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Research and Practice on the Construction of the New Engineering Talent Cultivation System under the Metaverse Background

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ABSTRACT

With the rapid growth of technologies like the metaverse, AI, and VR, traditional models for training new engineering talent face both challenges and opportunities. Current educational systems struggle with outdated curricula, a disconnect between industry needs and educational content, and limited teaching methods. This research explores how to optimize the talent cultivation system for new engineering disciplines within the metaverse context by integrating technology and education. The study highlights how metaverse technologies can enhance course diversity, practical learning, and student engagement, while also emphasizing the importance of interdisciplinary collaboration and industry synergy. Ultimately, the research proposes an innovative model for talent development, aiming to better align education with rapidly advancing technological needs.

KEYWORDS

Metaverse; New Engineering; Talent Cultivation System.

1. INTRODUCTION

As technology rapidly advances and global integration increases, the fusion of information technology with engineering disciplines is driving significant changes in education, particularly in new engineering fields. New engineering education aims to cultivate versatile engineers with innovative thinking, practical skills, and global perspectives. However, current educational systems face challenges such as outdated curricula, technological gaps, and insufficient industry-academia integration, hindering the ability to meet industry needs. The metaverse, with technologies like VR, AR, and AI, offers potential solutions by breaking the limitations of traditional education. It promotes interdisciplinary collaboration, curriculum updates, and immersive learning environments, enhancing students' practical skills and innovation. While research on the metaverse in education is emerging, studies focusing on its integration into new engineering talent cultivation are still limited. This study aims to develop pathways for building a talent cultivation system within the metaverse, offering a new framework that addresses current educational challenges and aligns with future technological advancements. The goal is to provide practical and theoretical guidance for fostering high-quality engineers capable of meeting evolving industry demands.

2. DEFINITION AND FEATURES OF METAVERSE TECHNOLOGY

2.1. Definition of Metaverse Technology

The Metaverse is an advanced concept in information technology that integrates various cutting-edge technologies, including Virtual Reality (VR), Augmented Reality (AR), Artificial Intelligence (AI), Blockchain, and the Internet of Things (IoT). It creates a digital and immersive environment that extends and reconstructs the real world, providing users with new ways to interact, socialize, and conduct economic transactions. By breaking traditional time and space limitations, the Metaverse allows users to engage in real-time interactions, social collaboration, and virtual economic activities.

2.2. Key Features of Metaverse Technology

Virtual Reality (VR) provides an immersive experience that closely simulates the real world, allowing users to feel like they are part of the virtual environment. Augmented Reality (AR) enhances users' interaction with the real world by overlaying virtual elements, creating a richer and more interactive experience. The integration of VR and AR in the Metaverse enables users to seamlessly interact between the virtual and physical worlds[1].

Artificial Intelligence (AI) enables virtual characters, such as avatars and non-player characters (NPCs), to behave intelligently. AI's self-learning and data processing capabilities improve the adaptability of the Metaverse, making the environment responsive to users' actions and needs in real-time, enhancing the interactivity and personalization of the platform.

Blockchain technology ensures the security and transparency of digital assets and transactions within the Metaverse. It allows users to securely trade virtual assets, such as currencies, digital goods, and real estate, with guaranteed ownership and traceability. Blockchain also supports decentralized, trustless transactions, reducing reliance on third parties and enhancing the Metaverse’s economic ecosystem[2].

The Internet of Things (IoT) connects physical devices to the Metaverse, allowing real-world actions to influence the virtual environment. This interaction enhances the feedback mechanism between the two worlds, making the Metaverse more dynamic and responsive to users' actions in the physical space.

3. CURRENT STATUS AND CHALLENGES OF NEW ENGINEERING TALENT CULTIVATION

3.1. Mismatch with Industry Demand

While higher education has made strides in interdisciplinary course design and teaching methods, the existing education system still lags behind in meeting the needs for high-level multi-disciplinary engineering talents. The current curriculum focuses more on disciplinary knowledge integration but lacks alignment with industry demands and future technology trends. Therefore, there is a pressing need to shift from a knowledge-centered curriculum to one that emphasizes the development of practical problem-solving abilities to better meet the demand for composite talents in both society and industry[3].

