Theoretical logic, realistic review and promotion of physical education meta-verse teaching mode of co-construction, co-governance and sharing

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Abstract. Under the background of network in the new era, China actively carries out MOOC, credit bank, virtual simulation and other virtual education platforms. Exploring the theoretical conception of innovating physical education teaching mode with the help of meta-verse technology to improve the quality and effect of education and teaching is of great practical significance and developmental value, which provides solution ideas to meet the students' learning needs, integrate various educational resources, realize the effective communication between the students' learning data and the assessment data within the school, and solve the problem of multi-platform severance. Literature, logic and scenario analysis methods are used to further explore the construction and development of the physical education meta-verse and how to enhance the design and interdisciplinary integrative nature of the teaching content, to promote the process of education reform and to improve the quality of education and teaching efficiency. The aim is to promote the discussion and co-construction of more PE teachers, business leaders and university collaborators, to explore the curriculum design and scoring standards of the PE education meta-verse, and to solve the problem of non-communication of data within the program. The openness of the physical education meta-verse promotes a wider range of collaborative sharing opportunities, and different schools and institutions can jointly carry out physical education activities in the meta-verse, thus forming rich educational resources and positive cooperation mechanisms.

Keywords: physical education meta-universe; educational reform; collaborative sharing.

1 Introduction

In 2020, *Opinions on comprehensively strengthening and improving school physical education in the new era* [1]issued by The State Council of the People's Republic of China and *Education informationization 2.0 Action Plan* [2]issued by Ministry of Education of the People's Republic of China stated, It is necessary to base on the needs of the new era, update the concept of education, deepen the reform of teaching and learning, so that school sports are in line with the reform and development requirements

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of the cause of education. Research on educational reform has received widespread attention and has achieved good results in the present, such as the credit bank education management model[3]. Regrettably, however, in the context of the current meta-universe development, research in the field of educational reform in recent years has also revealed a number of problems to be solved. Especially in the field of physical education. Students' demand for personalized and high-quality educational experience is growing day by day, but the problem of data fragmentation and non-communication between multiple platforms limits the sharing and flow of educational resources, resulting in the waste and repeated construction of educational resources. Although Yan Xiaoping[5] makes a new breakthrough in discussing the learning achievement certification system in his research, it is obvious that he ignores the problem of data sharing and flow among various platforms, and fails to realize the importance of the lack of communication means and ways among education platforms, or even between enterprises and educational institutions. Therefore, in his view, there is a separation between platforms, resulting in the waste and repeated construction of various educational resources.

The physical education meta-universe combines virtual reality technology with education[6] to create a virtual space that can be used for teaching and learning. By creating platforms with interoperability, the lack of interoperability between multiple platforms can be effectively addressed and students' needs for more sports data can be met. It can provide students with more learning space, integrate various physical education resources, and realize effective communication between student learning data and internal assessment data; It can promote more discussions and co-construction among physical education teachers, business leaders, and university collaborators, and promote synergistic innovation between businesses and educational institutions to achieve sustainable development in the field of education.

2 Theoretical logic: the theoretical framework of the integration of meta-universe technology and physical education innovation

2.1 Theoretical connotation of inter-working relationship between cosmic technology and physical education

The relationship between the meta-verse and the real world is complementary. By modelling and recreating various scenes, situations and experiences of the real world, the meta-universe provides students with a learning environment that is similar to or even richer and more diverse than the real world[7]. There are some differences between the physical education meta-universe and the general education meta-universe. The physical education meta-universe emphasizes the cultivation of sports and physical quality, and pays attention to students' experience and movement expression in the virtual environment. Compared with the traditional educational meta-universe, the physical education meta-universe pays more attention to the training of sports skills, the exercise of tactics and the cultivation of team cooperation.

Physical education meta-universe is an innovative practice that combines meta-universe technology with physical education, aiming to provide students with a more immersive and personalized learning experience, and promote their physical development and comprehensive ability improvement. Through the physical education meta-universe, students can carry out physical training, technical learning and competition simulation in a virtual environment to enhance their physical literacy and competitive ability. It enriches the form and content of education and stimulates students' learning interest and participation[8].

In the field of physical education, the application of new meta-universe technologies has encountered a number of real-life dilemmas, including issues such as the 1+x certificate system, virtual simulation, MOOCs and credit banks, which are mainly in the area of interoperability and integration of educational resources.

