

Integrated Application Path of 3D Printing Technology in Professional Education Training Platform Construction

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Abstract: "3D printing" technology is a new advanced manufacturing technology, and its application is more and more extensive. At the moment when professional education is facing the need of transformation and upgrading, this article focuses on the application of 3D printing technology in the construction of professional education training platform. In this article, the theoretical basis, advantages, challenges and application paths of its application are discussed in depth. It is found that the principle of 3D printing technology is unique, and its integration with professional education training platform is supported by constructivism and other theories, which can enrich teaching resources and enhance teaching interest, but it faces challenges such as high equipment cost and shortage of teachers. Based on this, this article puts forward the integrated application path from the perspectives of concept, curriculum system, teaching mode, training resources and teachers. Its purpose is to provide scientific and effective strategies for the construction of professional education training platform, to promote professional education to better cultivate technical and skilled talents to meet the needs of the times, and to improve the teaching quality and modernization level of professional education.

1. Introduction

In today's era of rapid development of science and technology, professional education, as an important way to cultivate high-quality technical and technical talents, faces many new opportunities and challenges [1]. With the transformation and upgrading of manufacturing industry and the wide application of digital technology, the construction of professional education training platform needs to keep up with the pace of the times and innovate and improve constantly [2]. As a revolutionary advanced manufacturing technology, 3D printing technology is gradually showing great application potential in various fields, which provides a new method for the construction of professional education training platform.

From the perspective of the development of professional education itself, the traditional practical teaching mode and means can not meet the high requirements of modern industry for talents' practical ability and innovative thinking to a certain extent [3]. As the key place of professional education and teaching, the construction quality of training platform is directly related to the training effect of students' vocational skills [4]. How to optimize the training platform with the help of emerging technologies and improve the pertinence and effectiveness of training teaching has become an important issue to be solved urgently in the field of professional education.

With the characteristics of rapid prototyping, personalized customization and diversified materials, 3D printing technology can effectively make up for the shortcomings of traditional practical teaching [5]. It can not only provide students with a more intuitive and real practical operating environment, but also stimulate students' interest in learning and innovative ability, so that students can better adapt to the needs of future career development [6]. At present, the academic circles have done some research on the application of 3D printing technology in the field of education, but the research on its integrated application path in the construction of professional education training platform is still relatively weak [7]. In particular, how to deeply integrate 3D

printing technology with the practical needs of professional education and practice teaching, and build a scientific and reasonable application model and system has not yet formed a systematic and mature theory and method. Therefore, it is of great significance to carry out in-depth research on the integrated application path of 3D printing technology in the construction of professional education training platform. This aims to provide a useful reference for the reform of professional education practice teaching, promote the high-quality development of professional education, and cultivate more technical and skilled talents to meet the needs of the times.

2. 3D printing technology and theoretical basis of professional education training platform

3D printing technology is defined as a form of implementation of additive manufacturing technology. Its principle is based on the discrete-accumulation principle, by slicing the 3D model data in layers, and then stacking them layer by layer according to the sliced data by using specific materials, the 3D solid model is finally constructed [8]. Common types of 3D printing technologies include fused deposition molding (FDM), stereo lithography apparatus (SLA) and selective laser sintering (SLS). Each technology has its own characteristics in material adaptability, molding accuracy, cost and so on, which provides a variety of choices for applications in different fields.

Professional education training platform is a teaching practice place built by vocational colleges to cultivate students' practical skills and professional accomplishment. It has multiple functions such as practical teaching, skill appraisal, technology research and development and social service [9]. The construction of professional education training platform should follow the principles of practicality, advancement, openness and sharing, so as to ensure that the platform can meet the needs of students' vocational skills training and adapt to the development trend of industry technology.

The integration of 3D printing technology and professional education training platform has a solid theoretical basis. Constructivist learning theory emphasizes learners' active constructive role in the learning process. 3D printing technology provides students with opportunities to practice and explore knowledge independently, which helps students to build a knowledge system in practice. Situational learning theory holds that learning should be carried out in real situations, and 3D printing technology can simulate real production situations, so that students can learn and master skills in a close working environment and improve their professional ability. These theories laid a theoretical foundation for the integrated application of 3D printing technology in the construction of professional education training platform, and guided the exploration of subsequent application paths.

3. Advantages and challenges of integrated application of 3D printing technology in the construction of professional education training platform

With the continuous progress of science and technology, 3D printing technology has gradually emerged in the construction of professional education training platform. Its unique technical characteristics bring many advantages to the training platform, but at the same time, it also faces a series of challenges.

