Research and Exploration on Information and Computer Technology Enabling the Future of Engineering Education Ecology

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Abstract. With the application of information and computer technology and algorithms related to educational analysis in the field of engineering education, its empowering effect on the future education ecology has been revealed. In order to explore the role and path of information and computer technology in the construction of the future education ecology, this paper, based on the purpose of future Engineering Education and the trend of information and computer technology development, predicts four major transformations needed in the future education ecology, namely, the transformation of the education subject, the transformation of the education field, the transformation of teaching and learning styles, and the transformation of the top-level design of education by the government and industry. It also proposes a path for information and computer technology enabled future education ecology construction, as well as the main risks to be avoided in future Engineering Education.

Keywords: information and computer technology · future engineering education · transformation · education ecology

1 Introduction

Engineering education is the cornerstone of social development, and looking at the current form of social development, it is necessary to give priority to education and accelerate the modernisation of education in a comprehensive manner. The use of technology tools is increasing rapidly in all fields, especially in education, from pens, pencils and books to using interactive technology to convey knowledge and understanding [1]. Information and computer technology empowers the education ecosystem, with technological developments. The development and integration of information technology forms the mainstay of innovation in the education ecosystem and drives a comprehensive reform of the education ecosystem.

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2 Information and Computer Technology Enables the Future of Engineering Education Ecology

2.1 What is the Future Education

Nowadays, the development of education cannot be limited to the past and the transmission of current knowledge, but should keep up with the technological developments of the times in order to adapt to the future trends of human society. In the future, with the development of information and computer technology in the field of education, the educational object and the educational environment will undergo great changes. The education of the future will be a more open education, which will break through the limitations of time and space to create a ubiquitous learning situation where "everyone can learn, everywhere can learn". The future of engineering education is a more considerate education that is more inclusive of students' individuality and diversity, allowing students to take more initiative. Four major changes in the future of engineering education.

Transformation of the Future Engineering Educational Mind
On the one hand, we have long recognised that the two main subjects of education are the teacher and the student. However, the emergence of various accompanying learning machines and robot teachers, empowered by information technology, has led to a shift in thinking and to the realisation that technology is no longer just a mediating system, but is gradually becoming one of the main subjects of engineering education in the future. On the other hand, the role of the educational subject in the future of education has changed. Education is a social activity that nurtures people. With the development of information and computer technology, the accessibility of knowledge has increased and the roles of teachers and students have changed dramatically. With the support of information technology, teachers' repetitive work can be reduced, allowing teachers to grow. Secondly, the development of information and computer technology has enabled teachers and students to break the limitations of time and space. Information technology has extended the space for teacher-student interaction, increasing the frequency of teacher-student interaction and reducing the distance between teachers and students, so that the teacher-student relationship is no longer limited to the classroom or even to the school.

Information and Computer Technology Changes in the Engineering Educational Field
Traditionally, educational activities have been carried out mainly in schools, and the educational activities carried out by teachers and students have mainly revolved around schools. As the demand for universal access to education increases, it is gradually realised that the first step to making education as universal as possible is to enhance the communication properties of education, which must break through the walls of the school and extend the field of educational activities. This coincides with the development of information and computer technology, which can achieve a revolutionary shift between the "physical field" and the "virtual field", a good example being the widespread use of flipped classrooms. There is also a good relationship between the learning environment

and student learning outcome [2]. By the age of digitally mediated education informatics, the field of teacher-student interaction has changed dramatically. The explosive extension of knowledge has stimulated teachers' and students' mindset towards learning, increasing the need for teacher-student interaction, both emotionally and intellectually. The digital age of information and computer technology has made it possible for students to interact with information and computer technology. The pace of technological development is increasing personal interaction between people at great distances. This is the essence of distance learning: being able to participate in educational activities regardless of time or distance [3]. Information and computer technology is enabling the construction of educational spaces and extending the field of educational activity.

