

# Research on the Design and Application of Scaffolded Learning Resources Based on the OBE Concept: A Study on Learning Science and Technology

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## Abstract

Nowadays, education continues to be reformed, and in the context of the new era that emphasizes outcome-oriented education, course learning in colleges and universities needs to improve the quality of resources again. Learning Science and Technology is a key course in the information age, and there is a disconnect between traditional teaching resources and students' actual learning needs. To solve this problem, this study utilizes scaffolded learning theory, combines students' learning needs, and constructs a scaffolded learning resource system from the course objectives. The system covers learning content, activity design, and evaluation and feedback. The research focuses on the time of student learning, based on learning theory to build a learning scaffold suitable for students to carry out learning, through cases, empirical evidence to test the application of the scaffold effect. The study shows that the application of scaffolding learning resources can effectively improve student initiative and achievement. It provides favorable support for the teaching quality of the course. It has implications for similar courses.

## Keywords

OBE concept; scaffolded learning; learning resource design; Learning Science and Technology; teaching reform.

## 1. Relevant Theoretical Foundations

### 1.1. OBE Concept

Outcomes - Based Education (OBE) is a kind of education concept oriented to students' learning outcomes. Its core lies in defining the specific abilities and quality requirements that students should achieve after completing their studies, and then designing the curriculum system, teaching content and teaching methods, organizing teaching activities, and carrying out evaluation and feedback around these expected results. The OBE concept emphasizes that the ultimate goal of the educational process is for students to be able to master and apply the knowledge and skills they have learned in order to solve practical problems and realize their personal development and the needs of the society. Applying the OBE concept in the design of course resources requires us to first define the expected learning outcomes of the course, and then plan and construct learning resources that match these outcomes to ensure that the resources can effectively support students to achieve their goals. With the continuous development of higher education, the traditional teaching mode has been difficult to adapt to the new requirements of talent cultivation. The OBE concept should be integrated into the reform of higher education teaching mode. [1] The OBE concept emphasizes the solution of the following four questions: what are the learning outcomes of students? Why do students want such learning outcomes? How to help students achieve such learning outcomes? How to test whether students achieve such learning outcomes? [2]

## 1.2. Scaffolding Learning Theory

Scaffolding learning theory originates from Vygotsky's "zone of nearest development" theory. According to this theory, there are two levels of student learning: one is the actual level of development of students to solve problems independently; the other is the potential level of development that students can achieve with the help of others, and the gap between the two is the zone of nearest development. Scaffolding teaching is to help students cross the zone of nearest development by providing appropriate "scaffolding" and gradually raise them to a higher level of development. During the teaching process, the teacher or the learning system plays the role of "scaffolding", providing students with the necessary support, such as guidance, prompting, demonstration, cooperation, etc., to help students accomplish learning tasks that they would otherwise be unable to do independently. As students' abilities improve, the support role of scaffolding is gradually reduced so that students can eventually complete the learning tasks independently. Learning scaffolding is one of the very important aspects, and it can even be said that learning scaffolding is the fullest and most centralized embodiment of teachers' modern teaching skills. [3] Learning scaffolding is a temporary support framework provided for students according to their learning needs, with the aim of helping students to cross the zone of nearest development, to obtain further development and the ability to learn independently. [4] In the process of practice, we gradually realized that the cultivation of students' critical thinking needs to be guided and supported by the scaffolding, so we reconstructed the model of critical thinking cultivation supported by the learning scaffolding. [5] Scaffolding Instruction (Scaffolding Instruction), is based on Vygotsky's theory of the zone of recent development of a new type of teaching theory, which provides a set of learning scaffolding to help learners understand the knowledge, construct meaning. [6]

## 2. The Characteristics of The Course "Learning Science and Technology" and Traditional Teaching Resources Problem Analysis

### 2.1. Course Characteristics

The Learning Science and Technology course integrates knowledge from a number of subject areas, including education, psychology, and computer science, and aims to cultivate students' modern learning concepts, learning strategies, and the ability to use information technology for learning. The content of the course includes the basic theories of learning science, the application of learning technology, the design and development of learning resources, etc., which is characterized by a strong combination of theory and practice. Students not only need to understand the relevant learning theories, but also need to be able to use the knowledge and skills learned to solve practical learning problems, such as designing personalized learning programs and using information technology tools for collaborative learning.

