ISSN 2663-8169 Vol. 5, Issue 19: 1-5, DOI: 10.25236/IJNDE.2023.051901

The Construction and Practice of Task-driven Cloud Textbook in the Context of New Liberal Arts

Runqin He[a,*], Yubin Zhang[b]

College of Digital Technology and Engineering, Ningbo University of Finance & Economics, Ningbo, Zhejiang, China
[a]herunqin@nbufe.edu.cn, [b]zhangyubin@nbufe.edu.cn
**Corresponding author*

Abstract: *With the rapid development of information technology, there has been a fundamental revolution in the way knowledge is presented and disseminated. In order to enhance the level of instructional material construction, the government has continuously upgraded the content and form of textbooks. Among them, digital textbooks, as a new type of learning resource, have been widely introduced into higher education institutions. As a mobile, interactive digital teaching material, Cloud textbook provides learners with richer educational resources and learning opportunities. This paper takes the interdisciplinary elective course "Fundamentals of Engineering Technology" as an example to study the construction and practice of task-driven Cloud textbook for liberal arts, aiming to guide students in applying engineering knowledge to understand the application and development of engineering.*

Keywords: *New liberal arts, Task-driven, Cloud textbook, Foundations of engineering technology*

Textbook serves as an integral component of teaching, fulfilling various functions such as instructional guidance, learning resources, standardized criteria, assessment tools, and reference materials. It provides teachers with guidance and support for instruction while offering students a systematic learning framework and tasks, facilitating the achievement of teaching objectives and meeting students' learning needs. Traditional textbooks have traditionally been in the form of printed materials. However, with the progress and development of the era, printed textbooks are limited by their inconvenience in carrying, monotonous layout, and printing constraints, thus failing to meet readers' reading needs. [1] In the context of the new era, textbook needs to undergo innovative changes and digital transformation. Integration of textbook with information technology, Cloud textbook has emerged as a new digital form of textbooks in the current context.

1. The current status of the application of Cloud textbook in curriculum instruction

1.1 The current application status of Cloud textbook in higher education institutions

As a significant form of digital resource, Cloud textbook has emerged as a novel learning resource in higher education. Over the past few years, online teaching has gradually become the norm, and blended learning, combining online and offline instruction, has become the prevailing trend in education today and in the foreseeable future. Consequently, the Cloud textbook has experienced rapid development and has been widely adopted and popularized in numerous universities nationwide. As early as 2019, the School of Acupuncture at Hunan University of Chinese Medicine applied the Cloud textbook in its acupuncture courses. [2] Since 2020, various courses, such as "Engineering Drawing," " International Trade Practice," "Computer Basics," and "College Physics," have implemented Cloud textbook for their instructional practices. [3-6] These sources indicate that Cloud textbook can recommend personalized learning resources and pathways based on students' learning needs and interests. Additionally, the learning data and analysis functions within the Cloud textbook can assist teachers in understanding students' learning progress and challenges, providing personalized guidance and support.

1.2 The current state of our school's engineering and technical foundation courses

With the rapid advancement of science and technology and the continuous progress of productivity, "disciplinary integration, knowledge fusion, and technological integration" have become prominent features of contemporary society. Higher education in our country has also shifted from the original focus

ISSN 2663-8169 Vol. 5, Issue 19: 1-5, DOI: 10.25236/IJNDE.2023.051901

on cultivating specialized talents with narrow and deep knowledge towards the direction of cultivating versatile and innovative talents with a broad knowledge base, solid professional skills, and high comprehensive qualities. Talent cultivation promotes the interaction between humanities and sciences, advocating that students in science and engineering have humanistic qualities, while students in the humanities possess scientific and engineering qualities.

