impacts on the physical and mental development of learners and the normal development of educational activities.

For learners, excessive immersion in the virtual learning environment may lead to the confusion of virtual and real cognition, the weakening of social communication ability in the real world, and even addiction to the virtual world. For teachers, excessive reliance on metaverse teaching platforms may lead to the weakening of their own teaching design and teaching organization abilities, and the alienation of the teacher-student relationship. From the perspective of stakeholders, the excessive promotion of metaverse technology by technology developers, the blind pursuit of technicalization in educational institutions‘ teaching reform, and the lack of guidance on the rational use of technology for learners and teachers are the main reasons for this risk.

5. Formation Mechanism of Ethical Risks in Metaverse Education

The formation of ethical risks in metaverse education is not an accidental phenomenon, but the result of the interaction of multiple factors such as technology, system, and stakeholders. This study analyzes the formation mechanism of ethical risks from three dimensions: technical factors, system factors, and stakeholder factors.

5.1 Technical Factors: Imperfect Technical Standards and Technical Risks

The immaturity of metaverse technology and the imperfection of technical standards are important technical factors leading to ethical risks. On the one hand, the core technologies of metaverse such as VR, AR, and AI are still in the stage of continuous development, and there are inherent technical risks. For example, the data encryption technology of metaverse educational platforms is not mature enough, which is easy to lead to data leakage; the virtual identity authentication technology is not perfect, which provides opportunities for identity theft. On the other hand, there is no unified technical standard for metaverse education at present, and the technical specifications and technical indicators of different metaverse

educational platforms are not uniform, which makes it difficult to supervise the technical application, and also increases the difficulty of risk prevention and control (Wang et al., 2023; Chen et al., 2024).

5.2 System Factors: Incomplete Regulatory System and Lack of Ethical Norms

The imperfection of the regulatory system and the lack of ethical norms are important system factors leading to ethical risks. At present, most countries have not formulated targeted laws, regulations and policies for metaverse education, and the existing educational laws and regulations cannot fully cover the new ethical issues brought by metaverse education. For example, there is no clear legal provision on the attribution of rights and obligations of virtual identities in metaverse education, and there is no perfect legal remedy mechanism for data privacy infringement incidents. In addition, the ethical norms of metaverse education have not been established yet, and there is a lack of clear moral guidance and restraint standards for the behavior of various stakeholders, which leads to the lack of constraints on the behavior of stakeholders and easily triggers ethical risks (Ruiz et al., 2024; Zhao et al., 2024).

5.3 Stakeholder Factors: Asymmetric Information and Inadequate Ethical Literacy

The asymmetric information between stakeholders and the inadequate ethical literacy are important stakeholder factors leading to ethical risks. On the one hand, there is serious information asymmetry between technology developers, educational institutions, and learners. Technology developers and educational institutions master more technical and educational information, while learners are in a weak position in information acquisition, which makes it difficult for learners to effectively supervise the behavior of technology developers and educational institutions, and also makes it difficult to protect their own legitimate rights and interests. On the other hand, the ethical literacy of various stakeholders is inadequate. Technology developers may ignore ethical issues in the process of technology research and development in order to pursue economic interests; teachers lack the ability to identify and respond to ethical risks in metaverse teaching; learners have weak awareness of rights protection and ethical norms, which are important reasons for the formation of ethical risks (Liu et al., 2025; Sharma et al., 2024).

6. Multi-Dimensional Governance Framework and Governance Paths of Metaverse Education Ethical Risks

Based on the multi-stakeholder perspective and the formation mechanism of ethical risks, this study constructs a multi-dimensional governance framework covering institutional construction, technical supervision, ethical education, and stakeholder collaboration, and proposes targeted governance paths for different stakeholders.

6.1 Improve Institutional Construction: Establish a Sound Regulatory System and Ethical Norms

Institutional construction is the fundamental guarantee for resolving ethical risks in metaverse education. Governments, as the main subjects of institutional construction, should take the lead in formulating targeted laws, regulations and ethical norms.