### 2.2. Problems of traditional teaching resources

The content is outdated, and traditional teaching materials tend to be updated slowly, failing to reflect in a timely manner the latest research results and practical cases in the field of learning science and technology. For example, in the application of learning technology, new educational software and online learning platforms are constantly emerging, but the textbooks may still remain in the introduction of the old tools, resulting in a disconnect between what students learn and practical application.

The form is single, mostly based on paper textbooks, supplemented by some simple courseware. This single form of resources is difficult to meet the diverse learning needs and learning styles of students. For some abstract learning theories and complex operational processes, only through the presentation of text and static pictures, students find it more difficult to understand, and are prone to learning fatigue and boredom.

Lack of interactivity, traditional teaching resources are usually teacher-centered, and students are in a passive position to receive knowledge. Teaching materials and courseware are often one-way knowledge transfer, lacking interactive links between students and resources, which is not conducive to cultivating students' independent learning ability and critical thinking ability. For example, in the design of learning activities, traditional resources seldom provide students with opportunities to participate in discussions and collaborative inquiry, making it difficult for students to deepen their understanding and application of knowledge in practice.

### **3. Construction of Scaffolding Learning Resource System Based on OBE Philosophy**

#### **3.1. Define the course objectives**

According to the OBE concept, the objectives of the Learning Science and Technology course are first clarified and refined. Through in-depth interviews and research with industry experts, educators and student representatives, the expected learning outcomes of the course were determined, including: students can accurately articulate the basic theories and concepts of learning sciences, such as constructivist learning theories, cognitivist learning theories, etc., and understand the value of their application in educational practice. Master the operation methods and application strategies of commonly used learning technologies, such as the use of online learning platforms, the production of multimedia courseware, the use of collaborative learning tools, etc., and be able to utilize these technologies to solve problems in actual learning. Have the ability to design and develop simple learning resources, such as writing learning materials, producing teaching videos, etc., and be able to design and optimize resources according to different learning objectives and learning objects. Be able to apply the learning theories and methods learned to evaluate and reflect on their own and others' learning process, and make suggestions for improvement.

#### **3.2. Learning content scaffolding design**

The knowledge system is constructed by dividing the course content according to knowledge modules, each of which is organized around a core theme. For example, the learning science theory part is divided into constructivist learning theory module, cognitivist learning theory module, etc.; the learning technology application part is divided into online learning platform application module, multimedia courseware production module, etc.. Within each module, knowledge points are organized in the order from simple to complex, from basic to advanced, forming a clear knowledge system structure. At the same time, correlations are established between modules to help students understand the intrinsic connections between different knowledge modules and form a complete knowledge network.

Provide learning materials. For each knowledge point, diversified learning materials are provided, including e-textbooks, academic papers, case studies, video tutorials and so on. The e-textbook presents the basic content of the course in digital form, which is easy for students to access anytime and anywhere; the academic papers select representative and cutting-edge research results in the field to broaden students' academic horizons; the casebook collects typical cases in actual education and teaching to help students combine theory and practice; the video tutorials explain complex operation processes and abstract theoretical concepts through vivid demonstrations, which meets the needs of students with different learning styles. video tutorials explain complex operational processes and abstract theoretical concepts through vivid demonstrations to meet the needs of students with different learning styles.

#### **3.3. Activity Design Scaffolding**

Diversified learning activities are designed. According to the course objectives and students' learning needs, a variety of types of learning activities are designed, including online

discussions, collaborative group projects, hands-on exercises, role-playing, and so on. Online discussion activities are centered on the key and difficult issues in the course. Under the guidance of the instructor, students communicate and discuss on a dedicated online learning platform, share their views and insights, and promote in-depth understanding of knowledge. Group collaboration projects require students to work in groups to complete a practical project related to the course content, such as designing a constructivist-based learning activity program, developing a simple multimedia courseware, etc., to cultivate students' teamwork ability and the ability to comprehensively apply knowledge. Practical exercises are aimed at the application of learning technologies, providing students with a large number of practical opportunities, such as the operation of the online learning platform, the use of multimedia software practice, etc., to improve students' hands-on ability and operational proficiency. Role-playing activities allow students to play different roles as teachers, students and educational technologists to simulate actual teaching scenarios, experience the responsibilities and roles of different roles in the teaching process, and deepen their understanding of learning theories and teaching methods.

