Application of Internet +3D printing technology in the construction of English teaching platform

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Abstract. In order to explore the application of Internet +3D printing technology in the construction of English teaching platform, the author first elaborated the concept of teaching, then, based on learning theory, "learning by doing" theory and activity theory, a framework of learning activity design in the application of 3D printing technology in teaching is constructed. Compared with the traditional teaching model, the Internet + flipped classroom teaching model can make full use of the fragmentary learning time before and after class, task-based teaching activities should be carried out in face-to-face teaching classes, but they should be properly applied according to different teaching situations in order to exert their effectiveness, for example, in the teaching of "3D printing technology" in the course of "Mechanical Engineering English", according to the learning situation of higher vocational students, the knowledge points with low memory and difficulty should be placed before class, difficult knowledge points, task-based teaching activities and laboratory observation and operation activities are put into the class for "partial flipping", supplemented by after-class expansion, so that students can grasp knowledge and skillfully use skills.

Keywords: Internet; 3D printing technology; The English teaching.

1. Introduction

3D printing technology first appeared in the United States, started in the late 19th century and realized and developed in the 1980s, now the 3D printing technology in Europe and the United States and other developed countries has initially formed a successful business model in consumer electronics, automobile manufacturing, aviation, medical and other fields. Compared with foreign countries, the research on 3D printing technology started later in China, especially the application research in basic education is less. Studying 3D printing technology and its application in the field of education can enable teachers and students to have a comprehensive understanding and mastery of 3D printing technology, for teachers, the use of 3D printing technology in the teaching process can make up for the disadvantage of lack of direct experience in normal classroom, by making tacit knowledge and cognitive structure explicit, learning materials can be changed from abstract to concrete, so as to improve the teaching effect. 3D printing technology is an advanced manufacturing technology integrating computer-aided design, numerical control technology and 3D printing, using 3D design data, on one SLM molding device, any complex shape parts can be directly manufactured quickly and accurately. However, at present, 3D printing mainly focuses on individual personalized production and lacks the hardware and software foundation of data sharing, remote control and online operation, there are many difficulties in realizing the application of rapid manufacturing integration technology, such as collaborative development and mass production, at the same time, there is no technical service and talent training platform for 3D printing to adapt to industrial transformation and upgrading. In elementary school, because of their limited logical thinking and spatial imagination, therefore, it is difficult for many students to learn graphics. Starting from the learning content of primary school mathematics, the first grade know all kinds of graphics; Second grade learning axisymmetric graphics; Third graders learn the area and perimeter of shapes; Fourth graders learn to look at shapes from different directions; The fifth grade learns to calculate the volume and surface area of various shapes, as well as the layout of the shapes. Sixth graders learn to calculate the surface area and volume of a circle, cylinder and cone. In the traditional teaching method, only teachers use the form of drawing or pictures to show on the books and computers, and students can not understand

the characteristics of the graphics from the real objects, unable to truly understand the reasoning process of the formula of area and volume, teachers often just take these contents as formulas for students to simply memorize, such a teaching mode will lead to students' incomprehension of the learning content and rote memorization, which is also one of the most prominent and urgent problems in the traditional teaching method of mathematics in terms of graphic content.

With the help of 3D printing technology, this problem can be fundamentally solved. 3D printing technology allows designs to jump out and be presented to students in physical form. Triangles, squares, parallelograms, cubes, cuboids, circles, cylinders, conics and irregular shapes can all be turned into real objects, let the students' understanding of the graph is no longer an armchair talk, but from the graph itself, at each conclusion, so as to have a comprehensive and real understanding of the problem. At the same time, it can help students to realize personalized thinking design, enrich the course content, cultivate students' spatial imagination and creativity, and further stimulate students' enthusiasm for learning. At present, Qiqihar Longsha Primary School has carried out 3Done course teaching, in class, students can use the software to design simple shapes, such as various spatial and three-dimensional graphics, dolls or buildings, as long as they imagine the image of objects, they can draw them in the modeling software, it can not only satisfy the desire of students to make by themselves, but also improve their cognition ability in observation and have a deeper understanding of spatial graphics.