The 1+x certificate system allows students to obtain relevant certificates through online education platforms such as MOOC or participation in practical activities in addition to majoring in specialised courses during their school studies. Although MOOC provides rich teaching resources and online training opportunities[4], the interoperability issue with credit banks becomes a constraint. Credit banking is a credit recognition and transfer mechanism that aims to enable students to transfer credits between different educational institutions[9]. However, the current problem of mutual recognition of credits in credit banking prevents 1+x certificates and MOOCs from effectively interfacing with credit banking, limiting the transfer of credits between students in different learning environments. At the same time, there are problems with the recognition of credits for MOOC courses in different schools, and students have difficulties in transferring credits between schools, leading to a waste of learning resources and inconvenience in credit accumulation. In addition, due to differences in the recognition standards of different certificates, the certificates obtained by students cannot be widely recognized and applied among different educational institutions or enterprises. These issues not only affect the effectiveness of certificates earned by students through MOOCs and 1+x certificates in terms of credit transfer and recognition [10], but also limit the wider use and dissemination of educational resources, further exacerbating the problems of credit transfer and recognition of certificates, and restricting the flexibility and diversity of students' ability to make use of the certificates they have earned in different learning environments.

The application of virtual simulation in the physical education meta-universe also faces challenges. Virtual simulation technology provides immersive experiences and interactions that can simulate real sports scenarios and enrich students' learning experiences. However, there are problems with the diversity of virtual simulation platforms and inconsistencies in the allocation of resources in educational institutions, resulting in difficulties in interoperability and sharing of virtual simulation resources developed by different educational institutions, and teachers and students are unable to make full use of these resources for teaching and learning.

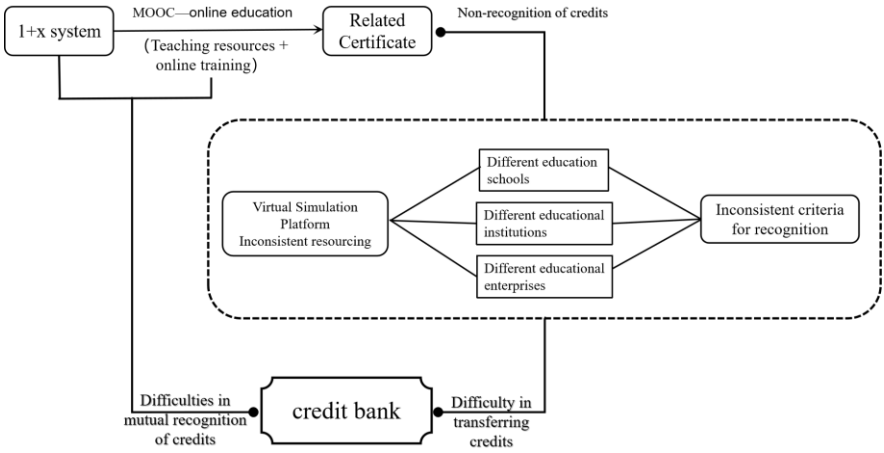

Fig. 1. Problems of interoperability and integration of teaching resources from different schools, institutions and enterprises

Figure 1 identifies the current dilemma of interoperability and integration of the 1+x certificate system, virtual simulation, MOOC and credit banking issues in physical education. Solving these problems requires the education sector to strengthen the development and management of unified standards, establish interoperability and recognition mechanisms, and promote cooperation and coordination among different educational institutions, so as to achieve the sharing of educational resources to ensure that students are able to make full use of relevant teaching and learning resources, and to improve the breadth and effectiveness of education.

2.2 Logical framework of the problem of interoperability process manifestation between meta-universe technology and physical education

Logical framework of the problem of teaching subjects.

The introduction of the physical education meta-universe platform as a teaching tool, while providing teachers with the possibility of more innovative and pedagogical resources, teachers meanwhile face additional pressures and challenges when applying the platform to their teaching [11], including the impact of the increased quality of teaching and learning requirements on the pressures on teachers as well as the challenges that the physical education meta-universe platform poses to teachers.

With the increasing demand for teaching quality in schools, teachers are expected to have higher levels of teaching results and performance. They need to invest more time and energy in preparing content, designing courses, and evaluating student learning outcomes. At the same time, teachers are facing pressure from various aspects of teaching evaluation, including student test scores and school performance evaluation. Teachers must continually update their pedagogical knowledge and skills to ensure that they are able to cope with the ever-changing teaching and learning environment and requirements. However, these increased demands on the quality of teaching and

learning also put teachers under immense pressure to do more in a limited amount of time while maintaining a high level of teaching effectiveness.

The application of the physical education meta-universe platform requires teachers to have appropriate technical skills and a sense of innovation. For many teachers, mastering new technologies and adapting to new teaching modes may require extra learning and effort; the operation and management of the physical education meta-universe platform also requires teachers to invest more time and effort in learning and understanding the platform's operating procedures and flexibly utilizing various meta-universe tools and resources in their teaching. This requires teachers not only to take on traditional teaching responsibilities but also to act as platform administrators and technical support staff; In addition, the application of physical education meta-universe platform also puts forward higher requirements for teachers' innovative ability. Teachers need to give full play to the advantages of the meta-universe platform through innovative teaching methods and activity design to enhance students' participation and learning effect. However, this kind of innovation requires teachers to constantly try and practice, and face possible challenges and difficulties, which increases the work pressure of teachers.

