

## Research on the Integration of 5G+AI Technology to Empower Digital Education Under the Background of Industrial Internet

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### Abstract

*With the continuous maturity and gradual application of 5G technology, this technology will break the traditional traffic service model and shift to a full factor ecological chain model. The integration of 5G technology and industrial industries will greatly improve industrial production efficiency and accelerate the digital transformation of industrial upgrading. When 5G + AI technology is accelerated into the education and learning process, what effect will this have on the educational scene? Undoubtedly, this is a new subject worthy of attention and research. 5G + AI technology will reconstruct the future education information ecosystem, bringing subversive technological changes and educational application scenarios. The integration of 5G + AI and education and teaching practice will innovatively bring many important scenarios, such as technology integration, teacher training, student learning, digital campus management, teaching context, curriculum development, environmental design, teaching evaluation, special education, etc.*

**Keywords:** 5G+AI; industrial industry; intelligent education; educational ecology; application scenarios

### I. Research background and origin

In recent years, with the gradual maturity and popularization of new generation information technologies such as Big Data, Cloud Computing, Internet of Things, and Mobile Internet, information technology has become an important driving force for economic development. However, the development of these cutting-edge technologies depends on mobile communication technology. Needless to say, the 5th-Generation mobile communication technology (5G) and a new generation of artificial intelligence technology (AI) will deeply change and influence our education ecosystem. The influence that 5G + AI technology will bring to the traditional education field are mainly reflected in the following aspects.

At the micro level: 5G + AI technology will make the teaching more intelligent. By solving the space and time problems faced in the traditional teaching process, modern information technology can achieve the presentation and connection of multiple teaching scenarios, thereby improving the effectiveness and efficiency of teaching;

At the meso level: The application of 5G + AI technology in teaching can not only create a better educational environment, but also realize the sharing of educational resources. On the one hand, it solves the quality of teaching from the root, on the other hand, improves the efficiency of learning;

At the macro level: 5G + AI technology is an innovation and technological breakthrough to the past education industry. A series of evolutions and developments will occur under this breakthrough, which not only reflects in the transformation of the underlying mobile communication technology, but also further promotes the innovation and

development of upper-middle technology and application models. Therefore, the application scene of educational technology will also have a breakthrough change.

The integration of 5G + AI technology in education and teaching can promote the maximum use of educational resources, effectively expand the breadth and dimension of the design of teaching scenarios, and can also accelerate the reform and development of education and teaching. Therefore, the use of new technologies represented by artificial intelligence 2.0 and 5G technology will make many problems in education and teaching require new design, thinking and response. However, there are few relevant research results on 5G+AI at home and abroad, so it is particularly important to explore the possible impact of 5G+AI technology on the transformation of educational scenes. This article tries to explore, with a view to providing some forward-looking references and enlightenment for the current innovation and transformation of education informatization.

**II. 5G + AI: technology will reconstruct the education information technology ecology**

With the extensive application of 5G + AI technology in the education industry, the traditional education ecosystem will be reconstructed including education resource management system, education situation design system, education system management system and evaluation system, which will effectively promote the development of education informatization .

Throughout the application process of educational technology, if new technology is to be applied to teaching, it must first have support for teaching, and at the same time its performance must be actively changed or innovative according to educational factors. For example, in Figure 1, under the technical environment of 5G + AI, various application scenarios and forms that may appear in the teaching field in the future have gradually emerged. The impact of 5G + AI technology on education and teaching is not an application of a new technology in essence, but an innovation and extension of 4G + AI technology. The application of 5G + AI technology will promote the huge reform of the teaching environment, including the traditional education resource management system, education situation design system, education system management system and evaluation system.

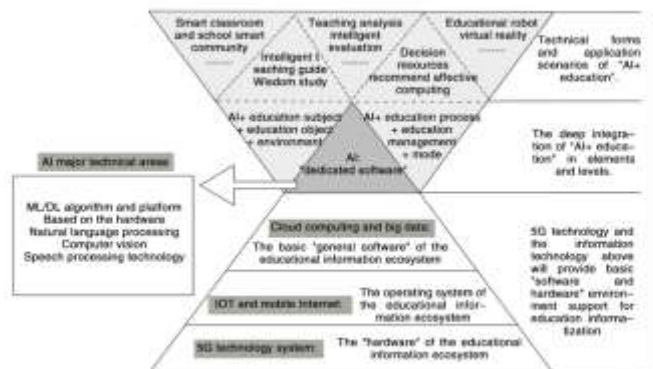


Fig. 1. The ecological structure of educational information technology from the perspective of 5G + AI [1]