2. Literature Review

In the field of basic education, the UK Department for Education launched a pilot project to integrate 3D printing into STEM subjects in 2012-2013, the hope is to create new learning "hubs" through 3D technology, where teachers and students learn through manufacturing and sharing processes. In 2015, Bernardi, P. D proposed that 3D printing should be student-centered in mathematics teaching of primary and secondary schools, and the application of 3D printing should highlight challenging learning links. Gebhardt, A took the 3D printing technology project of primary and secondary schools in the UK as an example, in order to provide experience for exploring the application of 3D printing in the field of basic education in China; Vanmathi, C studied the application of 3D printing technology in the field of higher vocational education. The application of 3D printing technology in education has always been a research hotspot in the field of education, however, 3D printing technology is still in its infancy in the field of education, and the depth of research needs to be further explored. However, these studies do not specify what kind of knowledge is suitable for pre-class, what kind of learning tasks can be placed in class, and what specific knowledge and skills can be communicated after class, few scholars have conducted classroom exploration of 3D printing technology for the course of "English".

The author will take specific documents in specific textbooks as examples, explore how to give full play to the advantages of Internet + 3D printing technology in the course of Mechanical Engineering English.

3. Application of Internet +3D printing technology in English classroom teaching

3.1 Use the Internet of Things technology to build a networked 3D printing equipment system

Iot technology is the use of the Internet or local network and other communication technologies to connect machines, controllers, sensors, people and things in a new way, forms are connected with things, and people are connected with things, the realization of remote management control, information and intelligent technology. 3D printing companies implant printers directly into the Internet, so that production equipment can trigger actions online or remote control, data collection, etc., forming 3D printing Internet of Things technology, building a networked equipment system,

realizing the perception, transmission and analysis of real-time data information of production and manufacturing, and accelerating the optimal allocation of production resources.

For example, a self-developed 3D printing equipment, independently developed the technical architecture mode of motion controller based on DSP&FP-GA, it has the following performance characteristics: Based on Windows CE.NET embedded real-time operating system, integrated display, USB, serial data communication interface, industrial Ethernet communication interface, can effectively exchange equipment data, realize network transmission and control. For this controller, based on sensors and computer technology, with information interaction as the core, the corresponding focal plane correction device based on Internet of Things technology is developed, as shown in Figure 1. Here's how it works: The 3D printer locks the focus of the laser beam output by the laser galvanometer 1, which is the brightest spot of the laser printed spot formed on the inclined plane. The supporting part 5 is arranged on the bottom plate 2, and the correction plate 6 is arranged on the supporting part 5 tilted to form the inclined plane. At the same time, the bottom end of the correction plate 6 extends into the inside of the through groove 4, and the support piece 7 is installed, the two are in a vertical relationship, in this way, the bevel can be aligned with the laser galvanometer 1. A slider is arranged on the laser galvanometer 1, and a vertical guide rail is arranged on the bracket 3, through the connection between the slider and the slide rail, the lifting of laser galvanometer 1 on the bracket 3 is realized, in order to adjust the distance between laser galvanometer 1 and base plate 2. The size of the distance is accurately measured by the camera 10 and the position measurement sensor, according to the position feedback information, the above self-developed networked motion controller based on DSP&FPGA, through the local network, output measurement information, by adjusting the position of the focus, adjust the distance between laser galvanometer 1 and base plate 2 again until the focal plane of the 3D printing machine is coplanar with base plate 2 of the molding chamber, that is, you can start printing. The advantage of this design is that the focal point is known in one shot, at the same time, through network transmission, data sharing, online operation, achieve remote adjustment and batch processing of multiple pieces, greatly improving the efficiency of 3D printing.