Increased teaching quality requirements have had an impact on the pedagogical pressures on teachers at school level, especially during the application of the Physical Education Meta-verse platform. Teachers need to have relevant technical skills and a sense of innovation, and take on additional workload and responsibilities. To help teachers cope with these challenges, schools can provide professional training and support, and set up reasonable teaching resources and management mechanisms to reduce teachers' pressure and facilitate the effective application of the Physical Education Meta-Universe Platform.

Logical framework of teaching resources.

The physical education meta-universe, as an emerging pedagogical model that integrates technologies such as virtual reality, augmented reality and interactive learning tools, is rich in pedagogical resources and powerful in its potential. However, there are currently some limitations in the application and promotion process, resulting in a relatively low utilisation of the physical education meta-universe, which is unable to give full play to virtual interaction and multimedia resources.

The 1+x certificate system proposed by the State provides students with a wide range of learning opportunities and certificate options to meet individualised learning needs. However, due to insufficient knowledge and understanding of the system and its operation by educational institutions and students, many certificates are under-utilised or even unused. This means that a large amount of teaching resources are wasted and not put to their proper use.

Online education resources such as virtual simulation and MOOC provide students with flexible learning paths and rich teaching content. However, in practical application, the utilisation rate of these resources is not high due to the lack of effective instructional design and guidance, as well as the lack of students' motivation to learn. Many students may not fully participate in and complete online courses, resulting in the potential value of these teaching resources not being fully realised.

As a credit recognition and transfer mechanism, credit banks provide students with more flexible learning paths and interdisciplinary learning opportunities. However, in practice, the construction and operation of credit banks face a series of challenges, including the inconsistency of credit recognition standards and the cumbersome credit transfer process. This has led to the inability of credit banks to achieve efficient credit transfer and utilisation, and the problem of wastage of teaching resources in interdisciplinary learning has gradually come to the fore.

The problem of inefficient use or waste of educational resources relates to the physical education meta-universe, the 1+x certificate system, virtual simulation, MOOC and credit banks. The potential value of these educational resources has not been fully utilised, mainly due to factors such as limitations in applications and promotion, insufficient knowledge and understanding, inappropriate instructional design and guidance, and problematic operational mechanisms. To deal with this problem, schools and governments need to enhance the understanding and application of these educational resources, formulate appropriate policies and norms, and provide support and training to ensure that teaching resources can be utilised efficiently to provide students with a quality educational experience.

Logical framework of educational environment issues.

In modern society, enterprises and educational institutions have accumulated a large amount of educational data, including students' academic performance, teachers' teaching evaluation, and the use of teaching materials. These data include students' physical education data including physical fitness test scores, performance in physical education courses, participation in physical education activities and other information, which are crucial for assessing students' physical education level and health status. However, due to the lack of an effective data interoperability mechanism, students' physical education data are often separated from learning data of other subjects, and it is difficult to integrate and utilise education data among enterprises and educational institutions, which brings a range of problems to education management and decision-making.

(1) Problem of independent data systems.

Businesses and educational institutions have independent data systems and databases that lack uniform standards and formats. This makes students' sports data separate from their learning data and prevents sharing and integration. It is difficult to effectively integrate the sports data generated by students in and out of school, and it is impossible to comprehensively assess students' sports abilities and development potential. The separation of sports data from learning data leads to difficulties in comprehensive assessment, and bias in the assessment of students' overall ability to accurately reflect development and performance in sports. In addition, the separation of sports data also limits interdisciplinary educational research and resource integration, affecting the overall development of students.

(2) Data security and quality issues.

There are privacy and security issues in student sports data, which contains sensitive personal information and needs to ensure data security and privacy protection. The lack of unified data management and sharing mechanism makes it difficult to guarantee data

security and privacy protection, which limits the integration and utilization of educational data. In addition, the standardization and quality problems of student sports data also limit the effective integration and utilization of data, and different institutions use different standards and evaluation indicators, leading to data differences and inconsistencies, reducing the credibility and validity of data. Data quality issues also affect the reliability and availability of data, and increase the difficulty of integrating and utilizing educational data.

(3) Organizational structure segmentation problem.

Students' sports data have different roles and values in businesses and educational institutions. On the enterprise side, sports data can be used as a measure of comprehensive quality, help assess the physical fitness and athletic ability of students, provide reference for the recruitment and selection process, and provide relevant information for health management and insurance evaluation. In terms of educational institutions, the analysis of students' physical education data can optimize the planning and distribution of educational resources, meet students' physical education needs, develop personalized learning plans and educational assessments. Integrating student sports data in enterprises and educational institutions can provide more comprehensive student assessment information, help to develop personalized education and support programs, can provide more comprehensive background information for students' career development and employment opportunities, can provide more comprehensive, accurate and targeted information, and lay the foundation for students' integrated development and success.