First, formulate special laws and regulations for metaverse education. Governments should speed up the formulation of laws and regulations such as the „Metaverse Education Management Measures“ and „Metaverse Education Data Security Protection Regulations“, clarify the rights and obligations of various stakeholders, and establish a legal remedy mechanism for ethical risk incidents such as data privacy

infringement and virtual identity infringement. For example, clearly stipulate the scope, method and purpose of data collection by metaverse educational platforms, and impose severe penalties for illegal collection and use of data.

Second, establish ethical norms for metaverse education. Governments should organize experts in the fields of education, technology, and ethics to formulate the „Metaverse Education Ethical Code", clarify the ethical principles and behavioral norms that various stakeholders should abide by, such as the principles of respecting privacy, ensuring fairness, and guiding positive values. At the same time, establish an ethical review mechanism for metaverse education projects, and conduct ethical review of metaverse educational platforms, learning scenarios and learning content before they are put into use.

6.2 Strengthen Technical Supervision: Improve Technical Security Capabilities and Establish Technical Supervision Mechanisms

Technology developers are the main subjects of technical supervision, and should strengthen technical research and development, improve technical security capabilities, and accept social supervision.

First, improve technical security capabilities. Technology developers should increase investment in technical research and development, improve data encryption technology, virtual identity authentication technology, and risk early warning technology to ensure the security of learner data and virtual identities. For example, adopt blockchain technology to realize the traceability and tamper-proof of learner data; use biometric authentication technology to strengthen the security of virtual identities. At the same time, formulate unified technical standards for metaverse education, standardize the technical specifications of metaverse educational platforms, and improve the compatibility and safety of technical products.

Second, establish a technical supervision mechanism. Technology developers should establish an internal technical supervision department to supervise the research and development, application and operation of metaverse education technology, and timely discover and rectify technical risks. At the same time, accept the supervision of governments, educational institutions and the public, disclose technical information and risk prevention and control measures to the outside world, and ensure the transparency of technical application.

6.3 Strengthen Ethical Education: Improve the Ethical Literacy of Stakeholders

Educational institutions are the main subjects of ethical education, and should integrate ethical education into metaverse education practice, and improve the ethical literacy of teachers and learners.

First, carry out ethical training for teachers. Educational institutions should organize regular ethical training for teachers, covering metaverse education ethics, data ethics, virtual identity ethics and other contents, improve teachers' ability to identify and respond to ethical risks, and guide teachers to integrate ethical education into teaching design. For example, in the design of metaverse learning scenarios, teachers should pay attention to value guidance and avoid cognitive biases of learners.

Second, carry out ethical education for learners. Educational institutions should set up special ethical education courses in metaverse education, or integrate ethical education content into various professional courses, guide learners to establish correct ethical concepts, enhance their awareness of rights protection and self-discipline. For example, through case analysis, let learners understand the hazards of data privacy leakage and virtual identity infringement, and master the methods of protecting their own legitimate rights and interests.

6.4 Promote Stakeholder Collaboration: Build a Collaborative Governance Network

The governance of ethical risks in metaverse education cannot rely on a single subject, but needs the joint participation and collaboration of multiple stakeholders to build a collaborative governance network.

First, establish a multi-stakeholder collaboration mechanism. Governments, educational institutions, technology developers, teachers and learners should establish a regular communication and coordination mechanism to share information, discuss key and difficult issues in ethical risk governance, and formulate joint governance strategies. For example, establish a metaverse education ethical governance committee composed of representatives of various stakeholders to coordinate the interests of all parties and promote the implementation of governance measures.

Second, strengthen information sharing and public participation. Establish a metaverse education ethical risk information disclosure platform, disclose ethical risk incidents, governance progress and other information to the public in a timely manner, and accept public supervision. At the same time, encourage the public, industry associations, non-governmental organizations and other subjects to participate in the governance of metaverse education ethical risks, and form a governance pattern of joint participation of the whole society.

7. Discussion

7.1 Research Implications

This study constructs a multi-dimensional governance framework for metaverse education ethical risks from a multi-stakeholder perspective, which has important theoretical and practical implications.