**III. 5G + AI: Innovation in educational application scenarios**

3.1 New scenarios of technology integration applications

In the application scenarios of 5G + AI technology, Smart Sensors, Internet of Things, Digital Twins, Cloud Computing, Edge computing and other smart technology groups are used as carriers of teaching methods, and the fission effect generated by them will promote the development of intelligent education. The intelligent education system comprehensively captures and analyzes the learner's behavior and learning state through sensors, and then presents the learner's potential habits and commonly used logical methods [2]; The Internet of Things is able to accurately push the materials and data needed by learners through the associated devices, bringing convenience to learners; Using 5G network for learning can effectively improve efficiency, because 5G network has the characteristics of high efficiency, low energy consumption, fast link and large capacity; AI actively captures the learning data and analyzes the needs of learners, and uses this to build an interactive learner-led teaching model; Digital twin is to build a virtual learning scene for learners, so that learners can get a learning experience in the game; Artificial intelligence technology with big data support and efficient computing capabilities can make online services more scientific, accurate, and convenient; Edge computing will help learners to provide intelligent and accurate services by analyzing their needs efficiently.

### 3.2 New scene of teacher training

Teacher training needs to solve two key issues, namely content and method. The scientific and humanized teacher training program needs to be adjusted in terms of training content and methods according to the real-time changing needs of the training objects to ensure that the desired effect is achieved [3]. G + AI makes personalized training practical. This service performance depends on strong data support and super computing power. The training content under 5G + AI technology tends to provide learners with "hard goods" and "dry goods". In terms of training methods, he refused to follow the original propaganda subject and refused to "template" training, but really meet the different needs of trainers.

If traditional teacher training wants to achieve good teaching results, not only the professional qualities of the relevant teachers and trainers need to be consistent, but also the consistency of the educational expectations of teachers, students, parents, schools, families and social environment. The integration of 5G + AI technology can not only effectively realize the sharing of educational resources, but also realize the individualization of the educational model, fundamentally solving the problems of education and teaching. In the future education and teaching, the integration of 5G + AI technology can not only provide learners with high-quality and comprehensive educational resources, but also create intuitive learning situation models for learners through advanced technologies. At that time, the distance teaching mode and instant interactive teaching can effectively break the time and space constraints, making teaching and learning more convenient and simple. Moreover, personalized teaching can not only enhance the learner's interest in learning, but also effectively discover the learner's own potential; The reform of teaching mode and evaluation system can also better promote the improvement of teachers' professional ability and the optimization of training content [4].

### 3.3 New scene of teacher training

In recent years, with the development of new information technology, higher education has increasingly invested in active learning classrooms and learning spaces. Having a more advanced and more complex way of thinking is the demand for current and future labor in the "smart +" era [5]. In order to realize the learning of new theories, concepts and knowledge, it will surely promote the generation and development of new learning environments [6]. Advanced technologies such as online communities, mobile devices and the Internet of Things have promoted the transformation and development of the learning environment and space. Therefore, the scene reconstruction of the learning space will be an important reflection of the penetration of 5G + AI technology into higher education [7].

Obstacles to the learning space are a difficult problem to solve in the education and teaching process. Many modern technologies are working to solve this problem, such as wireless bandwidth, display screens, and various writing surfaces, but these all belong to the innovation of the physical learning space. In the 5G + AI technology environment, designing and developing virtual learning spaces will be an important trend in the development of higher education. In recent years, a new learning space based on extended reality (XR) programming has been proposed, which will bring a better learning experience for individual learning and team learning [8].

The use of 5G + AI technology will bring amazing changes to the design and setting of learning spaces, and new technical support will also break through the limitations and obstacles of traditional learning space settings. 5G + AI technology will realize the ecological co-construction of terminals, connectors and controllers. Powerful information technology creates a more efficient learning model and an interactive intelligent learning space ecological platform for learners, thereby achieving the transformation and upgrading of "smart +" education (see Figure 2).