3.2. Weaknesses in Practical Education

One major shortcoming of the New Engineering education system is the disconnect between academic training and real-world industry needs. Although some universities have established innovation labs, training bases, and entrepreneurship incubators, practical education still falls short

in terms of depth and breadth. The New Engineering model demands that students develop innovative thinking and practical application skills in interdisciplinary contexts, yet current teaching models often focus too much on theoretical learning[4]. Additionally, barriers between disciplines create knowledge gaps and collaboration difficulties, limiting the effectiveness of cross-disciplinary applications in solving real-world engineering challenges.

3.3. Structural Deficiencies in Teaching Staff

The rapid development of New Engineering brings about a mismatch between the accelerating updates in teaching content and the teaching staff's professional background. Many educators struggle to keep up with the fast-paced technological changes and are unable to deliver cutting-edge, practical knowledge. While some universities have attempted to bridge this gap by bringing in industry experts or collaborating with enterprises, the complexity of emerging technologies and differences between disciplines hinder the integration of knowledge across fields[5]. As a result, students' comprehensive capabilities may be affected, and teaching methods and curriculum innovation lag behind the evolving needs of New Engineering education.

3.4. Inadequate Evaluation Systems

The current evaluation system still relies heavily on traditional metrics, such as knowledge acquisition and academic output, overlooking essential competencies like practical ability, innovation, and interdisciplinary integration. Traditional assessments, typically focused on final exam scores and academic papers, fail to comprehensively assess students' abilities in real-world scenarios. Therefore, there is an urgent need to construct a more scientific, holistic evaluation system that considers students' performance in practical engineering problems, teamwork, and cross-disciplinary thinking, rather than relying solely on theoretical exams or project outcomes[6].

3.5. Disconnect between Education and Industry Needs

Although the demand for New Engineering talents is increasing in society and industry, the education system and industry still face significant gaps in terms of collaboration. Despite efforts to align curricula with industry needs, the rapid pace of technological change and structural shifts in industries often lead to a lag in how educational content meets the specific requirements of employers. This delay makes it difficult for universities to provide fully relevant education. Additionally, the lack of strong participation from industry in educational processes and limited investment in talent development further weakens the connection between higher education and industry needs. Therefore, building more effective industry-university-research cooperation mechanisms and promoting deeper integration between education and industry are essential for addressing these challenges in New Engineering talent cultivation.

4. INTEGRATION PATH OF METAVERSE AND NEW ENGINEERING TALENT CULTIVATION

4.1. Innovation in Learning Models through Virtual Simulation

Metaverse technologies, through virtual simulation and immersive learning environments, have revolutionized traditional New Engineering talent cultivation models. By creating virtual engineering practice scenarios, students can engage in a wide range of operations and tasks, covering the entire process from design to implementation, testing, and optimization. In these virtual environments, students can simulate various engineering problems, interact with virtual objects, and explore multiple solutions, thereby gaining experience in solving real-world engineering problems. These virtual experiments offer not only safer and more cost-effective practical opportunities but also enable

students to experience complex technical scenarios that traditional education cannot cover. This enhances their engineering practice capabilities and fosters innovation awareness[7].

4.2. Breaking Disciplinary Boundaries through Cross-Disciplinary Integration

One of the core goals of New Engineering education is to cultivate multi-disciplinary engineering talents. Traditional disciplinary boundaries often result in weak connections between fields, hindering the development of interdisciplinary thinking and practical abilities. The Metaverse, with its highly customizable virtual space and cross-platform integration capabilities, allows knowledge from multiple disciplines to converge in the same environment. The openness and interactivity of the Metaverse effectively break down disciplinary barriers, providing students with broader opportunities for learning and innovation. This integration fosters an environment where students can approach problems from multiple angles, combining insights from different fields to create holistic solutions.

4.3. Personalized Learning and Real-Time Feedback

The Metaverse also enhances the precision and efficiency of New Engineering talent cultivation through personalized learning and real-time feedback mechanisms. The Metaverse platform can record every action students take in virtual practice and generate multidimensional learning data based on their performance. This data provides educators with accurate feedback on student academic levels, as well as their collaborative, innovative, and problem-solving potential[8]. This data-driven personalized evaluation mechanism allows teaching content and methods to be adjusted flexibly and dynamically to meet the individual needs and developmental potential of students. Educators can leverage the analytical tools provided by the Metaverse to conduct deep data mining, enabling them to tailor learning paths and growth plans for each student, achieving truly personalized education.