In May 2019, the Ministry of Education and 12 other ministries launched the "Six Excellence, One Top" 2.0 program. It started to comprehensively promote the construction of "new engineering," "new medical," "new agricultural," and "new liberal arts" disciplines. In June 2019, our university, with its commercial advantages as a private university in finance and economics, initiated the construction of interdisciplinary elective courses. Through the development of a series of interdisciplinary elective courses, students are able to combine their technological and managerial abilities, cultivating professionals with distinctive characteristics and a solid understanding of socialist core values. "Fundamentals of Engineering and Technology," as an interdisciplinary elective course under the general education curriculum, primarily targets students majoring in liberal arts disciplines, aiming to cultivate students' engineering knowledge and labor skills, enrich their knowledge structure, enhance their interdisciplinary thinking, and improve their vocational competitiveness. This course mainly focuses on cultivating students' engineering knowledge and labor skills, providing support for subsequent interdisciplinary elective courses. Currently, three rounds of teaching practice have been conducted for a total of 7,042 students. Due to the unique nature of this course in our university, no existing textbooks in the market are suitable for students in the liberal arts discipline. Therefore, there is an urgent need to develop a new type of engineering textbook specifically designed for these students.

2. Compilation of cloud textbook using a task-driven approach

2.1 Approach to Compilation Cloud Textbook for Fundamentals of Engineering Technology

As a textbook aimed at liberal arts students studying engineering, it is important to avoid obscure content and dry expressions while still highlighting the characteristics of engineering. Therefore, the textbook should achieve a combination of “humanities” and “engineering”, avoiding excessive and overly complicated knowledge points. The emphasis should be on the practical application of theory, leaning towards practicality. The task-driven approach will be used to create a new form of Cloud textbook and publish it in physical format, catering to the teaching needs of over 2,400 students each academic year. The content of the “Fundamentals of Mechanical Technology” and “Fundamentals of Electrical and Electronic Technology” modules will focus on foundational knowledge, using everyday examples that are simple and easy to understand. The module on intelligent manufacturing will focus on high-end technologies such as 3D printing, robotics, and smart agriculture.

The entire textbook is organized into modules, specifically divided into four modules: Fundamentals of Mechanical Technology, Fundamentals of Electrical and Electronic Technology, Intelligent Manufacturing, and Creative Integrated Application. The specific contents of each module are shown in Table 1.

Table 1. The specific contents of each module

Serial number	Chapter content	Knowledge points
1	Overview	Course Introduction. This course takes the Fourth Industrial Revolution as its main theme and explores the development of science and technology through typical case studies. The aim is to inspire students' interest in this subject.
2	Fundamentals of Mechanical Technology	The course covers the practical usage of commonly used mechanical tools and introduces students to familiar mechanisms such as gear mechanisms, cam mechanisms, and screw mechanisms.
3	Fundamentals of Electrical and Electronic Technology	The course covers the fundamental knowledge of circuits and electronics, including basic concepts and principles. Students will also learn how to use commonly used electrical and electronic tools. Additionally, the course introduces students to familiar electronic components and their functions.
4	Intelligent Manufacturing	The course explores topics such as 3D printing technology, robotics, and smart agriculture. Additionally, it provides an overview of the current state of China’s manufacturing industry. Students will gain insights into the advancements, challenges, and opportunities in these areas, as well as an understanding of how these technologies are revolutionizing various industries in China and globally.
5	Creative Integrated Application	Production of Creative Products: Proficiency in the production of creative products, such as assembling smart fish, building models, 3D modeling, 3D printing, etc.

According to the table, it can be seen that each module has corresponding practical tasks. When compiling the textbook, the content of each module is to serve practical applications, aiming to emphasize

ISSN 2663-8169 Vol. 5, Issue 19: 1-5, DOI: 10.25236/IJNDE.2023.051901

the goal of cultivating students' engineering knowledge and labor skills, enriching their knowledge structure, enhancing interdisciplinary thinking, and improving their competitiveness in the workplace.

The organizational structure of each module in the textbook is as follows:

1) Task Name: The name provides an intuitive understanding of the general content of the task.

2) Task Introduction: A summary introduction of the task, including an explanation of the task background and expected outcomes.

3) Task Objectives: Through task-driven approaches, the relevant knowledge objectives, skill objectives, and quality objectives are required to be achieved.

4) Task Implementation: Detailed instructions on the specific operational procedures of the task, utilizing rich media such as videos and images to facilitate the completion of the intended tasks.