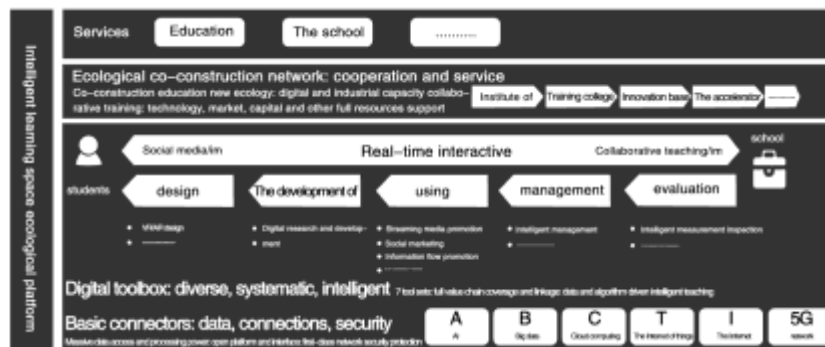


Fig.2. 5G + AI technology helps the learning space become more interactive [1]

### 3.4 New scene of digital campus management

Plication scenarios of digital campus management will gradually mature. First of all, 5G + AI technology can effectively realize the intelligent control of terminal devices. When problems and faults occur in the terminal equipment, the relevant staff can directly diagnose and solve the problem through remote control. Intelligent remote services can realize spatial links and improve the efficiency of problem solving. Secondly, 5G + AI technology can effectively improve the information intelligence of the digital campus. "One-key operation" mode can realize the content switching and management of campus terminal display screen. The "one-key management and control" digital management model will become an important direction for the new scenarios design of digital campus management.

### 3.5 New scenes in teaching situations

#### 3.5.1 Virtual / Augmented reality (VR / AR) teaching situation application

The technical characteristics of VR / AR are reflected in technical avatars, multiple concurrent users, multiple communication tools, communication tools, content creation tools, environment persistence, representation of space and other aspects [9]. However, in the past applications, the performance of communication technology limited the performance of VR / AR in educational application scenarios. The low transmission rate and long delay cause VR / AR to be presented in a desktop virtual way in educational application scenarios. With the gradual maturity and application of 5G technology, those problems of communication technology have been perfectly solved. There will be a variety of situational teaching modes, such as distributed virtual, immersive virtual and enhanced virtual. The high speed and low

latency of 5G + AI technology will further enrich teaching scenarios. The high-speed and low-latency of 5G + AI technology will further enrich the teaching scene mode, making the diversified educational scene design more popular in teaching activities. At the same time, this technology provides strong technical support for teaching activities such as simulation experiments, maker education, and project-based learning.

### 3.5.2 UHD Video or UAV remote live education

Nowadays, distance education is getting more and more attention. However, the current distance education platform still has some problems such as low learning efficiency, insufficient interaction, and high dropout rate. The application of 5G + AI will effectively make up for the shortcomings of teaching in the remote network live broadcast platform. The ultra-high-definition video live broadcast system will provide learners with a smooth teaching situation and personalized teaching services through one-to-one interaction. At the same time, an emerging teaching model is to use the drone panoramic live teaching process to provide learners with a more realistic and infectious teaching situation, so that the learners can be immersive. This emerging teaching model is also a reform and innovation of education and teaching.

### 3.5.3 Robot education and other applications

The integration of 5G + AI technology will not only bring changes to traditional teaching methods, but also change the role of teachers. Traditional teachers are real people who preach and teach, but 5G + AI technology will create another kind of "teacher", namely artificial intelligence teachers [10]. Artificial intelligence teachers are robot teachers constructed by intelligent technology. They will share and supplement the work of traditional teachers in future education, as shown in Figure 3.