3 Realistic review: The main problem of low teaching efficiency caused by imperfect teaching mode of physical education meta-universe

Based on the current imperfect online and offline mixed teaching mode of physical education, there are problems such as excessive teaching pressure caused by the improvement of teaching quality requirements, waste of teaching resources caused by low allocation efficiency of educational resources, and difficult integration and utilization of educational data caused by non-communication between enterprises and educational institutions. First of all, the improved quality requirements of the curriculum lead to excessive teaching pressure on teachers, who need to adapt to the new teaching mode in a short period of time. Teachers need to face the differences between online and offline teaching and take on more teaching tasks while ensuring the quality of teaching, which will have a negative impact on the physical and mental health of teachers and the effectiveness of teaching. Next, the allocation of educational resources is inefficient, and there is a lack of effective allocation and management for the online-offline hybrid teaching mode of physical education, which leads to a waste of teaching resources. Finally, the lack of data interoperability between enterprises and educational institutions makes it difficult to integrate and utilise educational data, which cannot provide effective support for teaching practice.

There is a tight connection between these three problems. Excessive pressure on teachers' teaching and waste of educational resources directly affect teaching efficiency and the quality of students' learning; and the difficulty in integrating and utilising educational data further exacerbates the situation, affecting the improvement of teaching quality and the in-depth advancement of educational reform. Therefore, it is necessary to solve these problems by improving and perfecting the teaching model of physical education meta-universe to improve the efficiency and quality of teaching.

3.1 The improvement of teaching quality requirements leads to the problem of teaching subject

Figure 2 shows that in the current teaching reform, in order to achieve more comprehensive education goals and improve teaching efficiency, educational institutions and countries generally implement online resource platforms and mixed teaching models, which increase the work burden of teachers to a certain extent.

At the macro level, the State has made requirements for schools to make full use of online resource platforms to carry out online-offline blended teaching, which has brought new teaching methods and teaching requirements for teachers, and at the same time increased their workload and pressure. Schools, as teaching organisations and administrators, have also made requirements for teachers to effectively implement the blended teaching mode in the classroom, requiring them to provide more teaching resources and auxiliary teaching tools through online platforms, which has also brought more teaching pressure to teachers.

At the micro level, vocational skills training is an important means of human capital investment in the post-labour market, China is in a critical period of economic transformation and upgrading, the structural contradiction of employment is increasing, and extensive vocational skills training is an important measure to build a sufficient quantity and quality of industrial army [12]. The state has implemented OBE results-oriented education in the field of education, aiming to achieve the transformation from teaching-centred to learning-centred, from knowledge system-centred to competence attainment, in order to cultivate students' comprehensive quality and employability skills. In response, the state has promoted a series of measures, such as the 1+x certificate system[13] and virtual simulation, to motivate students to learn and practice more actively. At the same time, the state also promotes the development of shared classrooms. Through the online course learning platform of Chinese universities MOOC and credit bank system[14], it provides students with more flexible and diversified learning channels and promotes the sharing and utilization of learning resources.

However, the usage of online platform resources requires efficient utilisation and effective integration by teachers, which puts additional pressure on them. Teachers need to be able to master the skills of online platforms and at the same time be able to select and use online resources rationally according to the needs of students and the actual situation in order to improve the effectiveness of teaching and the quality of lessons. Therefore, teachers need to have more comprehensive and professional abilities and qualities to continuously improve their education level and teaching ability to meet the requirements of education development in the new era. Meanwhile, teachers

also need to continuously refine and improve their teaching methods and strategies through communication and interaction with peers and students in order to better cope with the challenges and opportunities of online teaching.

The immense pressure faced by teachers has a significant impact on the efficiency and effectiveness of mixed online and offline teaching. The different abilities and skills of teachers lead to different efficiencies in the utilisation of mixed online and offline teaching modes, which in turn affects the effectiveness of teaching and learning. For teachers with high ability, they are able to effectively blend online and offline teaching modes. For teachers with average ability, although they are unable to utilise online resources efficiently, they still need to meet the requirements of the state and the school and are compelled to use the online-offline hybrid teaching mode. This passive approach to teaching can lead to problems such as teachers feeling fatigued, demotivated and in a bad mood. As for less capable teachers, they may choose to avoid using online resources, leading to a complete disconnection of the network of online and offline teaching relationships and inefficient teaching. All these problems ultimately lead to uneven professionalism of teachers and utilisation of online teaching resources, which in turn leads to inconsistency in the quality of the courses, which is an important challenge for online physical education. Therefore, in order to improve the quality of online physical education, we need to focus on improving teachers' skills and qualities, as well as rationally allocating and utilising online teaching resources.