5) Task Summary: A necessary summary of the task, emphasizing and supplementing the key points and difficulties.

6) Knowledge Expansion: By scanning QR codes, similar content related to the main task is provided to promote deeper and consolidated understanding and application of knowledge.

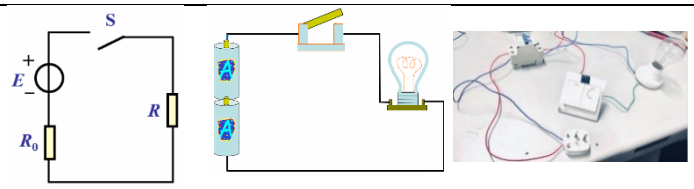
7) Appendix: The experimental guidebook for the module is attached.

Taking the Electrical and Electronics Fundamentals module as an example, I will briefly outline the approach to developing the textbook, as shown in Table 2.

Table 2. Approach to writing the foundation module of electrical and electronic technology

Serial number	Name	Details
1	Task Name	Chapter 3: Fundamentals of Electrical and Electronic Engineering
2	Task Introduction	By studying this chapter, you will gain an understanding of the history of electrical and electronics technology development, master the use of common electrical tools, and become familiar with commonly used electronic components and their applications.
3	Task Objectives	Knowledge Objectives: - Recognize common electrical and electronic components and understand their applications. - Understand simple circuit models. Skill Objectives: - Master the use of common electrical tools. - Be able to install, wire, and troubleshoot common lighting circuits. - Understand the display principles and wiring methods for LEDs and digital tubes. Personal Development Objectives: - Foster harmonious interpersonal relationships. - Cultivate a spirit of unity, cooperation, and teamwork.
4	Task Implementation	Task 1: Electrical Technology ✧ Compile the theoretical knowledge needed for Experiment 4 in the field of electrical technology. ✧ Topics include mastery of the usage of common electrical tools like multimeters and screwdrivers, as well as understanding components such as light bulbs, sockets, and circuit breakers. ✧ Explain the concepts using a combination of actual photos and theoretical diagrams. ✧ When describing home lighting circuits, present three sets of images: circuit model, actual circuit, and physical components. ✧ To ensure the accuracy of the textbook, provide the physical circuit diagram in the form of a QR code. Task 2: Electronic Technology ✧ Focus on the theoretical knowledge required for Experiment 5 in the field of electronic technology. ✧ Use a combination of actual photos and theoretical diagrams to explain the concepts. ✧ Ensure rigor and accuracy in the textbook, especially when explaining electronic circuit principles and applications, by including examples of physical circuits and actual circuit diagrams. ✧ Consider providing actual circuit diagrams in the form of QR codes to facilitate in-depth learning and practical application.

ISSN 2663-8169 Vol. 5, Issue 19: 1-5, DOI: 10.25236/IJNDE.2023.051901

		 Circuit model Practical circuit Physical circuit
5	Task Summary	This chapter primarily focuses on the common knowledge in the field of electrical and electronic technology. It introduces familiarization with common electrical tools and components, as well as the ability to conduct lighting experiments and experiments related to LED and digital display. Additionally, it covers an understanding of safety precautions regarding household electricity usage.
6	Knowledge Expansion	①What will happen if two identical incandescent bulbs (rated voltage 220V) are connected in series in a 220V circuit? ②What measures should be taken if there is a sudden power outage at home? ③What electrical components are commonly used for short circuit and overload protection in a circuit? ④How is the blinking effect of LED lights achieved? The above knowledge can be expanded using QR codes, which can be combined with experiments for verification.
7	Appendix	Including the corresponding laboratory manuals for each module at the end is a great way to integrate theory and practice in textbook development. In this module, we will provide the laboratory manuals for Experiment 3: Installation of Lighting Circuit, and Experiment 4: LED and Digital Display Experiment.

2.2 Innovation in "Fundamentals of Engineering and Technology" Cloud Textbook

1) Writing Approach: The textbook follows the approach of prioritizing practical application while providing sufficient theoretical knowledge. It adheres to the principle of theory serving practice and employs a task-driven method to compile the materials.

