Research on the Construction of Digital Textbooks for Vocational Education

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Abstract: To achieve digital transformation of vocational education. There is an urgent need for corresponding digital textbooks to meet the teaching needs of professional courses. This article explores and studies the construction of digital textbooks in vocational colleges, and implements a comparative teaching experiment on digital textbooks. It has been proven that digital textbooks can enhance students' enthusiasm and make classroom teaching more flexible.

Keywords: Digital textbooks; Project-based learning; Vocational college

1. Introduction

The upgrading of industrial technology and the adjustment of economic structure have put forward many new requirements for the training of vocational education talents. However, the talents trained by vocational education in China cannot meet the needs of society. As an important carrier of cultivating high-quality skilled talents, the existing teaching materials of vocational education have obvious shortcomings in goal setting, content selection and structure organization, which leads to the mismatch between the knowledge structure of teaching materials and the upgrading of social industrial structure. The teaching materials of vocational education in China are constantly upgraded and improved, but there are still some shortcomings.

In the study of the structure of teaching materials in foreign countries, the modular writing style is adopted. German vocational training textbooks are organized in the form of unit modules, and the composition of the content of each unit module breaks the conventional discipline system. The German vocational education chart manual textbook arranges the content of the textbook according to the requirements of the ability points in the learning field.

There are also many scholars in China who have studied the design style of vocational education textbooks. Wei Xiaoyang pointed out that in recent years, vocational education textbooks have appropriately reformed the chapter style of traditional textbooks by adding projects, tasks, activities, cases, etc[1]. Li Zheng proposed to design a new form of vocational education textbook based on ability, with theoretical and practical knowledge centered around ability points[2]. Zheng Zhiyong proposed to abandon the subject genre of ' chapter style ', update the concept of textbook design, and design the textbook structure with ' task-driven ', which is conducive to practical teaching[3].

A shared assumption in this feld is the urgent need for schools to appropriate digital technology and radically transform their discourse and pedagogical practice[4].Digital transformation is directly afecting the feld of educational material and school teaching resources[5]. However, at present, there are few digital textbooks for higher vocational education published in China. Different professional categories have different professional post requirements. The development of new digital teaching materials for electronic information in higher vocational colleges is still in the exploratory stage. It is still facing great challenges in grasping the educational connotation, teaching characteristics and coupling relationship with digital teaching materials of electronic information specialty.

2. The necessity of developing digital teaching materials in vocational colleges

2.1 The need for digital transformation of education

The development and use of digital textbooks is one of the driving factors for the digital transformation of education in China[6]. In order to modularize the teaching of professional courses, it is necessary to effectively integrate the relevant content such as the requirements of enterprise post skills, promote the construction of digital teaching materials, and form a digital teaching material with scientific arrangement, rich supporting resources, flexible presentation, appropriate application of information technology, more audible, visual, practical and interactive.

Digital textbooks are a new community closely related to curriculum, blended teaching and teaching resource platform. With the continuous optimization and improvement of talent training ideas, it is necessary to promote the digital transformation of curriculum. It is not only necessary to build curriculum education resources, but also to develop digital textbooks with vocational education characteristics, so as to comprehensively improve the quality of curriculum and professional construction and realize the digital transformation of vocational education.

2.2 The practical needs of higher vocational teaching

2.2.1 The transformation of traditional classroom

As vocational colleges continue to learn from the professional quality assurance mechanism and professional certification concept of higher education at home and abroad, the ' student-centered' curriculum teaching reform has changed the traditional teacher-centered teaching mode in the classroom, and changed to play the leading role of teachers to promote the realization of student-centered learning. The role of teachers in the classroom has shifted from how to teach to how to guide students to learn. Students are no longer passive recipients of the classroom, but become the main body of teaching activities. Therefore, it is necessary for teachers to constantly innovate teaching forms to promote the innovation of teaching mode in the teaching process.However, the existing paper-based teaching materials mainly use words as the carrier of content, mainly teaching, and lack of innovative design for learning links, so it is difficult to fully adapt to the transformation of teachers and students' teaching

and learning methods.It is urgent to develop textbooks suitable for classroom teaching interaction between teachers and students.

2.2.2 The lag of paper textbook information update

In the new wave of information technology revolution, new technologies, new processes and new equipment of the industry are constantly emerging.Especially in the rapidly developing electronics industry, it is necessary to introduce new technologies and new processes related to intelligent systems in a timely manner according to the industrial development and the requirements of post capabilities.However, due to the limitation of its carrier, publishing cost and publishing cycle, the content of traditional paper teaching materials often lags behind the development of industrial technology, and the timeliness of teaching elements to follow up technology is insufficient. Although there have been many excellent loose-leaf and manual textbooks on the market, if the content of the textbook can be updated in time without destroying the overall structure of the textbook, the overall compilation and publishing cost of the textbook is very high, which will undoubtedly increase the learning burden of students.