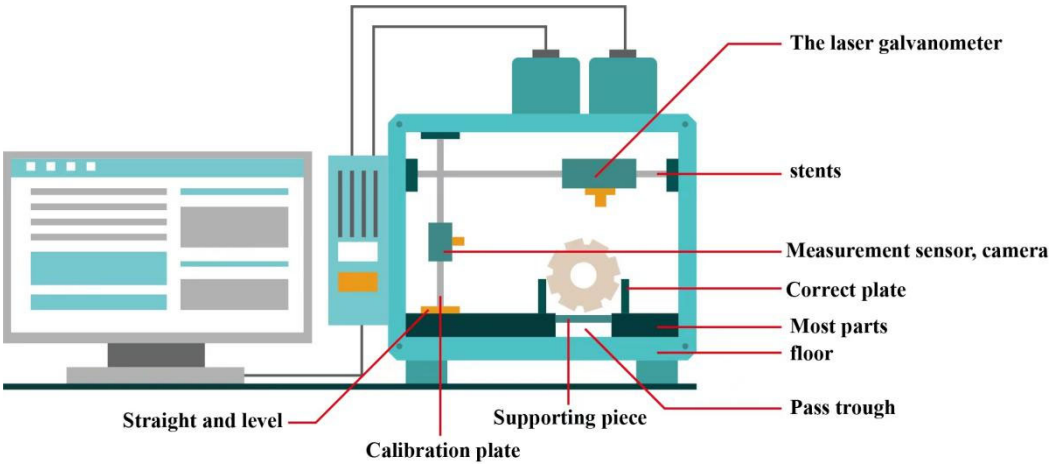

Figure 1. Coke plane correction device of 3D printer based on Internet of Things technology

3.2 3D printing technology and design thinking

3D printing technology is based on digital model files, and the solid model is created by printing material layers layer by layer through "accumulation modeling method", which is mainly used for prototype design and product manufacturing. The commonly used 3D design software includes SketchUp, AutoCAD, Bl e n d e r, etc., and 3D scanning equipment such as Ki n e c t and goSCAN can also be used to obtain 3D data of objects. Commonly used materials for 3D printing are: Nylon glass fiber, gypsum materials, rubber, and even food materials, using adhesives to color objects. Under the two-dimensional design thinking mode, there are often errors in plane, elevation and section data, this is essentially because the two-dimensional design tools restrict the designer's

thinking. When the human brain receives the intuitive morphological signals sensed by the senses, it is very likely to deviate after the process of thinking transformation from three-dimensional to two-dimensional. As shown in Figure 2, the initial state of brain thinking is simple and scattered, and the final state of cultivating design thinking is to reach the level of system, innovation and comprehensive synthesis. In the process of cultivating students' design thinking, teachers should first cultivate students' thinking ability and space imagination ability by three-dimensional thinking mode. 3D design software is the progress of design tools, but also the reconstruction of the inherent thinking mode, it can better help students to construct spatial thinking. Students observe, experience and modify the internal structure of the designed object, extract elements from the design object, the process of reorganizing it and then reorganizing it is a critical stage in design thinking, this stage can help students switch between abstract and concrete thinking. All the data in the model are related to each other, so if you change one of the data values, the data associated with it will change accordingly, which simplifies the laborious modification process.

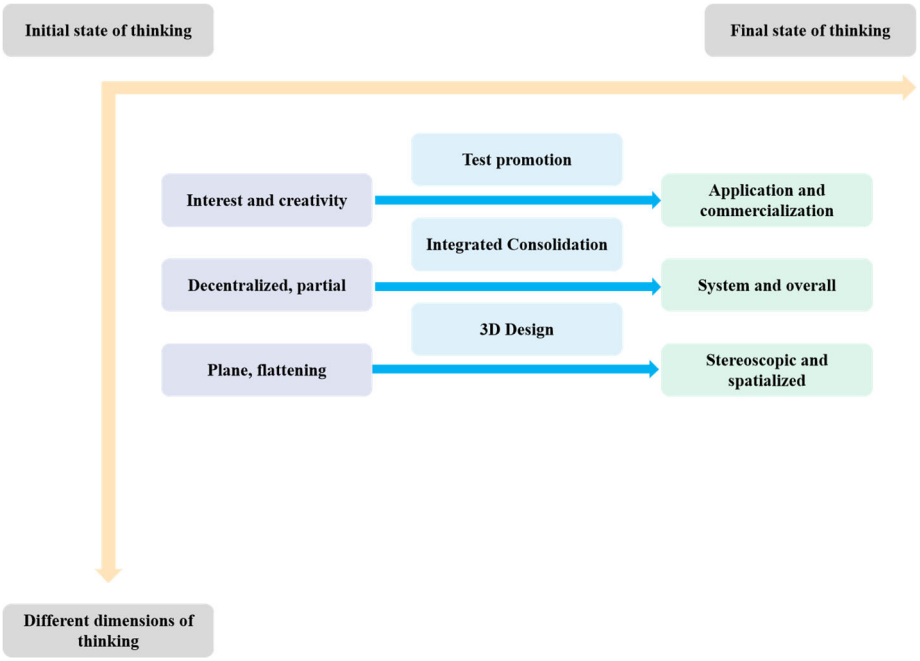

Figure 2. Course design

3.3 Construct the learning activity design framework of 3D printing technology in teaching

In the learning activities supported by 3D printing technology, the ability requirements of students and teachers, as well as the requirements of resources and tools for activities are similar to those of traditional classrooms. This study designed and explored operational learning activities, it provides reference and guidance for teaching based on 3D printing technology.