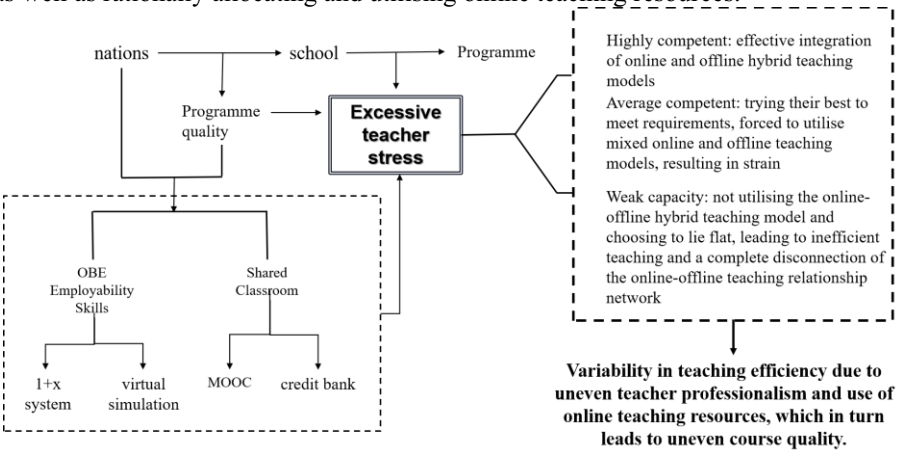

Fig. 2. Problem of excessive teacher stress

3.2 Low allocation efficiency of educational resources leads to problems of teaching resources

Inefficient use or waste of educational resources is caused by poor resource allocation, planning and management(Figure 3). The new educational models and policies proposed by the State, such as the 1+x certificate system, virtual simulation, MOOC and the credit bank system, can improve the efficiency of the use of educational resources and the learning experience of students. However, these new models and policies also put higher demands on the quality of program mes. For example, under the 1+x cer-

tificate system, teachers are required to have higher professionalism and practical experience to improve the quality of teaching; in virtual simulation and MOOC, more in-depth digging and analyses of teaching content are needed to ensure the scientific and accuracy of teaching[15];In the credit banking system, it is necessary to establish a more strict credit recognition and evaluation mechanism to ensure that students' learning results are fairly evaluated. These new models and policies require educators to continuously improve their own literacy and ability, and constantly innovate education and teaching methods in order to improve the quality and level of education and teaching. At the same time, when the quality of the curriculum is improved, it will promote the better implementation and function of the four education models and policies. For example, quality course content can better adapt to the teaching form of MOOCs and virtual simulations to improve students' learning experience and results; High quality teaching assessment and certification can increase the credibility and value of the 1+x certificate system; The credit bank system can better support students' cross-professional learning and career development planning, and improve the utilization efficiency of educational resources. In addition, improving the quality of courses can also lead the innovation and improvement of education models and promote the sustainable development of education.

In order to achieve greater results, they need to be used efficiently and integrated effectively. The emergence of virtual teaching and research room can break this deadlock, but it will also produce new problems, such as the duplication and waste of online teaching resources. In order to solve this problem, we propose to apply the meta-cosmic technology to the physical education curriculum. When it comes to physical education courses, online teaching resources may be used inadequately and irrationally. This is because in physical education, students need to receive targeted teaching content such as movement guidance and skill training, but online teaching platforms are usually difficult to provide personalized learning resources to meet the needs of students. In addition, it is difficult for online teaching platforms to provide sufficient and effective movement guidance and skill training, resulting in difficulties for teachers in the teaching process and difficult to achieve the expected teaching effect. Therefore, for physical education courses, we need to find a more effective online teaching method, so that teachers can better guide students and improve teaching efficiency. Therefore, the meta-universe technology can provide teachers and students with more targeted learning content and more effective movement guidance and skill training, so as to improve the teaching effect. By applying meta-cosmic technology to physical education curriculum, we can further break the deadlock and achieve efficient use of teaching resources [16].