Provide activity guidance, providing a detailed guidance program for each learning activity, including the purpose of the activity, the steps of the activity, and the evaluation criteria. The activity guidance program is presented in the form of online documents or videos, which students can access at any time during the activity process to clarify the requirements and directions of the activity. At the same time, teachers provide real-time guidance and feedback to students through the online platform or offline classroom in the process of the activity, help students solve problems encountered, guide students to participate in the activity correctly, and ensure the smooth implementation of the activity and the achievement of learning results.

### **3.4. Evaluation and feedback scaffolding construction**

Diversified evaluation methods and a diversified evaluation system are constructed, including student self-assessment, mutual evaluation, teacher evaluation and automatic evaluation of the online learning platform. Student self-assessment requires students to self-evaluate their learning process and learning outcomes according to the evaluation criteria provided by the teacher, reflect on their strengths and weaknesses, and put forward improvement measures after completing each learning task or learning activity. Mutual evaluation, on the other hand, allows students to evaluate each other's learning outcomes, such as group assignments and online discussion presentations, to promote communication and learning among students. Teacher evaluation consists of comprehensive evaluation by teachers based on students' learning performance, completion of assignments, results of practical activities, etc., providing targeted feedback and suggestions. The automatic evaluation of the online learning platform, on the other hand, aims at some objective question types and operational tasks, and provides timely feedback to students on the learning results and reasons for errors through the platform's automatic correction and analysis functions.

The feedback mechanism is designed to establish a timely and effective feedback mechanism to ensure that students can obtain learning feedback information in time. The automatic feedback function is set up on the online learning platform, so that students are able to see their scores and the analysis of wrong answers immediately after completing exercises or tests. Teachers regularly correct and evaluate students' assignments and performance in learning activities, and provide students with feedback and suggestions for improvement through online messages, emails or classroom lectures. At the same time, teachers adjust the teaching content and teaching methods and optimize the learning resources according to the feedback from students, forming a closed-loop feedback and improvement mechanism to promote the continuous improvement of students' learning effects.

## 4. Empirical Research

### 4.1. Research Design

In order to further verify the application effect of scaffolded learning resources in the course of Learning Science and Technology, this study adopts a quasi-experimental design. Two parallel classes of the same major were selected as research objects, one of which was used as an experimental class with the teaching mode based on scaffolded learning resources; the other class was used as a control class with the traditional teaching mode. The experimental cycle is one semester, and the students in the two classes are tested before and after the experiment, and relevant data are collected and analyzed.

### 4.2. Test instruments

Pre-test and post-test papers, pre-test and post-test papers are prepared by the course teachers according to the course syllabus and teaching objectives, and the contents of the papers include theoretical knowledge part and practical operation part, the theoretical knowledge part is mainly to test students' mastery of the basic theories of the learning sciences, and the question types include multiple-choice, short-answer and case study questions, etc.; the practical operation part is mainly to test the students' ability to use the learning technologies to solve practical problems, such as asking students to design a simple learning technology to solve practical problems. The practical part is mainly to test students' ability to use learning technology to solve practical problems, such as requiring students to design a simple learning activity program, make a multimedia courseware, etc. The question paper is divided into 100 marks. The test paper is worth 100 points, of which the theoretical knowledge part accounts for 60 points and the practical operation part accounts for 40 points.

Students' learning attitude questionnaire, before and after the experiment were issued to the two classes of students learning attitude questionnaire, the questionnaire, including students' interest in the course, learning motivation, independent learning ability and other aspects of the questionnaire, the use of Likert five-level scale for scoring, 1 means "strongly disagree", 5 means "strongly agree".

### 4.3. Data analysis

The achievement data were analyzed by statistically analyzing the pre-test and post-test scores of the students in the experimental and control classes. The results of the analysis of the pre-test scores showed that the average scores of the two classes before the experiment were similar, with no significant difference ( $p>0.05$ ), indicating that the two classes had a comparable learning foundation before the experiment. Analysis of the post-test scores showed that the average scores of the students in the experimental class were significantly higher than those of the control class ( $p<0.05$ ), indicating that the teaching mode based on scaffolded learning resources can effectively improve students' academic performance and promote their mastery of course knowledge and skills.