In addition, due to the limitation of space, the quality expression of paper textbooks is not enough, and it is impossible to start from the most basic knowledge. The concentration and simplification of the text lead to no visualized knowledge description, no rich examples or case description, and no detailed concept description.

Paper-based teaching materials are also constantly strengthening the interaction of teaching materials in teaching, but the main way of interaction is still limited to the study of text pictures and auxiliary two-dimensional code.In the classroom, teachers and students are unable to interact, share, and track students' learning process and effectiveness in a timely manner.

2.3 Advantages of digital textbooks

The development and reform of technology has spawned changes in the form of teaching materials. The construction and application of digital teaching materials will promote the reform of digital teaching.Digital textbooks can carry out rich media layout design and interactive design of teaching content according to readers' situational, dynamic and visualized reading needs.Through a variety of electronic devices, to provide learners with a rich, scalable, interactive, progress can be tracked, refined new reading and learning experience[7].

Digitized teaching materials have changed from content supply to learning support. Through network technology, students can analyze and solve problems when reading digital teaching materials, which is far beyond the boundary of paper teaching materials. Unlike PDF e-books that only have images, text, and static links, digital textbooks can combine mobile technology to create a comfortable online learning environment, and transfer the process of students' use to the textbooks.Different from the online course platform or resource library, the digital textbook retains the advantages of the resource library with vivid learning resources such as video, animation, and audio. At the same time, through the style of the textbook, the use of directories, introductions, use guides, curriculum plans, and material topics Discussion and other ways to help students obtain the necessary learning resources, improve the efficiency of students ' content selection, and quickly establish a knowledge link for learning.

3. Thoughts on the Construction of Digital Teaching Materials in Vocational Colleges

3.1 Establish job employment skills

The implementation of the course is to support the training of professional talents, so it is necessary to clarify the professional orientation and the corresponding training objectives of the course. Taking the course of ' Intelligent System and Arduino Basic Development ' as an example, this course is a practical course for electronic information engineering technology major in higher vocational colleges.

In the course setting of electronic information engineering technology specialty, the main line of the course is formed through the intelligent system of ' circuit foundation ' and the basic development of Arduino ' single chip microcomputer technology ' intelligent electronic product development. ' To achieve professional electronic product design and development and other work personnel training.

3.2 Determine the course learning objectives

The course of ' Intelligent System and Arduino Basic Development ' focuses on the ability requirements of electronic product design and development positions. Based on enterprise research data and teaching conditions, the course emphasizes the basic cognition of intelligent system. The learning objectives of the course are : to master the hardware development and debugging of intelligent systems ; understand the working principle, system composition and key technologies of commonly used intelligent systems ; it can identify the fault points of general problems in intelligent systems.

Due to the rapid development of technology, the hardware and software versions of intelligent system development are constantly changing. Therefore, the development of digital textbooks based on project-based learning can better adapt to the curriculum reform and development and meet the teaching needs.

3.3 Determine the content design of the textbook

According to the teaching characteristics of vocational colleges, the real-time project of school-enterprise cooperation is transformed into the teaching content, and the teaching is carried out in a project-based practical way. The textbook constructs five modules of ' Introduction-Basic-Advanced-Comprehensive-Expansion '.The introduction module mainly introduces the basic knowledge of intelligent system development.The basic module and the advanced module select the intelligent induction lamp project, the intelligent parking assistance system, the smart home development system and other projects for individual skills and composite skills application training.Considering the vocational education characteristics of school-enterprise cooperation and work-study combination, enterprise projects are introduced in the comprehensive module and expansion module, and training is carried out through practical projects such as classic game development, robotic arm control and intelligent obstacle avoidance car. Enable students to achieve ability training through the progressive development of ' development knowledge cognition-application situation skill training-enterprise project development actual combat '.

3.4 Design textbook structure

According to the content selection, the textbook is finally determined to be composed of 6 items :Project one intelligent induction lamp implementation, project two intelligent parking assistance system, project three intelligent home system development, project four to create a classic game, project five simple mechanical arm control, project six intelligent obstacle avoidance car.Project 1 introduces the necessary skills and knowledge of Arduino intelligent system development. Project two and project three correspond to the application of situational skills training. Project four, project five and project six correspond to the development of complex and comprehensive practical projects. With the deepening of students ' learning of project content, the ability training from the application of external equipment with different functions to the overall joint debugging of the system will be gradually strengthened.

3.5 Present the content of the textbook

Guided by constructivism and information processing theory, the learning activities of each project in the textbook are designed.

3.5.1 Project lead

Each project introduces the project background, the main task of the project through the project introduction, and leads to the implementation of the project task.

3.5.2 Task analysis

Each task implementation is divided into learning activity 1 task analysis, learning activity 2 task implementation, learning activity 3 task acceptance. Task analysis can stimulate students ' interest in learning. Students can operate skills in the learning situation of simulated work, establish the connection between knowledge and work tasks, guide students to analyze problems through work situations, collect learning materials to solve problems independently, and construct the meaning of the knowledge learned.