(1) Constructivism learning theory. In teaching based on 3D printing technology, the teaching AIDS made by 3D printers make the learning situation closer to the real situation. Students use 3D design software to operate, construct the meaning of knowledge independently, and the cognitive process is more complete.

(2) Dewey's theory of "learning by doing". Students use 3D design technology to carry out learning activities such as observation, experiment, inquiry, design and operation, build abstract knowledge into a physical model for direct learning experience.

(3) Theory of activity. The unit of concern of activity theory is an "activity system" that goes beyond the individual student. Figure 3 on the previous page is the structure diagram of the learning activity system based on 3D printing technology, it can be seen that the activity system includes six elements: Subject, object, community, tool, division of labor and rules. The core components of the system are subject, object and community, which together with the other three elements constitute

the communication subsystem, the production subsystem, the consumption subsystem and the distribution subsystem.

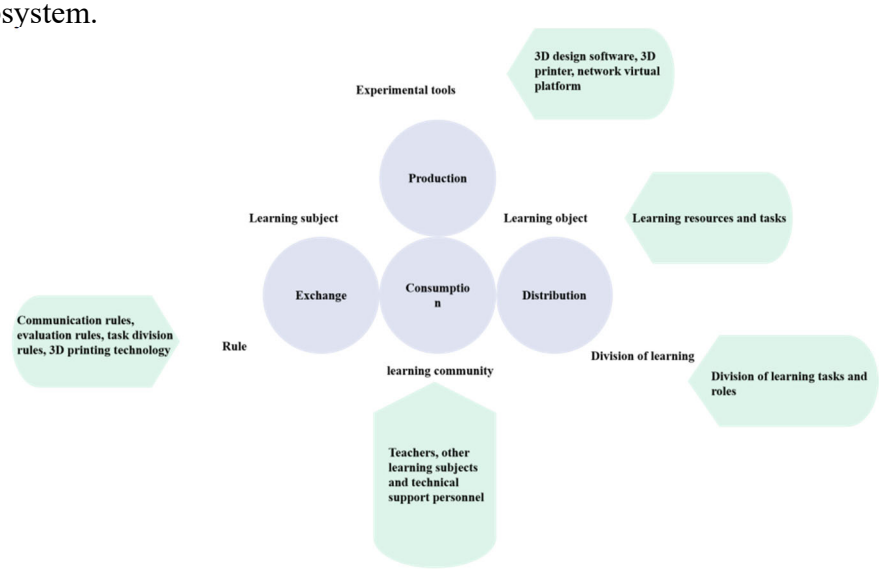

Figure 3. Structure diagram of the learning activity system

3.4 Framework of learning activity design of 3D printing technology in teaching

According to the relationship between six elements in the learning activity system, by integrating the ADDIE mode of teaching design, the framework of learning activity design of 3D printing technology in teaching is constructed, as shown in Figure 4. In teaching, each stage is inseparable from structured and serialized learning activities.

