

The Role of 3D Printing Technology Education and Practice Courses in Talent Training and Employment Guidance in Vocational Colleges

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Abstract: 3D printing technology, that is, additive manufacturing technology, is a multi-disciplinary technology, involving mechanical engineering, materials science, architecture, product design and other disciplines. Vocational colleges as an important position to train high-skill talents, its educational goal is not only to teach students theoretical knowledge, but also pay more attention to training students' practical ability and professional quality. In this context, incorporating 3D printing technology into the curriculum system of vocational colleges can not only improve students' technical skills but also lay a solid foundation for their employment and career development. This paper will discuss the important role of 3D printing technology education and practical courses in the talent training and employment guidance of vocational colleges, with special emphasis on the positive role of the integration of industry and education and school-enterprise cooperation in promoting the employment of vocational college students, as well as the influence of enterprises on the empowerment of schools.

Keywords: 3D printing technology; Vocational colleges; Career guidance

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1. Introduction

Vocational colleges, as an important base for training applied talents, incorporate 3D printing technology into education and practice courses. Through practical operation and project design, students can deeply understand the working principle and application scenarios of 3D printing technology, which is of great significance for improving students' hands-on ability, innovation ability and employment competitiveness.

2. Definition and principle of 3D printing technology

3D printing technology is an advanced manufacturing technology based on digital model files to construct objects by printing layer by layer. The basic principle is to process the 3D design file in layers, and then

stack the material layer by layer by printer, and finally form a complete 3D object. This process involves the selection of materials, such as powdery metal, plastic and other adhesive materials, as well as the control of printing accuracy and layer thickness [1]. Through digital models generated by computer-aided design (CAD) software, 3D printers can accurately build complex structures and geometries according to design requirements, giving them a unique advantage in the manufacturing industry.

3. The application of 3D printing technology in vocational education

3.1. 3D printing technology and product design course application

Product design courses are widely offered in vocational and technical colleges, requiring students to fully master the relevant design theories and practical skills related to material, tone, function and structure. This course usually adopts a project-oriented teaching mode, with 3D printing equipment as the core experimental tool. In the teaching process, students will learn the basic concepts of product performance, materials and construction, and apply CAD software to conceive and draw innovative designs. These ideas are then concretized into solid models using a 3D printer. By closely combining theoretical knowledge with practical practice, the course aims to inspire students' passion for industrial design, enhance a deep understanding of the field and give them a confident foundation for successful studies [2]. With 3D printing, students can quickly transform their digital models into physical models, which is essential for testing, evaluating and optimizing designs. For example, in a course project to design a portable water cup, students can first design the structure of the cup on a computer using CAD software, taking into account ergonomics and material constraints. Once the design is complete, a prototype is quickly produced via a 3D printer. During this process, students may find problems with the design, such as the handle of the water cup not being strong enough or the design is not easy to grip, and then go back to the design stage to make changes [3]. This iterative process, which can take weeks or even months in traditional manufacturing methods, can be completed in days or even hours with the help of 3D printing technology.

3.2. 3D printing technology and mechanical design course application

The core goal of the mechanical design courses is to enable students to fully grasp the basic concepts of mechanical structure, transmission system, operation principles and functions, and use methods and specifications of various mechanical components. The course aims to enable students to rationally select mechanical systems and transmission devices, master the methodology of mechanical design, and have the ability to analyze mechanical problems and evaluate and maintain machinery. In addition, students will learn how to integrate knowledge from the fields of mechanics, mathematics and dynamics to create mechanical products that meet the needs of industry. The integration of 3D printing technology into the course will deepen students' spatial understanding of mechanical construction, enhance digital design skills, and proficiency in the application of design software such as CAD and MakerBot Desktop, thereby stimulating their interest in mechanical design and expanding students' breadth of knowledge and innovative thinking [4]. 3D printing allows students to achieve rapid prototyping of these complex components, especially those that are difficult or prohibitively expensive with traditional manufacturing techniques. Taking a simple gear system as an example, students can design gears containing different sizes and numbers of teeth, which need to be precisely chimes and turned efficiently. Through 3D printing, students can not only verify the accuracy of the gear design but also test the effect of different materials on the performance of the gear.

3.3. Course application of 3D printing technology and reverse modeling

The reverse modeling course is different from the traditional forward design course, it focuses on teaching how to analyze and study the existing products deeply through technical means. This course uses 3D modeling software such as CAD and 3D printing technology to further deduce the structural attributes, functional performance, technical parameters and manufacturing process of products, to achieve the design purpose of product upgrading or “rebirth of old things” [5]. The key content covered in the course includes 3D scanning technology, reverse modeling technology, software operation and 3D printing production. Students can use 3D scanners to conduct detailed scanning and data acquisition of target objects in 3D LABS, then reconstruct 3D models, and adjust parameters and optimize structures of models to replicate and innovate original models [6]. For example, if the original part is worn out by too many years of use, students can modify the design on the computer to enhance the durability or functionality of the part, and then use 3D printing to create a new optimized part. This ability has important applications in industries such as automotive restoration and cultural relic restoration.