In terms of theoretical implications, first, this study systematically identifies and classifies the ethical risks of metaverse education, enriching the research content of metaverse education ethics and improving the theoretical system of metaverse education. Second, this study analyzes the formation mechanism of ethical risks from three dimensions: technical factors, system factors and stakeholder factors, which deepens the understanding of the occurrence law of metaverse education ethical risks. Third, this study constructs a multi-dimensional governance framework based on multi-stakeholder collaboration, which expands the application of multi-stakeholder governance theory in the field of education and provides a new theoretical perspective for educational ethical governance.

In terms of practical implications, first, for governments, this study provides a basis for formulating laws, regulations and ethical norms for metaverse education, helping governments to improve the regulatory system and strengthen macro-control. Second, for technology developers, this study points out the direction of technical improvement and supervision, helping technology developers to improve technical security capabilities and realize the ethical development of technology. Third, for educational institutions, this study provides guidance for carrying out ethical education and strengthening teaching supervision, helping educational institutions to avoid ethical risks in metaverse education practice. Fourth, for teachers and learners, this study helps them improve their ethical literacy and awareness of rights protection, and protect their legitimate rights and interests.

7.2 Research Limitations

Despite the above contributions, this study still has some limitations. First, the research on ethical risk identification is mainly based on literature review and expert interviews, and lacks empirical research on a large number of metaverse education practice cases. Future research should carry out empirical

investigations on different regions, different educational stages and different types of metaverse education projects to verify and supplement the ethical risk types identified in this study. Second, the governance paths proposed in this study are mostly theoretical constructs, and their practical effectiveness has not been verified. Future research should carry out pilot studies on governance paths, adjust and optimize governance strategies according to the pilot results. Third, this study focuses on the ethical risks and governance paths of metaverse education at the current stage, and with the continuous development of metaverse technology, new ethical risks may emerge. Future research should track the development of metaverse education and carry out dynamic research on ethical risks and governance.

7.3 Future Research Directions

Based on the above limitations, future research can focus on the following directions: First, carry out empirical research on ethical risks of metaverse education in different contexts. For example, compare the ethical risks of metaverse education in different countries and regions, and analyze the impact of cultural differences and institutional differences on ethical risks. Second, study the effectiveness evaluation of metaverse education ethical risk governance paths. Establish an effectiveness evaluation index system, and evaluate the effectiveness of different governance paths through empirical research. Third, carry out dynamic research on metaverse education ethical risks. Track the development of metaverse technology and education practice, identify new ethical risks in a timely manner, and update governance strategies. Fourth, explore the ethical issues of metaverse education for special groups. For example, study the ethical risks and protection measures of metaverse education for minors, disabled learners and other groups. Fifth, strengthen the cross-disciplinary research on metaverse education ethics. Integrate the theories and methods of education, ethics, law, computer science and other disciplines to carry out in-depth research on metaverse education ethical risks and governance.

8. Conclusion

Metaverse education, as a new educational form, brings innovative opportunities to the field of education, while also facing complex ethical risks. From a multi-stakeholder perspective, this study identifies five types of ethical risks in metaverse education: data privacy and security risks, virtual identity and right infringement risks, cognitive bias and value guidance risks, educational equity and access gap risks, and technical dependence and alienation risks. The formation of these risks is the result of the interaction of technical factors, system factors and stakeholder factors. To resolve these ethical risks, it is necessary to construct a multi-dimensional governance framework covering institutional construction, technical supervision, ethical education and stakeholder collaboration, and rely on the joint efforts of governments, educational institutions, technology developers, teachers and learners.

This study holds that the ethical governance of metaverse education is a long-term and complex system project. It is necessary to adhere to the people-oriented principle, take protecting the legitimate rights and interests of learners as the core, balance the relationship between technological development and ethical norms, and promote the healthy and sustainable development of metaverse education. With the continuous improvement of the governance system and the joint efforts of all stakeholders, the ethical risks of metaverse education will be effectively controlled, and metaverse education will better play its role in promoting educational reform and development.

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