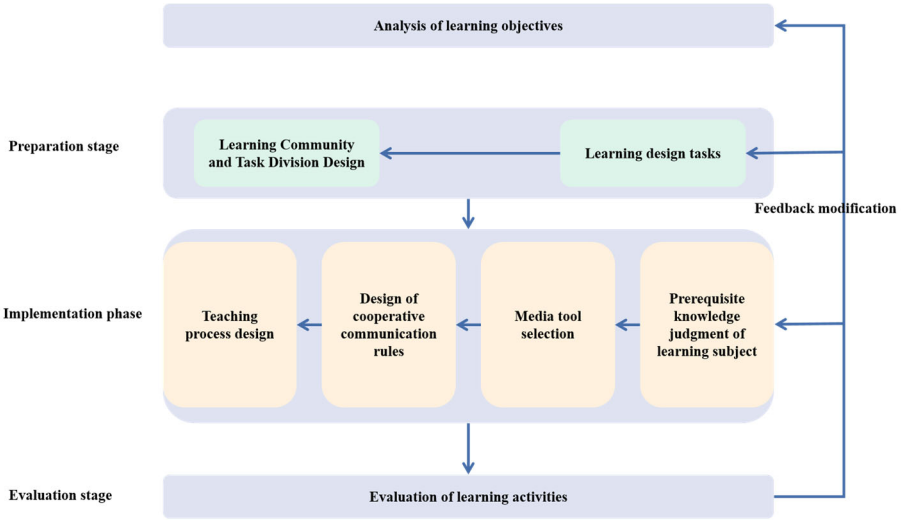

Figure 4. Frame of learning activity design

(1) Analysis of learning objectives. Teachers should analyze the learning objectives, determine specific learning tasks, make full use of the advantages of 3D design and 3D printing technology, and use 3D printing technology to support experimental teaching in the environment to meet specific teaching needs.

(2) The preparation phases. The learning tasks are designed into different learning sub-tasks according to the knowledge points, such as theoretical knowledge learning, physical investigation, operation learning of 3D design software, test questions, classroom exercises, etc. In the design stage of learning community and task division, students and teaching organizers jointly form a learning community, in the physical experiment environment or virtual platform, the teaching organizer will make learning plans and arrange the learning subjects to carry out group learning or individual learning. At this time, the teaching organizer will divide learning according to the interests and

characteristics of individual learners, and establish teaching activities on the basis of the original cognitive development level of students.

(3) Implementation stage. The teacher should first test the initial skills and original cognitive structure of the learning subject, according to the test situation, design effective teaching content, select appropriate media tools, and debug the technical constraints of media tools, ensure that technical factors do not interfere with teaching effectiveness. Develop rules for collaboration and communication, operating specifications and evaluation rules for the use of 3D printing technology, and then design the teaching process.

(4) The evaluation phases. The teaching organizer evaluates the whole process of learning activities and modifies each learning stage according to the feedback results.

3.3 Teaching process design of 3D printing technology in teaching

As shown in Figure 5 on the following page, teachers should first create problem situations, the specific activity tasks are integrated into the real-life situation of learning, starting from the existing knowledge and experience of students, motivate students to explore solutions, students can improve their design thinking ability while mastering knowledge. Based on the original cognitive structure, students consult relevant materials, make guesses and hypotheses, and design feasible experimental schemes. The Learning community evaluates and provides timely feedback and guidance. When the design scheme is feasible, the teacher presents the learning resources on the virtual platform, provides students with a learning scaffold, simulates the experimental principles with 3D animation, and reviews the pioneering knowledge. Students use 3D software to design the tools and materials for the experiment according to the actionable experiment scheme. The purpose of experimental teaching is not only to let students master the experimental conclusion, but also to pay more attention to the improvement of students' thinking ability in the process of exploring and solving problems. The function of asynchronous discussion is set up on the virtual platform, students should report the progress of the design regularly, and teachers should answer questions in time. In the discussion, students should recognize the mistakes in their design and correct them. Teaching organizers should actively create conditions to support students' independent learning and collaborative learning, which is a powerful guarantee to cultivate design thinking and enable students to carry out independent meaning construction. According to the experiment content with different degree of difficulty, the time of self-study on the virtual platform is reasonably arranged. During cooperative learning in the physical laboratory, teachers give technical guidance to the software operation and function problems of students in the design stage, and guide the design process to make it more conducive to the construction of knowledge, this requires teachers to master the ability of 3D design and solid subject knowledge. When completing the design work, the 3D printer is used to print out personalized experimental tools and materials, different materials and sizes of 3D printed works will take different time. In the experiment operation stage, teachers should focus on explaining the experiment purpose and matters needing attention before the experiment, help students understand the problem. In the course of the experiment, teachers pay attention to enlighten and enlighten students so that students can think in the direction of solving problems. Teachers organize students to conduct experiments with the 3D printed experimental tools and materials, if the experimental results are wrong, they should reflect on the problematic links and carry out iterative design. If the experiment is successful, organize a group discussion to explore the experimental conclusion. The learning community commented on the relevant design content and problems from different angles and put forward suggestions for revision. Students learn independently in the virtual lab, iterate the design again, improve the works, and write design reports and experimental reports. Teachers organize excellent works, share teaching cases on the virtual platform, display 3D printed works in the physical space, and organize visits and exhibitions.