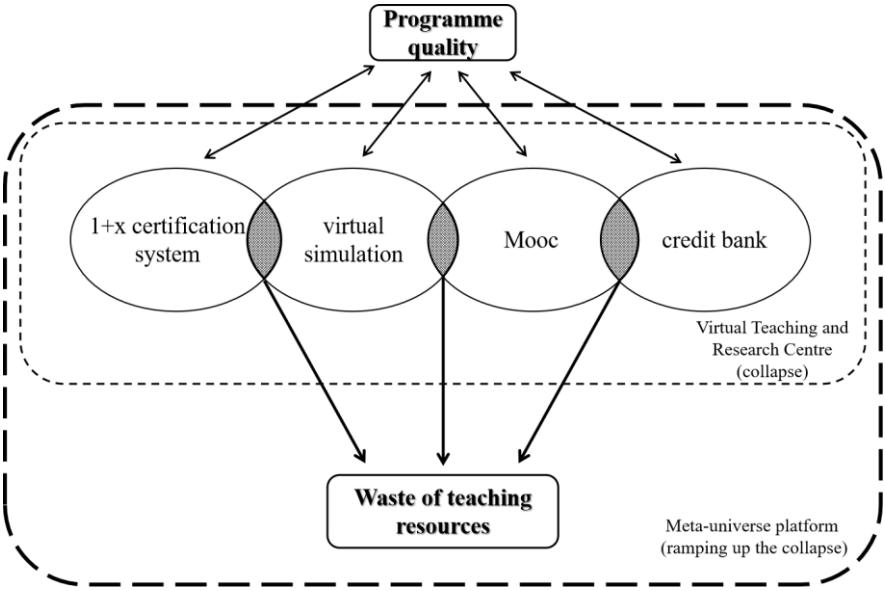

Fig. 3. Waste of teaching resources

3.3 Lack of data interoperability between enterprises and educational institutions causes problems in the teaching and learning environment

The data sharing problem refers to the lack of interoperability between the internal training data of enterprises and the teaching data of educational institutions, which makes it difficult to form a comprehensive and effective education and training ecosystem, and this mismatch and fragmentation phenomenon is also one of the major reasons for the ineffectiveness of online sports education(Figure 4).

The lack of data sharing between enterprises and educational institutions makes it difficult for the online physical education ecosystem to form comprehensive and effective education training. At the same time, China's performance appraisal has four characteristics: performance first, result is more important than process, evaluation is more important than development, and assessment is disconnected from strategy[17]. At the same time, the curriculum evaluation of physical education in our country also has similar characteristics, which are mainly manifested in four problems: achievement first, training results more important than training process, curriculum evaluation more important than curriculum development, curriculum assessment and strategy disconnection. This evaluation method is difficult to comprehensively and objectively evaluate students' physical education level and development, and lacks process evaluation of behavior and health, which makes it difficult to quantify the teaching effect of physical education and provide specific reference and feedback for students, and also difficult to provide effective improvement and optimization programs for teachers.

The mismatch between enterprise education data and educational institution data has a negative impact on the teaching quality and efficiency of online physical education.

Although some enterprises have a large number of sports-related data, such as athletes' training data, event data, etc., due to different data formats and acquisition methods, these data are difficult to integrate into the data of educational institutions, so as to provide more scientific and effective guidance for online sports education. In addition, the lack of means and ways to communicate among multiple platforms, and the contradiction between students' growing demand for sports data and unbalanced, inadequate and non-interoperable data platforms also lead to the waste and repeated construction of various educational resources. Therefore, highlighting the advantages of the meta-universe can integrate multi-field resources to assist students and teachers to achieve comprehensive teaching and solve these problems.

In the field of physical education, students and teachers need to obtain more sports data in order to better understand and evaluate students' performance and progress. However, due to the fragmentation among multiple platforms, these data are often unable to be effectively integrated and utilized[18], resulting in the waste and repeated construction of various educational resources. In addition, when students and teachers conduct online physical education, they also need more convenient and efficient platforms and tools to enhance the learning experience and teaching effect. However, the fragmentation of multiple incompatible platforms and tools also brings difficulties to the integration and utilization of educational resources.

Promoting data sharing and integration, eliminating fragmentation and breaking down barriers between different platforms will have a positive impact on the development of online physical education and the improvement of education quality[19]. At the same time, a variety of teaching evaluation methods should be adopted to comprehensively and objectively evaluate students' physical education level and development, so as to provide more specific and accurate reference and feedback, and provide more effective improvement and optimization programs for students and teachers.

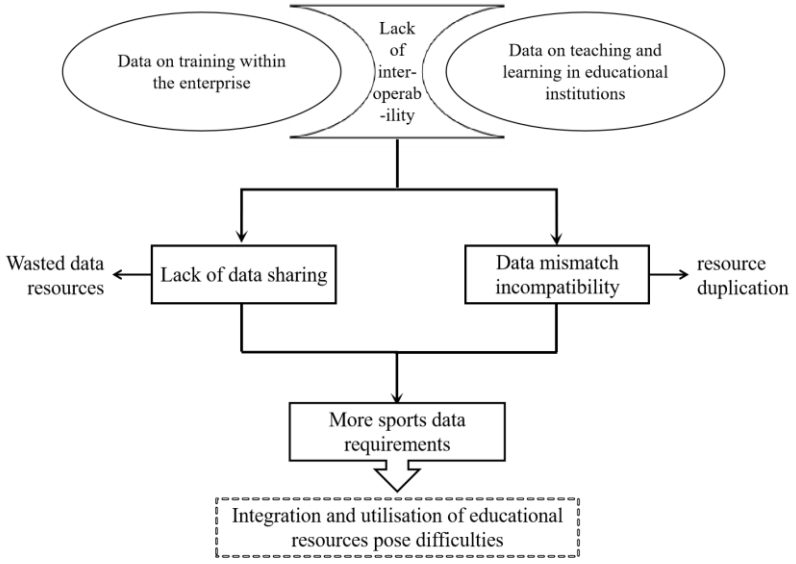

Fig. 4. Teaching and learning environment issues

4 Promotion turn: The realization strategy of physical education meta-universe teaching mode to improve teaching efficiency

Meta-universe research has focussed on computer software and applications, automation and other scientific and technological fields, with some scholars also focusing on areas such as environmental science and education [20].