Data analysis of learning attitude survey, the data of learning attitude questionnaire of pre-test and post-test of students in the experimental and control classes were statistically analyzed. In the pre-test, the difference between the scores of the two classes on each question item was not significant ( $p>0.05$ ). In the posttest, the scores of students in the experimental class in the areas of interest in the course, motivation to learn, and independent learning ability were significantly higher than those of the control class ( $p<0.05$ ), indicating that the application of scaffolded learning resources can improve the students' learning attitudes, stimulate their interest in learning and motivation to learn, and cultivate their independent learning ability.

## 5. Conclusion and Prospect

### 5.1. Research Conclusion

Based on the OBE concept, this study constructs a scaffolded learning resource system by applying the theory of scaffolded learning and combining the characteristics of the Learning Science and Technology course and students' learning needs. Through case application and empirical research, the following conclusions are drawn:

Scaffolded learning resources can effectively enhance students' learning initiative and achievement. In teaching practice, rich learning content scaffolding, diversified activity design scaffolding and diversified evaluation feedback scaffolding provide students with all-around learning support, help students overcome difficulties in the learning process, stimulate students' interest and motivation in learning, and make students more actively participate in learning activities, thus improving the degree of students' academic achievement and achievement of their comprehensive ability.

The application of scaffolded learning resources helps develop students' independent learning ability and teamwork ability. Through the provision of diversified learning resources and activities, students are able to independently choose learning contents and learning methods according to their own learning needs and learning styles, and carry out personalized learning. At the same time, in group collaborative projects and other activities, communication and cooperation among students increase, cultivating students' teamwork and communication skills.

The design of scaffolded learning resources based on the OBE concept can be closely centered on the course objectives and ensure the consistency of the teaching process with the course objectives. Through the clarification and refinement of the course objectives, the design and application of learning resources are closely integrated with the course objectives, so that students' learning activities are always directed toward the expected learning outcomes, and the relevance and effectiveness of course teaching is improved.

### 5.2. Research Outlook

Although this study has achieved certain results, there are still some shortcomings, such as the research object is relatively single, mainly focusing on students of a certain major; the application effect of scaffolded learning resources in different teaching environments and courses of different disciplines needs to be further verified. In the future research, the scope of the study can be expanded to apply scaffolded learning resources to more types of courses and students of different majors and levels to further explore its universality and effectiveness. Meanwhile, with the continuous development of information technology, such as artificial intelligence, big data and other emerging technologies in the field of education, the design and application of scaffolded learning resources can be further optimized to provide students with more intelligent and personalized learning support. In addition, the relationship between scaffolded learning resources and the improvement of teachers' teaching ability can also be studied in depth, so as to provide corresponding training and support for teachers, promote the better application of scaffolded learning resources to carry out teaching activities, and promote the overall improvement of the quality of education and teaching.

In summary, the design and application of scaffolded learning resources based on the OBE concept provides an effective way and method for the teaching reform of college courses, which is of great significance for improving the quality of course teaching and cultivating the comprehensive quality of students, and also provides a useful reference for the application of educational technology in teaching in the future.

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## References

- [1] Zhou Hongbo,Zhou Ping. Research on the reform of teaching mode in colleges and universities based on the concept of OBE[J]. China Adult Education,2018,(04):92-94.
- [2] Chang Jianhua,Zhang Xiuzai. Construction and Practice of Practice Teaching System Based on OBE Concept--Taking Electronic Information Engineering Major as an Example[J]. China University Teaching, 2021, (Z1):87-92+111.
- [3] Yan Hanbing. Study on Learning Scaffolding for Informatization Teaching[J]. China Electronic Education, 2003,(11):18-21.
- [4] Zhang Lixia, Shang Leijie. Types and Functions of Virtual Classroom Learning Scaffolds[J]. China Electronic Education, 2011, (04): 27-31.
- [5] GUO Jiong,GUO Yuhan. Research on the application of critical thinking cultivation model supported by learning scaffold[J]. Research on Electrochemical Education, 2015, 36(10): 98-105.DOI:10.13811/j.cnki.eer.2015.10.015.
- [6] Nie, R. H.. Research on the development of online learning resources based on scaffolding theory[J]. Research on Electrochemical Education, 2014, 35(11): 46-50+58. DOI:10.13811/j.cnki.eer.2014.11.007.