3.4. Application of 3D printing technology and architecture professional courses

Architecture is another field that benefits from 3D printing technology. In this program, 3D printing technology is often used to make architectural models or complex structural elements of buildings. Students can design a building or structural component and then realize its physical model through 3D printing technology. This not only speeds up the design process but also enables students to directly observe the actual effects of factors such as light and shadow, structure and materials on the model [7]. For example, in a project to design a Museum of Modern Art, students could use 3D printing to experiment with different exterior designs and material effects. By printing out small-scale architectural models, students can directly evaluate the visual and functional effects of different designs on the models, such as the introduction of natural light, the optimization of visitor flow lines, etc. [8]

4. The impact of 3D printing technology courses on talent training in vocational colleges

4.1. The improvement of technical skills

3D printing technology course through systematic teaching, students can fully master the whole process operation from modeling to printing. This kind of practice teaching of the whole process has significantly improved students’ hands-on ability and practical operation skills. Students are not only able to use CAD software for 3D modeling but also transform digital models into real objects via 3D printers [9]. Through these practical operations, in the process of solving practical problems, students can cultivate the innovative thinking and technology application ability needed in practical work.

4.2. Training of professional quality

The 3D printing technology course not only focuses on the improvement of students’ technical skills but also focuses on the cultivation of team spirit and problem-solving ability. In project-based learning, students often need to collaborate with their classmates to complete complex design and manufacturing tasks. This process of cooperation and communication greatly improves students’ communication skills and teamwork spirit. Through teamwork, students learn how to work in a division of labor, how to solve problems in a team and how to communicate effectively.

4.3. The improvement of comprehensive quality

3D printing technology courses closely combine theory with practice, emphasizing the application of interdisciplinary knowledge. During study, students not only need to master professional knowledge such as mechanical design, materials science and computer-aided design, but also need to apply this knowledge to solve practical problems. Through this comprehensive study, students' comprehensive quality and comprehensive ability have been comprehensively improved.

5. The role of 3D printing technology courses in employment guidance

5.1. It helps to promote the deep integration of production and education

In vocational colleges, the opening of 3D printing technology courses can effectively promote the integration of production and education. First of all, 3D printing technology courses pay attention to practical operations. Students not only learn theoretical knowledge in class but also can operate 3D printing equipment by hand to accumulate practical experience. This training mode enables students to have a solid technical foundation before entering the workplace and be able to quickly adapt to the needs of enterprises. Secondly, 3D printing technology is one of the cutting-edge technologies in the current manufacturing industry, and offering such courses in higher vocational colleges can help students master the latest manufacturing technology, giving them a competitive edge in job hunting ^[10]. In addition, by cooperating with enterprises, vocational colleges can introduce practical projects in which students not only learn the technology but also accumulate experience in project management and teamwork during the completion of these projects, laying a solid foundation for future employment.

5.2. It is conducive to strengthening school-enterprise cooperation

First of all, vocational colleges cooperate with 3D printing-related enterprises, students can intern in enterprises, directly participate in actual work projects, and improve practical ability, excellent students may also get employment opportunities directly after the internship. Secondly, through the cooperation between schools and enterprises, the enterprises can send professional and technical personnel to serve as part-time tutors of the schools and regularly come to the schools to teach or guide the students, which not only improves the professionalism of the courses but also enables the students to have access to the latest industry information and practical skills ^[11]. In addition, the school-enterprise cooperation can also jointly build a 3D printing technology laboratory, the enterprise provides equipment and technical support, and the school provides the site and human resources. This mode of cooperation enables students to have access to the most advanced 3D printing equipment and technology during their school days.

5.3. Guide students' career planning

First of all, through course learning and career guidance, students can have an in-depth understanding of the application of 3D printing technology in manufacturing, healthcare, construction and other industries, helping them to clarify their career interests and directions, and providing a foundation for future career development planning. Secondly, the course focuses on practical operation, and students can master relevant skills and tools through the practical operation of 3D printing equipment and software, which improves their competitiveness in employment ^[12]. In addition, the employment guidance not only provides employment information, but also provides personalized career planning advice for students according to their personal interests and abilities,

helps students find career positions related to 3D printing technology, and provides them with corresponding training and advice. Finally, vocational colleges usually establish partnerships with related industries to provide internships and employment opportunities for students, giving them the opportunity to get in touch with the actual working environment, understand the needs of the industry, and build connections with potential employers to lay the foundation for future employment ^[13].