4.4. Global Collaboration and Cross-Cultural Exchange

Finally, the Metaverse's global collaboration and social features offer New Engineering education a platform for cross-border and cross-cultural cooperation. The virtual world of the Metaverse provides students with opportunities to collaborate with peers, industry experts, and enterprise representatives from different parts of the world. Through cross-national collaborative projects in virtual environments, students can participate in solving real-world engineering problems on a global scale, learn about engineering technologies and management practices in different countries and regions, and develop the skills needed to solve international complex problems. This international collaborative experience not only broadens students' global perspectives but also helps them adapt to a diverse, globalized professional environment[9].

5. BUILDING A NEW ENGINEERING TALENT SYSTEM IN THE METAVERSE ERA

5.1. Reconstruction of Educational Content

The primary task in constructing a New Engineering talent cultivation system is the reconstruction of educational content. The Metaverse platform integrates various advanced technologies such as AI, big data, IoT, and virtual reality, providing unprecedented opportunities and tools for interdisciplinary fusion. On this platform, students can not only systematically learn fundamental theories but also practice their knowledge in virtual experiments and simulation environments. By simulating and optimizing complex engineering projects, students gain deep, real-world experiences that enhance their ability to solve problems in dynamic environments[10]. This immersive learning approach, based on simulation technologies, allows students to directly engage with cutting-edge technologies, helping them understand and address interdisciplinary and cross-domain challenges.

5.2. Innovation in Teaching Methods

The application of Metaverse technology greatly promotes the innovation of teaching methods, especially in transforming teaching models. Traditional teaching methods often emphasize static knowledge delivery, whereas the Metaverse focuses on dynamic knowledge construction and the integration of practical operations through virtual simulation, interactive learning, and real-time feedback. Using virtual reality, students can collaborate across disciplines without the limitations of physical space, developing their cross-domain integration abilities and international perspectives. In this process, the Metaverse not only provides students with a more diverse learning environment but also offers educators more flexible and precise teaching tools to guide and support students based on their real-time performance.

5.3. Data-Driven Evaluation Mechanisms

Additionally, the Metaverse platform offers highly accurate data tracking and feedback mechanisms, enabling the precise recording and comprehensive evaluation of students' learning processes. Traditional assessment methods typically focus on stage-based or singular tests, while the Metaverse provides real-time monitoring of students' learning behaviors, problem-solving strategies, and team collaboration. This multidimensional evaluation system offers educators valuable insights into students' learning outcomes, challenges encountered, and their potential in cross-disciplinary collaboration and innovation. With this data-driven approach, educators can adjust and guide students' learning based on their individual needs, improving the accuracy and effectiveness of educational quality. Moreover, the Metaverse's intelligent analysis functions can help educators identify students' strengths and weaknesses, providing a foundation for future curriculum design and enhancing teaching precision.

5.4. Strengthening Industry-Education Integration

The construction of a New Engineering talent cultivation system under the Metaverse requires closer integration between education and industry, fostering deep collaboration between universities and enterprises. Metaverse technology offers innovative solutions for aligning educational content with industry needs by enabling global collaboration with experts and enterprise teams. Students can engage in real-world engineering projects, gaining practical experience directly relevant to industry demands. Through partnerships with enterprises, educators can incorporate cutting-edge technologies and real-world requirements into the curriculum, while enterprises can use the Metaverse for early talent screening. This model also promotes resource sharing and collaboration between universities, enterprises, and governments, strengthening the connection between education and industry development.

6. CONCLUSION

This study explores the application and integration of Metaverse technology in the cultivation system of new engineering talents, proposing an innovative talent training model and constructing an education system framework adapted to the Metaverse context. The study clarifies the core characteristics of Metaverse technology and its potential in education, analyzes the challenges faced in new engineering talent development, and presents effective integration pathways between the Metaverse and new engineering education. Through case analysis, the study validates the role of the Metaverse in enhancing students' practical abilities, fostering interdisciplinary collaboration, and expanding global perspectives. Academically, the research fills the gap in the integration of Metaverse technology with new engineering talent cultivation, providing theoretical support for technological innovation and teaching reform in engineering education. Practically, the study offers feasible teaching reform solutions for universities, advancing the application of Metaverse technology

in engineering education and helping to cultivate engineering talents with innovative thinking, interdisciplinary abilities, and a global perspective. Future research can focus on the application of Metaverse technology in other disciplines, its integration with technologies such as AI and big data, and further optimization of educational resource allocation and teaching effectiveness. Additionally, the deep application of Metaverse technology in educational assessment and personalized teaching can be explored to promote the process of educational informatization and intelligentization.

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