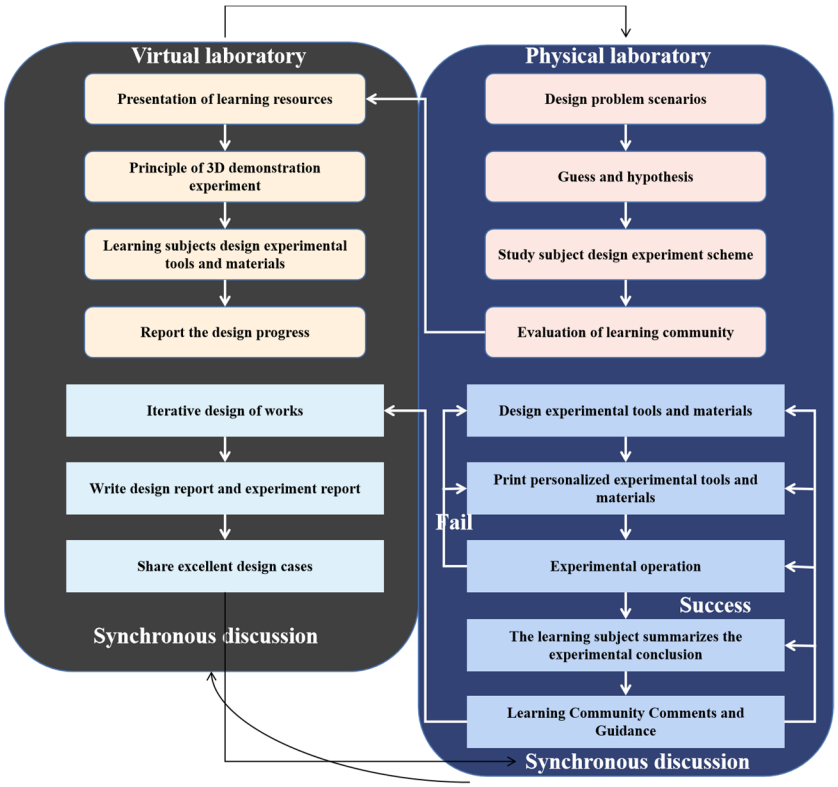

Figure 5. Teaching process design

3.4 Traditional teaching mode and Internet + 3D printing technology classroom teaching mode

Firstly, the author analyzes the advantages of the traditional teaching model and the Internet + 3D printing technology classroom teaching model by comparing the latter.

Traditional teaching model

The process of traditional teaching model is as follows: Review, introduction of new lessons, explanation of knowledge points of new lessons, classroom exercises, summary of the content of this section, and homework. Because students are just exposed to new knowledge in class, they have no time to understand deeply, and they are not able to take themselves as the main body, using knowledge to carry out learning activities, as a result, the traditional teaching mode is basically based on teachers, while students' knowledge application ability is limited.

In addition, because there is no teaching platform before and after class, a lot of students' time is wasted, which further reduces the learning effect.

Internet + 3D printing technology classroom teaching mode

The classroom teaching mode of Internet + 3D printing technology can be divided into three parts: The first part is to learn basic knowledge in online classroom before class; The second part is to carry out task-based learning activities in the classroom with students as the main part and teachers as the auxiliary part to cultivate the ability of using knowledge. The third part is the extension teaching of knowledge and skills by using online classroom after class. Since students have mastered the basic knowledge before class, they have the ability to exert their initiative to carry out various task-based learning activities in class, after class, they still have a learning platform (online classroom) to expand their knowledge and skills. In contrast, the Internet + 3D printing technology classroom can make full use of the time before and after class to teach, and can help the teacher's guidance in class, students as the main body to cultivate the ability to use knowledge, and effectively improve the future employment ability of students. If it goes up to the theoretical level, this is the constructivist learning method. Constructivist learning theory includes four factors: Context, collaboration, conversation, and sense-making. According to this theory, students need to take the initiative to build their own

knowledge system through the cooperation of peers in certain situations. The learning results obtained in this way must meet individual needs, and such learning is also profound rather than superficial.