Information and Computer Technology Change in Teaching and Learning in Future Education

In education, the way teachers teach plays a crucial role in the effectiveness of education. In the future of education, with the deeper integration of information and computer technology and education, teachers' teaching styles will also undergo a huge transformation. The development of information and computer technology will enable teachers to access richer teaching resources; they will also have the opportunity to learn from the teaching methods of other outstanding teachers and thus reflect on their own teaching styles and enrich their teaching experience. A revolution in technology will revolutionise teaching and learning material, As shown in Table 1.The deepening informatization of education has made knowledge a product accessible to more people, which is spread in a network, and the accessibility of knowledge has made it possible for more people to participate in the transmission of knowledge, which is no longer the exclusive preserve of school teachers, and this change has led to a reduction in the authenticity of the knowledge that is constantly being disseminated. Technology is a more familiar component to students than teachers, and tends to improve future learning rather than enhancing current education [4]. New access to information and information and computer technology is transforming the world, and with it, the world of education is transforming [5].

Information and Computer Technology Changes the Top-Level Design of Future Education

With the increasing relevance of information and computer technology and the global shift to the knowledge society, school systems and higher education are now faced with challenges related to preparing students for successful participation in the knowledge society [6]. On the one hand, this will be reflected in the policy aspect, where the

Table 1. Educational Technology Induces Change in Teaching and Learning Material

Education Technology	Teaching and learning styles
Word-of-mouth	Oral dialogue
Printing technology	Textbooks
Electronic communication technology	Video material
IT and Computer Technology	Multimodal internet material

government will increase its economic investment in schools so that they can be used for the construction of information and computer technology in schools. On the other hand, IT-related industries will gradually move into the field of education, teaching IT and education to integrate deeply, and education and technology to progress with each other, thus achieving a mutually beneficial symbiosis.

2.2 Model Construction: Information and Computer Technology Enables the Future of Education Ecology

As information and computer technology continues to develop, the existing education ecosystem will reform. We believe that IT and computer technology will change the education ecosystem in four ways: the mindset, the educational field, the educational activities and the top-level design of engineering education. As shown in Fig. 1.The first reform in mind is mainly reflected in the participants in educational activities.

The second reform in the educational ecosystem is the change in the educational field, which is an important part of the educational ecosystem. As technology continues to advance, the field of education has undergone a dramatic transformation from a 'physical field' to a 'virtual field'. In the future of education, the virtual field will continue to be strengthened in order to enhance the communication properties of education.

The third reform in the educational ecosystem is the change in educational activities. Information technology has the potential to facilitate new modes of teaching and learning, but it also requires new forms of interaction between scientists, teachers, and technology/software developers. This requires systematic There are few good incentives and the theoretical underpinnings are vastly incomplete [7]. The core of educational activity consists of 'teaching', 'learning' and 'evaluation'. With the integration of information and computer technology into the education ecology system, we have found that information technology can enable all aspects of education to be carried out effectively and can even reshape education activities.

The fourth reform in the education ecosystem is the change in the top-level design of engineering education. Education is a great undertaking of an important social nature. The Ministry of Education should happen only in schools; the building of the education

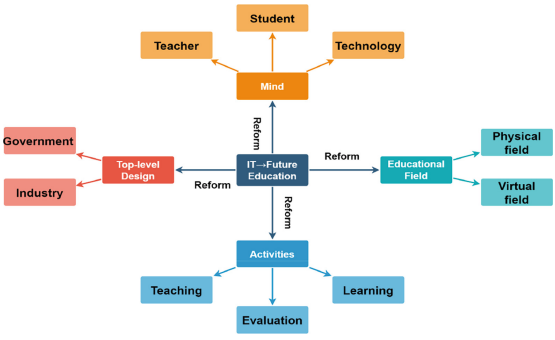

Fig. 1. Information Technology Enables the Future of Engineering Education Ecology

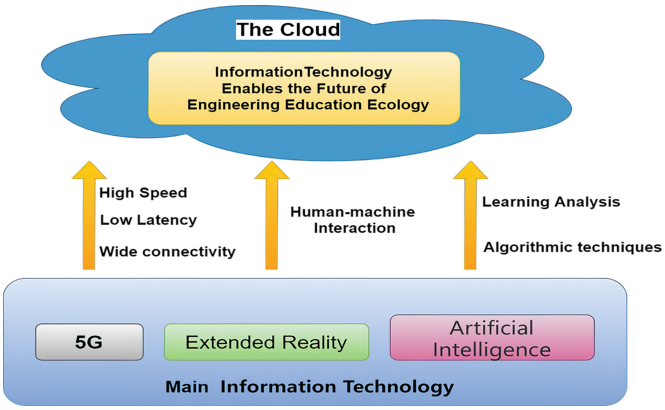

Fig. 2. How IT Enabled Future Engineering Education Ecology

ecosystem needs more social forces. In the future of education, the government and various industries will be further involved in the top-level design of education, contributing their share to the building of the education ecosystem.