3.1. Advantages of integrated application

Traditional practical teaching resources are mostly based on two-dimensional drawings and physical models, and there are some problems such as non-intuitive display and difficulty in presenting internal structure. 3D printing technology can quickly transform virtual design models into real objects, so that students can understand complex structures and principles more intuitively. For example, in the mechanical manufacturing professional training, transparent models of mechanical parts can be made through 3D printing, and students can clearly observe the internal structure and motion principle. This is difficult for traditional teaching resources to do. The 3D printing process has strong appreciation and participation. Students can personally participate in the process of model design and printing, from creative conception to final formation, which greatly

stimulates students' interest in learning. Compared with the traditional step-by-step training operation, 3D printing gives students more space to play independently, encourages students to think actively and explore actively, and enhances the interaction between teachers, students and students in practical teaching.

The personalized customization features of 3D printing technology encourage students to break through the traditional design restrictions and give play to innovative thinking. Students can quickly turn their ideas into objects according to their own ideas, and improve their innovation ability through continuous trial and improvement. At the same time, in the process of operating 3D printing equipment and post-processing model, students' practical ability has also been fully exercised.

For some expensive or easily damaged training equipment and spare parts, 3D printing can make replicas on demand, reducing the cost of equipment procurement and maintenance. For example, in the training of aerospace specialty, some high-precision parts are expensive. Using 3D printing to make teaching models can not only meet the teaching needs, but also avoid the high losses caused by the damage of real parts and reduce the risk of training. See Figure 1 for details:

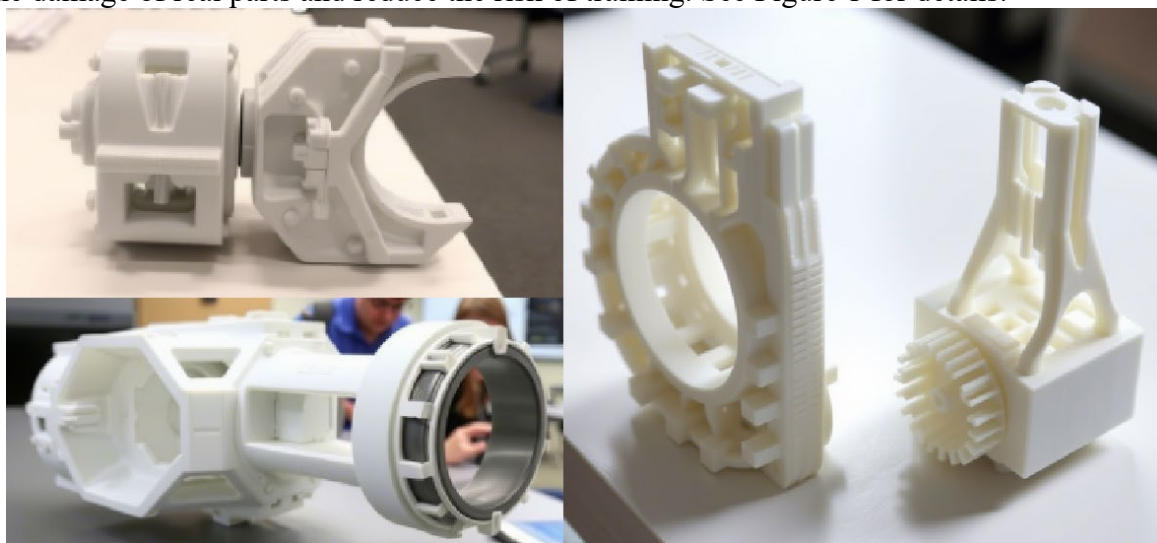


Figure 1 3D printing display of aerospace high-precision parts

3.2. Integrated application challenge

The price span of 3D printing equipment is large, and high-precision professional equipment is often expensive. For the limited funds of vocational colleges, it is difficult to purchase on a large scale. In addition, although the types of 3D printing materials are increasing, some high-performance materials are expensive, and long-term use will bring greater economic pressure to schools. 3D printing technology involves multi-disciplinary knowledge, including mechanical design, material science, computer-aided design and so on. At present, the number of teachers who are proficient in 3D printing technology and professional teaching in vocational colleges is insufficient. Teachers lack relevant knowledge and skills training, so it is difficult to effectively guide students to carry out practical teaching based on 3D printing.

Developing 3D printing resources suitable for practical teaching requires not only professional design ability, but also the combination of teaching objectives and students' actual level. At present, the construction of relevant teaching resource database is not perfect, and the independent development of colleges and universities faces problems such as high technical threshold and high time cost, which is difficult to meet the diversified needs of teaching. Harmful gases and dust may be generated in the process of 3D printing, which poses a potential threat to the health of teachers and students. At the same time, due to the limitations of 3D printing technology in accuracy and strength, whether the quality of the printed model can meet the teaching requirements when it is used in key training links needs further research and verification.