5.4. Enhancing the ability of enterprises to empower schools

Enterprise empowering schools means that enterprises support the teaching and research work of schools in various ways to improve the quality of education. First of all, 3D printing enterprises can provide advanced printing equipment and technical support to schools to help schools establish high-level laboratories and teaching platforms, which not only improves the quality of teaching but also enhances the scientific research capacity of schools. Secondly, enterprises can make curriculum recommendations to schools according to industry needs and technological development trends, helping schools optimize course content and ensuring that students' acquired knowledge and skills meet market demand ^[14]. In addition, enterprises and schools can carry out scientific research cooperation in the field of 3D printing technology to jointly overcome technical problems and promote technological progress.

6. Future development and prospects

In the future, the application of 3D printing technology in vocational colleges will be more extensive and in-depth. First, cooperation between schools and enterprises will be further strengthened, and enterprises will actively participate in the curriculum setting and teaching practice of schools, providing more internship and employment opportunities for students. Secondly, the rapid development of 3D printing technology requires the teaching content to be constantly updated, and vocational colleges need to keep up with the technological frontier and introduce the application of new technologies and materials in a timely manner ^[15]. In addition, the standardization and certification system construction of 3D printing technology will be promoted to ensure the consistency of education quality and industry standards. Interdisciplinary research and application will also become a trend, with the combination of different disciplines spawning more innovative applications.

7. Conclusion

3D printing technology education plays an important role in talent training and employment guidance in vocational colleges. Through systematic curriculum setting, scientific teaching methods and effective employment guidance, vocational colleges can cultivate 3D printing technical talents with high skills and high quality to meet the development needs of modern manufacturing and other industries. At the same time, through continuous optimization and innovation, 3D printing technology education will bring more opportunities and challenges for talent training and employment guidance in vocational colleges.

Disclosure statement

The author declares no conflict of interest.

References

- [1] Bian C, 2024, Application of 3D Printing Technology in Mechanical Manufacturing. *China Equipment Engineering*, 2024(5): 213–215.
- [2] Wei D, 2024, Case Analysis of Reverse Modeling and 3D Printing Technology. *Journal of Integrated Circuit Applications*, 41(1): 362–364.
- [3] Zhu S, 2023, Application Research of 3D Printing Technology in Industrial Design Major of Vocational Education. *China Educational Technology and Equipment*, 2023(24): 15–18+21.
- [4] Yao H, Tang J, Peng W, et al., 2023, Research on the Application of 3D Printing Technology in Vocational College. *Automobile Repair & Maintenance*, 2023(12): 80–81.
- [5] Wang Y, 2023, Research on the Application of 3D Printing Technology in Higher Vocational Teaching. *Science and Technology Wind*, 2023(33): 129–131.
- [6] Lu X, 2023, Application Research of 3D Printing Technology in the Training of Mechanical Students in Higher Vocational Colleges. *Times Automobile*, 2023(22): 46–48.
- [7] Tian C, 2023, Research on the Reform of Vocational Skill Training Mode Based on 3D Printing Technology. *Neijiang Science and Technology*, 44(9): 157–158.
- [8] Cao Y, Zhu S, 2023, Thinking on the Integration of 3D Printing Technology into Industrial Design Major of Vocational Education. *Journal of Higher Education*, 9(26): 76–80.
- [9] Yang W, 2023, Education and Training Strategies for 3D Printing Technology Professionals in Secondary Vocational Schools. *Information Systems Engineering*, 2023(8): 173–176.
- [10] Yu X, 2023, Research on Application of 3D Printing Technology in Industrial Product Design. *Modern Industrial Economy and Information Technology*, 13(3): 158–160 + 208.
- [11] Chen C, 2022, Research on 3D Printing Technology and Training of Applied Talents. *Industrial Science and Technology Innovation*, 4(6): 114–116. (in Chinese)
- [12] Liu Y, 2022, Design and Practice of School-Based Curriculum of Labor Education Based on 3D Printing Technology. *Information Technology for Education*, 2022(9): 77–80.
- [13] Li J, 2022, Integration Teaching Practice of Internet 3D Printing Technology Course Based on STEAM Education. *Electronic Technology*, 51(5): 70–72.
- [14] Wu W, Sun H, Guo J, 2020, Reform of Teaching Model and Method of “3D Printing Technology” Curriculum Under New Engineering. *Science and Education Guide (Mid-ten-day)*, 2020(20): 131–132.
- [15] Gao Z, Guo J, 2018, Research and Practice of “3D Printing Technology” Course in Mechanical Innovation Education in Higher Vocational Colleges. *Higher Vocational Education (Journal of Tianjin Vocational University)*, 27(2): 77–80.

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