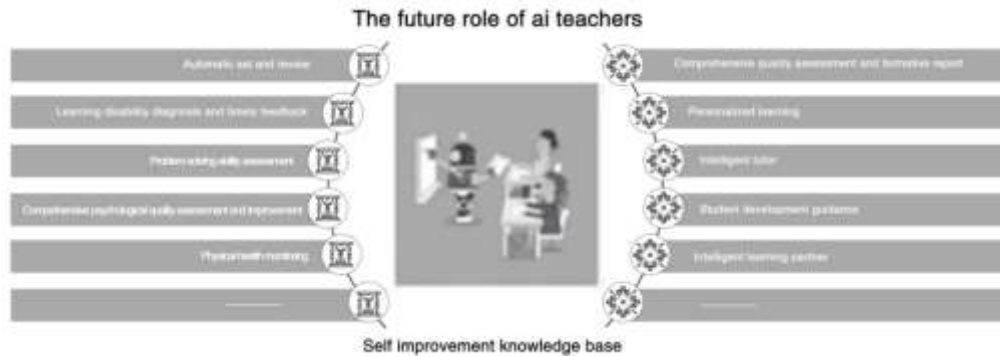


Fig.3. Future functions and roles of artificial intelligence teachers

The robot technology equipped with 5G + AI technology can meet the needs of education in speech, vision, tactile, emotional computing and other aspects. Artificial intelligence teachers will have the capabilities of speech recognition, face recognition, information acquisition, analysis and output. Artificial intelligence teachers with voice and face recognition capabilities can distinguish each learner and collect relevant information such as their daily learning behavior habits. Through AI technology, human observation ability and empathy can be programmed into intelligent robots, allowing robots to more anthropomorphically analyze the changes of learners' emotions, and thus provide learners with more suitable and personalized teaching services. At the same time, technologies such as machine learning and deep learning can help robots increase the level of intelligence in multiple fields, so that they can adapt to and play various roles in educational application scenarios [11].

### 3.6 New scenarios for curriculum development

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In the 5G + AI technology environment, it is possible to develop school-based courses with local characteristics. First of all, in the course development, the core literacy of the subject should be the main line, and the breadth and depth of knowledge should be expanded around the main line. In the course development of the subject, it cannot be limited to the setting of content and grade. It is necessary to take collaborative education as the main idea, and integrate the ideas of standing up people and encouraging innovation into the course design [12]; Second, the development of the course should be based on the idea of taking and using. In the development of school-based courses with local characteristics, different from the development of traditional courses, complex and divergent development ideas cannot be adopted, but the idea of education-oriented and minimal training should be adhered to [13]. With "take and use" as the core idea, the school-based curriculum with 5G + AI technical support will be more conducive to the cultivation of divergent thinking, the ability to solve problems and the establishment of practical spirit; Third, improve the training effect. In the past, users obtained training content through training. In the future, users will generate knowledge after internalizing the training content. The scattered data and knowledge points in traditional education can no longer meet the learning needs in the information society, and the systematic and structured knowledge structure is more conducive to learning and practice. Teachers and students will further improve their own cognitive system through the acquisition of systematic knowledge and the practice of situational learning.

### 3.7 New scene of environmental design

At present, the focus of wisdom education tends to solve the problem of learning environment. Although intelligent tools can be used to obtain student data in the current education and teaching process, the ability to transfer data in both directions during long-distance video learning still needs to be improved, and the scope of classroom content needs to be expanded. Therefore, two-way real-time interaction is still a key issue that needs to be solved urgently in the distance learning environment.

With the support of 5G + AI technology, learning classrooms that belong to two different regions and different spaces can be connected in real time with the help of information technology. At the same time, teachers and students in the classroom can also realize visual real-time interaction. Teachers can actually present the scenes designed in the classroom, so that students can learn in the context and better understand related knowledge points. The situational learning method is an innovation of the traditional learning model, which has a great impact on the teaching model and learning method. 5G + AI technology can realize the combination of virtual and real situation creation, can present the situation intuitively to the learner, and bring the learner a sympathetic learning atmosphere. The development and improvement of information technology will effectively enhance the sharing of high-quality knowledge. At that time, international classrooms will gradually become a popular phenomenon, and online teaching platforms and remote online schools will also be widely recognized.

### 3.8 New scene of educational evaluation

5G + AI technology will provide technical support for colleges and universities to build a comprehensive development of the campus education evaluation system of moral, physical, mental, and physical skills [14]. The technology can provide high-precision measurement of learning effects, and at the same time help colleges and universities achieve comprehensive education. The core technologies involved in measurement learning are data collection technology, sensor technology, intelligent scoring technology and discourse analysis method [15]. The integration of 5G + AI technology can not only effectively improve the collection efficiency of the massive data involved in teaching activities, but also use its efficient computing power to perform accurate statistical analysis of related data. According to the analysis results, develop individualized teaching guidance for different learners; The integration of 5G + AI

technology in the intelligent scoring technology can effectively improve the scientific and completeness of the evaluation system. The characteristic of 5G + AI is that it can comprehensively record students' learning habits, activity trajectories and thinking habits, which is conducive to systematically evaluating the learners' potential abilities. 5G + AI technology has brought innovation to measurement learning. Intelligent measurement not only improves the efficiency of the entire system, but also promotes the precision of measurement learning, realizing the conversion from empirical decision-making to "data + algorithm" decision-making.

The application of 5G + AI technology provides new concepts and ideas for the reform of the examination method. For example, 5G + AI technology can be used to classify the test questions collected for the whole society and store them in the cloud question bank [16]. Such a test question design model can not only examine the social requirements for disciplines, but also promote the comprehensive development of talents. At the same time, with the support of 5G + AI, remote examinations, interviews and other methods will become more popular, and the use of video live interactive technology to evaluate candidates will be gradually promoted.