4. Integrated application path of 3D printing technology in the construction of professional education training platform

4.1. Curriculum system integration path

In order to effectively promote the application of 3D printing technology in the construction of professional education training platform, it is necessary to explore the integrated application path from multiple dimensions, give full play to its advantages and overcome the challenges it faces.

Vocational colleges should renew their educational concepts and deeply understand the importance of 3D printing technology to the reform of practical teaching. Schools should encourage teachers to actively explore innovative teaching models based on 3D printing technology and create a teaching atmosphere that emphasizes practice and innovation. Vocational colleges can regularly organize teachers to participate in seminars on 3D printing technology education and application, invite industry experts to share successful cases, and urge teachers to change their ideas and actively integrate 3D printing technology into the teaching process.

It is the key to organically integrate the related contents of 3D printing technology into the professional curriculum system. Taking mechanical manufacturing specialty as an example, the basic knowledge of 3D modeling and printing can be added to the course of Mechanical Drawing, so that students can master the basic model design and printing operation. In the course of Mold Design and Manufacturing, the application case of 3D printing in mold manufacturing is introduced to let students know its advantages in actual production. Table 1 shows the specific integration methods:

Table 1: Examples of Integrating 3D Printing Technology into the Curriculum System for Mechanical Manufacturing Major

Course Name	Integration Content	Teaching Objectives
"Mechanical Drawing"	Basic operations of 3D modeling software, printing of simple models	Students should be able to use modeling software to design simple models and complete the printing process
"Mold Design and Manufacturing"	Process and workflow of 3D printing molds, case studies	Students should be familiar with the application of 3D printing in mold manufacturing
"Product Design"	Innovative product design methods based on 3D printing	Cultivate students' ability to utilize 3D printing for innovative product design

4.2. Innovation of teaching mode and construction of practical training resources

Project-based teaching: Teachers design practical projects around 3D printing technology, such as designing and printing a small mechanical device. Students complete the project in groups, from demand analysis, design modeling to print production, and exercise their teamwork, innovative thinking and practical ability in the whole process.

Inquiry teaching: Teachers ask enlightening questions, such as "How to optimize the structure of a product by 3D printing", guide students to explore independently, and cultivate students' ability to solve problems through consulting materials, designing experiments, verifying printing models and other steps.

Developing 3D printing teaching AIDS: Educational technology experts need to develop corresponding 3D printing teaching aids based on abstract professional knowledge. For example, in the course of electronic circuit, students can intuitively understand the circuit wiring and component layout by making a 3D printed circuit board model.

Building a 3D printing teaching resource library: Educational institutions should integrate various teaching resources, including 3D models, teaching cases, and instructional videos, to provide convenient channels for teachers and students to access resources. Schools can encourage teachers and students to participate in the construction of resource pool and enrich the content of resources.

4.3. The path of teaching staff construction

Schools should strengthen teacher training and focus on enhancing teachers' ability to apply 3D

printing technology. On the one hand, teachers are selected to participate in 3D printing technology training courses organized by professional training institutions to learn the latest technologies and applications. Schools should invite experts from enterprises to give special lectures and provide practical guidance to help teachers grasp the current application status of 3D printing technology in the industry. At the same time, it is necessary to establish a sound incentive mechanism to support teachers in conducting teaching research and practical innovation on 3D printing technology, in order to improve the overall teaching level. Through the above-mentioned integrated application paths, it is expected to give full play to the role of 3D printing technology in the construction of professional education training platform and improve the teaching quality of professional education.

5. Conclusions

This article focuses on the integrated application path of 3D printing technology in the construction of professional education training platform, and has achieved rich results. With its rapid prototyping, personalized customization and other characteristics, 3D printing technology has brought opportunities for innovation and change for professional education training platform. From the theoretical level, this article clarifies the theoretical basis of the integration of this technology and professional education training platform, such as constructivism learning theory and situational learning theory, which provides a solid support for practical application.

In the analysis of advantages and challenges, 3D printing technology has obvious advantages in enriching teaching resources, stimulating students' interest and cultivating innovative ability, but problems such as equipment and material costs and shortage of teachers can not be ignored. In view of these situations, a multi-dimensional integrated application path is proposed. The education department needs to update its teaching philosophy, organically integrate 3D printing technology related content into the curriculum system, innovate teaching models, strengthen the construction of practical training resources, and continuously improve teachers' professional abilities.

These paths are interrelated and promote each other, forming an organic whole. If it can be effectively implemented, it is expected to solve some difficult problems in the current construction of professional education training platform and improve the quality of training teaching. However, the application of 3D printing technology in professional education is still in the development stage. In the future, it is necessary to further deepen the research, continuously optimize the application path and strengthen various safeguard measures. In this way, we can give full play to the potential of 3D printing technology in professional education and push the cause of professional education to a new height.

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