3.5 Arrangement of teaching content before and after class

In order to give full play to the advantages of the Internet + 3D printing technology classroom teaching model, teachers need to determine the teaching content before, during and after class according to the functional characteristics of the model. The English foundation of higher vocational students is not very good, the following Table 1 is the results of the survey on the English level of the mechanical 1701 class.

Table 1. Survey of English Level

option	Difficulties in Learning Mechanical Engineering English			
	vocabulary	grammar	Vocabulary and Grammar	No difficulty
proportion	5.1%	28.2%	64.1%	2.6%
option	Only pass English Level III A	Pass Level III A and Level IV	Grade III A, I failed to pass Grade IV and VI	
proportion	18.4%	5.3%	76.3%	

From the above survey data, it can be seen that the English learning ability of higher vocational students generally needs to be improved, the foundation is poor, and they cannot fully control the 3D printing technology classroom, therefore, we should adopt "partial 3D printing technology", that is, a small part of the class time is taught by the teacher, most of the time, students study independently, discuss, report and evaluate each other. For the course "Mechanical Engineering English", the pre-class teaching content should focus on the knowledge points with low memorization and comprehension difficulty, in this way, not only students have the ability to complete, but also for the classroom knowledge application ability training to lay a good foundation. The classroom teaching content is divided into two parts, the first part is that teachers use a small part of the classroom time to teach difficult knowledge points, the second part is that students use most of the classroom time to carry out task-based learning activities. In this way, not only solve the students' doubts about learning, but also improve the students' future work ability. After class teaching content should focus on review and consolidation and knowledge expansion. In this way, it not only compels the teaching content required by the teaching plan, but also broadens the horizon and improves the comprehensive ability by using the Internet resources to keep pace with the times, so as to serve the future work.

4. Teaching Examples

Theory must be put into practice. Take the English course as an example to explore how to implement the Internet + 3D printing technology classroom teaching model. The author introduces the definition, development history, advantages, operation method and future development trend of 3D printing technology. Before class, in class, after class for the order of the discussion.

4.1 Before class

According to the definition, history, advantages and future development trend of 3D printing technology, teachers can make full use of Internet resources to make vivid teaching videos for students to learn and explain relevant vocabulary. For the actual operation method of 3D printing technology, teachers can select detailed operation process videos on the Internet for students to watch, supplemented by the explanation of 3D printing process and related vocabulary, students can have a general understanding of the operation method. In the above process, teachers need to make quizzes for each knowledge point for students to check the learning effect, and teachers supervise students' task completion in the background. At the same time, teachers should encourage students to have the courage to ask questions, discuss with each other online, and put them in class when necessary.

4.2 In the class

The author divided 10 students into two groups. The first part of the class is to publish online test questions to test students' pre-class learning. Although students had already done the test when they watched the video before class, whether they consulted books, asked classmates, and used other electronic resources to assist them in doing the test, a teacher can't tell. Moreover, in the classroom to detect again is to prevent students from forgetting knowledge points, in order to ensure the smooth progress of classroom teaching activities. Taking the author's teaching experience as an example, the author released multiple choice questions about the definition, history, advantages and future development trend of 3D printing in class, as well as connection questions related to the definition of relevant vocabulary. The author prepared the answers in the form of PPT in advance, according to the statistics of the background test results, the students' mistakes were selectively explained.

The second part of the class is to ask the students to raise their questions, and the teachers and students discuss and solve them together. My students have asked learning questions in online class discussion boards: How to analyze and translatelong English sentences? (How to analyze and translate long English sentences?) Based on my long-term understanding of school situation and observation of students' pre-class learning, i estimate that students will have this question, therefore, take a long sentence in English as an example and prepare a PPT to explain it. This lecture is given by the teacher, students are responsible for listening to lectures and answering teachers' questions, which can be asked using the online class's selection and rush function, grade students' performance in a timely manner. This is an example of "partial 3D printing". Due to the lack of solid learning foundation and limited learning ability of higher vocational students, it is unrealistic for students to master some knowledge points only through independent learning activities, so it is necessary to flexibly adapt the classroom teaching mode of Internet + 3D printing technology according to specific learning situations. When asking the students to translate this sentence, the author asked the two groups of students to discuss one translation and write it in the discussion area, then the teachers and students evaluated the two translations together, finally, a better translation can be obtained, and translation skills can be summarized to improve translation level.