For example, in the indoor temperature and humidity detection task, the required equipment, skills and learning situations are connected in series. Through the video embedded in the textbook, the importance of indoor temperature and humidity detection in vaccine cold chain transportation is demonstrated, so that students can understand the practical application of the skills they have learned.

3.5.3 Task implementation

When the task is implemented, according to the simulated situation design of the given task operation, the students are guided to think by guiding the problem chain, with the help of interrelated and progressive guiding problems. From the device principle-device use-circuit construction-program writing-functional verification, students are continuously guided to complete tasks by giving students scaffolding.

For example, in the indoor temperature and humidity detection task, through three guiding questions : how to detect data through temperature and humidity sensors - how to display temperature and humidity data - how to display data on the LCD screen, step by step to deepen the difficulty. The completion of the task is divided into different stages, one by one.

3.5.4 Task acceptance

By using the function of digital loose-leaf teaching materials, a loose-leaf task acceptance sheet is set up in the teaching materials. Different from the traditional paper-based teaching materials, students do not need to tear down the report to destroy the teaching materials, but students can directly record the implementation effect in the teaching materials according to the completion of the task, and carry out the acceptance summary. Then by clicking the button, the acceptance report can be sent to the instructor by email. It greatly reduces the difficulty of teachers ' collection of reports and improves teaching efficiency.

3.5.5 interactive mode

Combining with the learning characteristics of vocational students, it is a key step in the construction of digital textbooks to innovate the content of textbooks. In digital textbooks, students ' interest in learning can be stimulated and learning can be promoted through interactive design.

In the process of digital textbook construction, the design realizes interactive connection questions, multiple choice questions, graphic drag questions and card flips through interactive components to help students find problems in time and feedback their learning situation. Using the annotation function of digital textbooks, students can record their learning experience at any time, and timely access to the key and difficult points of learning marked by teachers, learning guidance and supplementary and perfect learning expansion materials according to professional or industrial development at any time, so as to make their learning more targeted and personalized, so that students can adjust themselves and finally achieve their learning goals.

At the skill point, the problem chain is guided by operation and combined with experimental operation video or simulation video to provide guidance support for students. The non-key content is made into extended reading buttons, bubbles and links that can be jumped for online search, so that students can choose to open reading on demand, avoiding the problem of increasing students ' learning burden caused by information overload due to the simultaneous display of too many learning resources.

4. Implementation effect of digital teaching materials

In order to test the results of the school-based use of digital teaching materials, two parallel classes were selected in the electronic information engineering technology major of our school to conduct a comparative experiment on the use of teaching materials.There were 41 students in the experimental group and 42 students in the control group.The experimental group used digital textbooks to carry out one-semester course learning, while the control group used traditional paper textbooks.From the data of the experimental results, the average scores of the students in the experimental group and the control group in the pre-test were 78.38 and 78.58 respectively.According to the results of the independent sample t-test, $p>0.05$ ($sig = 0.937$).It shows that the initial conditions of the experimental group and the control group are the same, and there is no significant difference in the scores before the experiment.The average scores of the students in the experimental group and the control group after the control experiment were

93.37 points and 85.58 points respectively.Independent sample t-test showed that the difference in students' post-test scores was statistically significant(sig=0.002).It shows that project-based digital textbooks have a significant impact on students ' learning outcomes.

Questionnaire survey data showed that all students (100%) in the experimental group were satisfied with the use of digital textbooks in course learning. Some students(82%) have a high evaluation of the interesting, gamified, and situational interactive evaluations and exercises provided in the textbook. Some students(88%) believe that the interactive functions of digital textbooks, such as learning videos, step-by-step guidance, and page tagging, are very beneficial in the learning process. Some students(95%) really enjoy the convenience of digital textbooks. Some students(78%) believe that sharing notes effectively enhances their learning outcomes. Students generally believe that the rich high-definition images, galleries, videos, audio, animations, etc. provided by digital textbooks are very helpful in describing the steps of project implementation. They believe that the most advantageous aspect of digital textbooks lies in the ability to complete project themes according to needs, mark pages in a timely manner, view annotated records of others' learning, watch learning videos, and conduct real-time feedback tests, which can greatly meet the needs of student-centered learning and increase the opportunities for a large number of personalized learning experiences.

The experimental results demonstrate that digital textbooks have good implementation effects, and students can achieve better learning outcomes through the use of affordable, user-friendly, attractive, and interactive digital textbooks.

5.   Conclusions

In summary, the digital transformation of vocational education textbooks is of great significance for promoting the intelligent process of higher education, breaking through the difficulties of the textbook publishing industry, and showcasing the advantages of digital information. Through practice, it has been proven that digital textbooks can enhance students' motivation, enhance their understanding ability, maintain their attention, promote social interaction and teamwork, increase their investment in knowledge construction, and improve their problem-solving skills, decision-making, collaboration with others, and time management. It can make classroom teaching more flexible and flexible; More diverse sources of professional knowledge for students; More diversified and personalized teaching modes; The shift from teaching to learning has been strengthened; Data based teaching management is more intelligent.

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