### 3.9 New scenes in special education

#### 3.9.1 5G + AI "empowering" education for poverty alleviation

5G + AI technology can fundamentally reduce the cost of education, because the sharing of educational resources and the realization of distance education can allow high-quality education to spread. In the online teaching platform, learners can more conveniently obtain the full range of high-quality educational resources of the whole subject, more easily interact with famous teachers, and obtain the guidance of high-quality teachers, which will effectively promote cross-regional and intelligent teaching exchange. In the field of poverty alleviation in education, 5G + AI technology will help solve the problem of teaching in remote mountain areas such as insufficient teaching equipment configuration, low level of education and teaching, and shortage of teachers. This will promote equality in education and improve national knowledge.

#### 3.9.2 5G + AI "Enable" Special Education Group

5G + AI technology will further promote equality in education and help solve the educational problems of people who have lost their normal learning ability, such as people with visual, hearing, and physical disabilities, making many teaching activities that are currently impossible for special groups possible.

1) Allow disabled people to acquire learning capabilities through related technologies.

Many people with disabilities do not have the learning abilities that ordinary people have, such as hearing and vision. 5G + AI technology can use artificial intelligence to enable people with disabilities to learn through other channels' perceptions and receive normal education;

2) Help learners with disabilities to gain access to learning.

Many people with disabilities are unable to obtain learning opportunities due to space barriers, such as high paraplegia. Intelligent robots, massive intelligent cloud, and AR / VR technology equipped with 5G + AI technology provide high-quality teaching for these people;

3) Help learners with disabilities to obtain learning evaluation in the sense of equality.

The measurement learning and accurate evaluation system under 5G + AI technology can bring learners a scientific learning evaluation and achieve the fairness of teaching results.

### 3.10 Possible education scenarios in the future

5G + AI technology is still developing and improving. This development process will bring unlimited possibilities and innovations to the education industry. The derivation of 5G technology will bring a batch of new formats and application models to the future. For example, the application of 5G + AI + MR in digital twin technology will create a new "digital twin world" (see Figure 4). Digital twin refers to analyze, diagnose and predict the original system through accurate reproduction and construction of data, thereby improving resource utilization.

The integration of new technologies and constantly improving intelligent technologies will create a new educational scene in the future and a new learning space. Therefore, in the future educational scene, various new fields, new technologies, and new applications will dynamically reconstruct the educational environment, such as the design and reconstruction of a new human-computer collaborative teaching environment.

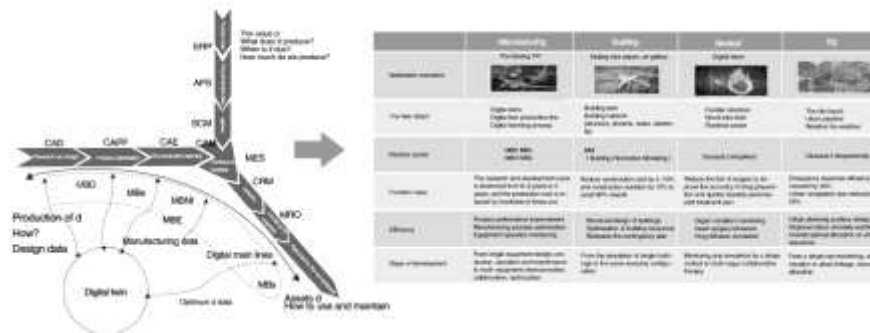


Fig.4. 5G + AI helps mixed reality build a "digital twin world" [1]

**IV. Conclusion**

The arrival of 5G is a milestone in the new era of human development. Combined with the objectives of the "Education Informatization 2.0 Action Plan", how to effectively integrate, apply and upgrade 5G + AI technology and education? This requires education researchers, practitioners, decision makers and managers to conduct more comprehensive thinking and research.

This research takes 5G + artificial intelligence 2.0 technology as an entry point and outlines a new field of application formed by the integration of technology and education. From the perspective of technological innovation and development, there may be more disruptive application scenarios in the 5G + AI technology system. In the future, we need to continue to pay attention to and study the ways and mechanisms of the integration of cutting-edge information technology and future education in the 5G technology environment. In addition, we need to study the profound changes and effects from different perspectives of 5G + AI technology on the subject and object of future education, education model, teaching process, etc.

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