3 How IT-Enabled Future Engineering Education Ecology

3.1 Model Construction: How IT-Enabled Future Engineering Education Ecology

First of all, we need to understand how information and computer technology is enabling the construction of the future of engineering education. As shown in Fig. 2, the main applications in future engineering education are 5G technology, extended reality technology and artificial intelligence technology. 5G enables future engineering education with its three outstanding features of high speed, low latency and wide connectivity; the implementation of extended reality technology makes human-computer interaction possible, which is also the outstanding model of future engineering education; artificial intelligence enables future engineering education with its accurate algorithms and learning tracking and analysis technology. And then, the mission of building the future of engineering education in the cloud will be achieved gradually.

3.2 Some Principles Should Be Followed

Learner-oriented Principle. Education is a social activity that nurtures human beings. Under the wave of development of information technology, education must adhere to the principle of human-centredness and avoid "technocracy" that undermines the nurturing properties of education. Information technology cannot change the core of education, i.e. the essence of education is the encounter between human beings and their souls.

The principle of lifelong learning. Information technology has enhanced the communication properties of education, so that education is no longer confined to schools

and is no longer the right of the few. Citizens have a wide and varied access to education and promote lifelong education.

The principle of integration and innovation. Innovation is the driving force behind development. Our needs transition from technological innovation to innovation in educational models, from external empowerment to internal change in education, and then from internal change in education to two-way empowerment of education and technology. Of course, innovation is also not only reflected in theory, but also in practice.

3.3 Risk Avoidance

Avoiding the malignant horse-trading effect that makes education inequitable. The Matthew effect is a phenomenon where the strong get stronger and the weak get weaker. While information technology promotes education, we should likewise reflect on the question of whether all people can enjoy the support of information technology. The answer to this is saddening, however, as information technology has made education less of a privilege for the few and more of a privilege for itself. Those who can afford to receive IT support can enjoy the convenience that IT and Computer technology brings to their learning, while those who cannot access this privilege are gradually marginalised, and when this pernicious horse-trading effect expands in education, it will lead to an inequitable education.

Avoid educating digital logic. On the one hand, the development of information and computer technology in education has enabled teachers and students to interact with each other in a relatively digital field in the form of "human-machine-human", where teachers and students exist as complete human beings, and communication relies on the logic of the heart, that is, the connection between emotion and emotion. However, when it comes to the "machine", the emotions that are supposed to be sincere and moving are likely to be transformed into cold codes, and the final transmission of both sides of the interaction is a language of instructions brought about by digital logic. On the other hand, the advent of information and computer technology in education has reduced the opportunities for teachers and students to think at a deeper level.

Avoid information cocooning. Information and computer technology is based on data, which we believe has an objective nature, however, data can also become a guide that will gradually cause you to lose your subjectivity and be trapped in a prison of data. Information technology can analyse your preferences and tailor your learning to them, however, its indulgence of you will gradually reduce your exposure to the world and the space in which you can play.

4 Conclusion

Information and computer technology needs to be integrated into all levels of engineering education to make a difference. The Department of Education should develop new policies to develop educational software and courseware to support these efforts, especially in vocational education [8]. To effectively address this challenge in engineering education, we must take into account both its promises and our concerns [9]. As we look to the future of engineering education, we need to look at information and computer

technology dialectically, both to see the promise it holds for us and to effectively avoid the risks and challenges it brings us. Information Literacy should be improved. Technology, Combining Reality and Imagination should be enhanced. Technology will play an increasingly important role in 21st century information age education [10]. The role of information technology has to be brought into play to meet the learning needs of more people. Students have more power in their choice of knowledge.

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