2) Focus on Engineering Knowledge Cultivation: By taking "engineering knowledge cultivation" as the starting point, the textbook caters to the learning characteristics of humanities students. It transforms the intricate and dry language used in engineering textbooks into plain and easy-to-understand forms, incorporating rich media such as images, videos, and animations to achieve a combination of "humanities" and "engineering."

3) Integration of Foundational Knowledge and Cutting-edge Technology: The content of the textbook reflects a combination of foundational knowledge and advanced technology. The Mechanical Technology Fundamentals and Electrical and Electronics Technology modules primarily focus on foundational knowledge, aiming to develop students' engineering knowledge and practical skills. In the Intelligent Manufacturing module, modern cutting-edge technologies such as 3D printing, robotics, and smart agriculture are introduced to provide students with specialized knowledge in advanced manufacturing industries.

3. Application of the "Fundamentals of Engineering and Technology" Cloud Textbook

This Cloud textbook primarily focuses on foundational mechanical, electrical, and electronic engineering knowledge. It explains the current status of China's manufacturing industry and the development and application of intelligent manufacturing. It systematically organizes the fundamental knowledge of mechanical, electrical, and electronic engineering, as well as the application of technologies like 3D printing in intelligent manufacturing. This textbook is also equipped with a wealth of case resources to expand students' knowledge. The content includes a gallery of images, 93 high-definition images, 7 videos, 15 bubble annotations, 4 interactive learning sections, and 9 supplementary reading materials. It was finalized in December 2021 and released in February 2022.

The Cloud textbook was implemented among more than 2,400 individuals from March 2022 to June 2023. According to statistical data, students who adopt the digital textbook demonstrated personalized learning in terms of video viewing, test accuracy, and interactive learning. They showed a high level of task completion and an improvement in enthusiasm for learning and self-directed learning abilities.

ISSN 2663-8169 Vol. 5, Issue 19: 1-5, DOI: 10.25236/IJNDE.2023.051901

4. Conclusion

Cloud textbook is digital learning resources based on cloud computing and internet technology. It offers online access, rich multimedia content, real-time updates, personalized learning, collaborative interaction, and data analysis and evaluation. It provides learners with convenient, flexible, personalized, and diverse learning opportunities. Through Cloud textbook, learners can access study materials anytime, anywhere, gaining a more vivid and intuitive learning experience. It can keep up with the developments of the era, achieve personalized matching of learning content, promote collaboration and interaction among learners, and optimize learning strategies in real time through data analysis and evaluation. The development and application of the Cloud textbook for the Fundamentals of Engineering and Technology course have significant reference value for the construction of new-style textbooks in other interdisciplinary elective courses in our school.

Acknowledgments

The work was supported by project of Key Education Reform Project of University (NO. 21jyzd05, 22xwkzd15); The 2022 annual “Fourteenth Five-Year” teaching reform project of ordinary undergraduate universities in Zhejiang Province’s Department of Education (NO. jg20220628).

References

[1] Jianan Zhang, Longlong Guo. The current state and analysis of the transformative revolution in higher education's cloud-based teaching methods [J]. Technology Wind, 2020(05): 83.
[2] Guoshan Zhang, Wei zhang, et al. An analysis of the features of the acupuncture digital textbook based on Lanmo Cloud [J]. Higher Education Exploration, 2017:90-91.
[3] Ding Qiao, Sun Yihong, Lu Yuming. Development and Application of the Cloud Course Based on Cloud Textbook of “Engineering Drawing” [J]. Journal of Graphics 2019, 40(5):976-982.
[4] Jie Shang. Innovation and Practical Exploration in the Construction of Cloud textbook for International Trade Practice, Journal of Wuhan Technical College of Communications [J]. 2022(24):121-124.
[5] Chong Huang. Development and Research of the Online Editor for LanMo Cloud Teaching Materials - Taking Computer Fundamentals Course as an example[J]. Occupation. 2023(10):30-32.
[6] Chunyan Zhi, Jinqiu Liu. Investigating the development of Cloud textbook for University Physics courses [J]. Technology Wind. 2023(20):26-28.