The third part of the class is to train the ability of business negotiation. The author put the words and common sentence patterns related to the business negotiation in the form of teaching videos on the online class for students to learn and test in advance. In class, the author first asked students to raise problems they encountered in pre-class learning, some students did not know much about the concept of STL file(standard template library file), using on-site teaching AIDS, i explained the concept in detail and repeatedly asked students for feedback until they understood the concept. After solving the problem of pre-class learning, the author released the role play task -- simulating 3D product customization English business negotiation. The author allocates 5 minutes for the students to prepare, during which the students discuss with each other mainly, supplemented by the teacher's guidance. Five minutes later, the first group selected two representatives to perform on the stage, and one student filmed the performance with a mobile phone, after the performance, the video was uploaded to the class QQ group, teachers and students discuss the advantages and disadvantages of the role play together, pool wisdom and learn from each other. Then, you fill in the online evaluation form, which is divided into four grades of excellent, good, medium and poor in vocabulary, grammar, pronunciation and language appropriateness, as a summary evaluation. The second group did the same for role-playing.

The fourth part of the class is to go to the 3D printing laboratory of the college for field observation, operation and explanation. The laboratory is equipped with all kinds of equipment required for the 3D printing process and all kinds of 3D products ordered by enterprises. After the author introduced various products to the students in English, under the operation demonstration of the laboratory teacher, according to the students' understanding level of English, the operation process of 3D printing is explained in a way mainly in English and supplemented by Chinese, then, students are asked to do the operation by themselves, students can discuss with each other during the process. The advantages of higher vocational students are higher interest in hands-on tasks and stronger ability, therefore, the

author designed this link to attract students to learn English in an intuitive and vivid form, combining learning with practice, and effectively improving the ability of future work. If students cannot go to the laboratory, teachers can also conduct actual production process and operation demonstration through the live streaming function of online classroom for students to watch and learn.

4.3 After class

After the class, students have gained a thorough understanding of the equipment and printing process required for 3D printing production activities, therefore, the author published the homework (role play) online to implement what he learned in class. The requirements are as follows: (Tom from Company A went to Company B to visit and learn 3D printing technology and related equipment and products. Mike from Company B was responsible for relevant introduction. Please design a dialogue of about 150 words.)Ask students to report the performance next class. At the same time, the author helped students select many articles and videos about the cutting-edge development of 3D printing technology on the Internet for students to expand their knowledge. The author also set up test questions, monitor students' learning in the background, and give extra points to students who actively study and answer questions. So far, the author and the students have jointly completed the study of 3D PrintingTechnology. As for the final assessment and evaluation, the author will take the process assessment, which is 70% of the usual score + 30% of the final exam score. Ordinary grades include online class activity, test question accuracy, face-to-face class attendance, task-based learning and other assignments. In the assessment process, the background statistics of the online class will play a big role. The author takes the teaching of the above literature as an example, it is also to show that when teachers use Internet + 3D printing technology in practical teaching, they must consider the characteristics of students' knowledge base, ability level, interest points and knowledge and skills, reasonably arrange the teaching content and teaching methods before, during and after class, make full use of the functions of online classes, teaching should be guided by the requirements of the industry, and the powerful functions of the Internet + 3D printing technology classroom teaching model should be properly and fully utilized.

5. Conclusion

The Internet + 3D printing technology classroom teaching model can make full use of students' spare time before and after class for teaching, in addition, students can have time and knowledge reserve to carry out task-based learning activities related to knowledge application ability training, such as role playing, etc. However, considering that higher vocational students' English learning ability needs to be improved and the general situation of poor English foundation, they can only arrange knowledge points with low memory and difficulty before class. A small part of the class should be set aside for the teacher to teach the more difficult points. Higher vocational students have strong practical ability, so they can make full use of the laboratory in class to learn English in operation, they can not only put English into practice, but also understand what they have learned more accurately and deeply. This study has studied and verified the application mode and effect of Internet + 3D printing technology classroom teaching mode in actual teaching, which is a microscopic study. In the follow-up research, different literature teaching of the same course and the teaching of other courses will be discussed to make the research more comprehensive.

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