4.1 Teaching main structure of physical education meta-universe

To explore the realization strategies of physical education meta-universe teaching mode to improve teaching efficiency, teachers need to combine team construction, platform construction, content construction, curriculum construction and mechanism construction[21] to effectively alleviate the problem of excessive pressure on teachers and effectively improve the teaching efficiency of physical education meta-universe teaching mode.

Team building is an important part of providing support and training for teachers. Build a team of professionals, including technologists, instructional designers, and education specialists, who can provide expert technical guidance and pedagogical support. Team members can work closely with teachers to help them master meta-universe technologies and innovative teaching methods.

The platform is built to construct an easy-to-use and operate metaverse teaching platform to reduce the technical burden of teachers and provide rich teaching resources and tools, such as virtual labs, interactive learning activities and multimedia materials, to support teachers' teaching needs.

Content building is designed to develop high-quality pedagogical content for the physical education meta-universe. This content should include elements such as virtual simulations and interactive learning activities designed to stimulate student interest and engagement. Teachers and educational specialists can work together to design and develop instructional content that meets educational goals and subject requirements, which can simulate real-world scenarios and allow students to learn and apply knowledge through virtual experiences[22], thus enhancing their learning and learning outcomes.

The curriculum is built to design courses that are compatible with the physical education meta-universe platform. Teachers should combine the features and functions of the platform and flexibly design a curriculum that combines virtual experience and practice. Such a curriculum design can provide a comprehensive learning experience that enables students to perform practical operations and applications in a virtual environment and develop their practical and problem-solving abilities.

Mechanisms are built to establish teacher evaluation and incentive mechanisms to encourage teachers to innovate in the teaching of the physical education meta-universe. Such a mechanism can stimulate teachers' motivation and creativity, prompting them to try new teaching methods and activity designs in the teaching process to improve teaching quality and effectiveness. Such mechanism building can help teachers better

cope with teaching pressure and promote their professional growth in physical education meta-universe teaching.

4.2 Teaching resource structure of physical education meta-universe

In the framework of the physical education meta-universe, the teaching resource level can solve the problem of the waste of teaching resources caused by the low allocation of educational resources by rationally utilizing the teaching modes proposed by the state such as 1+x system, virtual simulation, MOOC and credit bank system.

The 1+x system can provide diversified learning opportunities and programme choices in the course of students' studies. Through this system, students can choose sports-related programmes in addition to their major subjects to enrich their knowledge and skills. In order to avoid wastage of resources, educational institutions can carry out reasonable curriculum planning according to students' interests and abilities to ensure that students are provided with educational resources that meet their developmental needs in the meta-universe of physical education.

Virtual simulation technology can provide a highly interactive and realistic experience, providing students with a virtual environment that is similar to actual sports scenarios. Through virtual simulation, students can perform practical operations, observations and analyses to enhance their practical and problem-solving abilities. To avoid wasting resources, educational institutions can select suitable virtual simulation resources according to students' learning objectives and practical needs and integrate them into teaching activities so that students can make full use of these resources for learning and practice.

MOOC (Massive Open Online Courses) can provide students with flexible learning methods and rich teaching resources. Through MOOC, students can choose appropriate courses according to their interests and learning progress, enabling them to learn and master knowledge independently across the limitations of time and space. In order to avoid the waste of resources, educational institutions can combine the characteristics of the physical education meta-universe to develop MOOC courses combined with virtual experience and interaction. Meanwhile, teachers can help students make better use of MOOC teaching resources in the learning process through guidance and counselling to achieve effective and efficient learning. In addition, MOOC provides a platform for teachers to communicate and collaborate, and teachers can share their teaching experience and resources with other educators to promote the innovation and enhancement of teaching methods.

The credit banking system allows for the integration and transfer of credits earned by students in different learning scenarios. Through credit banking, students can match and articulate credits earned in the physical education meta-universe with credits earned in traditional learning scenarios. In order to avoid wasting resources, educational institutions can establish a sound credit banking mechanism, which helps teachers to understand students' learning journeys and outcomes, provides targeted teaching support and guidance, ensures that the credits earned by students can be effectively used and recognised, and promotes the coherence and transferability of students' learning experiences.

Through the rational use of teaching modes such as 1+x system, virtual simulation, MOOC and credit bank system, educational institutions can avoid the waste of teaching resources. The key lies in the fact that educational institutions should carry out effective resource allocation and planning according to students' needs and goals, and integrate these teaching modes so that they can complement and support each other [23], in order to improve the teaching effect and the efficiency of resource utilisation.

4.3 Teaching environment structure of the physical education meta-universe

(1) Establish unified data standards and specifications.

In order to solve the problem of difficult integration and utilization of educational data caused by non-communication between enterprises and educational institutions, the White Paper Series of China Meta-Universe Industry in 2022 points out that there is still a lack of standards and information tracking mechanisms to ensure the development order of the educational meta-universe[24], which means that unified data standards and norms need to be established first. Ensure that data between different systems can be recognized and interpreted. At the same time, a consistent naming rule is formulated to ensure that the naming of data is consistent and understandable, so as to facilitate data matching and integration between various systems. In addition, it is necessary to develop a data exchange protocol, which specifies the mode of data transmission, communication protocols and security requirements to ensure the integrity and confidentiality of data in the transmission process. By establishing unified data standards and specifications[25], enterprises and educational institutions can ensure that their data systems are interoperable and connected, so as to achieve smooth exchange and integration of educational data. This provides a foundation for cross-system integration and analysis of educational data, facilitating data-driven decision making and implementation of educational improvements.

(2) Establish security measures and management mechanisms.

In terms of data security, data encryption measures can be taken to encrypt data and prevent unauthorized access and data disclosure. At the same time, establish a permission control mechanism to restrict users' access to data and operation rights, ensuring that only authorized users can perform data operations. In addition, data backup and disaster recovery mechanisms are established to regularly back up data to prevent data loss or damage and ensure data recoverability.

In terms of data quality, a data verification and cleaning mechanism can be established to verify and clean data, remove duplicate, missing and wrong data, and improve the quality and credibility of data. In addition, the data monitoring and audit mechanism is established to regularly monitor and audit the data, discover and correct data quality problems, and ensure the effectiveness and reliability of the data. By establishing security measures and management mechanisms, the security and quality of educational data can be effectively protected. This helps to build users' trust and confidence in the data, promote the enthusiasm of data sharing and integration, and thus realize the efficient use and application of educational data. At the same time, for enterprises and educational institutions, it can also improve their data management and governance capabilities to provide reliable data support for decision-making.

(3) Establish a cross-organizational data cooperation mechanism.

There is a need to establish a framework for cooperation with clear objectives and principles for data sharing. In the framework of cooperation, the scope, purpose and beneficiaries of data sharing can be clearly defined to ensure the rational use and protection of data. In the process of data cooperation, it is necessary to clarify the use rights of the data to ensure that only authorized personnel can access and use the data. At the same time, it is also necessary to clarify the responsibilities and obligations of the data, including the accuracy, confidentiality and compliance of the data, to ensure that the data is legitimate and reliable. In addition, appropriate management bodies and personnel need to be established to supervise and coordinate the integration and utilization of data. A governing body or committee for data cooperation can be established to formulate policies and norms for data sharing and coordinate the cooperative actions of all parties. At the same time, it is also necessary to designate a special person or team responsible for data management and operation, including data collection, integration, cleaning and analysis, to ensure the effective use of data and maximize the value.

Through the establishment of a cross-organisational data cooperation mechanism, it is possible to promote cooperation and collaboration between enterprises and educational institutions, and to achieve the integration and sharing of educational data. This can help to increase the value and utilisation efficiency of education data and promote innovation and enhancement of education and teaching. At the same time, it can also provide reliable data support for policy formulation and decision-making and promote development and improvement in the field of education.

5 Conclusion

In the ever-changing digital era, physical education meta-universe is gradually emerging as an emerging educational approach. It not only provides students with richer learning experiences and interactive experiences, but also provides teachers with more teaching tools and teaching resources, and offers new ideas and paths for future educational development.

The development of the physical education meta-universe system will promote the application of personalized customization and digital education, and provide a better technical foundation. At the same time, openness will lead to greater opportunities for collaboration and sharing. However, with the rapid development of the physical education meta-universe, it also brings a series of risks and challenges. Ethical risk, addiction risk, privacy risk, capital monopoly risk and algorithmic pressure challenge[26] all require our high attention and prevention. At the same time, in the future development, the physical education meta-universe needs to clarify the development goals and layout plans, and focus on multi-channel and detailed technology. Teaching content design and interdisciplinary integration also need to pay attention to balance, while strengthening the guidance and management of students, focusing on mental health and information security. It is suggested that education, scientific research and enterprises should carry out interdisciplinary cooperation to provide more comprehensive support for the development of the physical education meta-universe.

In conclusion, the emergence of the physical education meta-universe brings new opportunities and challenges for the future development of education. It is of great practical significance and developmental value to explore the advantages of physical education meta-universe to improve the quality and effect of education and teaching, to promote the development of education, to create a smarter, more efficient, and more convenient education model, and to provide a better education environment and education experience for our future[27].

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