

# Research on Blending learning Design for Promoting Deep Learning

Huan Chenglin<sup>1\*</sup> • Chen Jianwei<sup>2</sup>

<sup>1</sup>College of computer science, Yangtze University, No.1 Nanhuan Road, Jingzhou, China.

<sup>2</sup>Institute of jingzhou, No.85 Xueyuan Road, Jingzhou, China.

Corresponding Author Email: webhcl@sina.com.

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**Abstract.** Under the background of further promoting the construction of "golden class" in universities, how to use teaching innovation and promote the cultivation of learners is the focus of educational researchers. Guided by the theory of deep learning, based on MOOC resource platform and teaching management platform, this study constructs a "3-stage-2 platform" blended learning mode for deep learning in three stages: before class, in class and after class, puts forward teaching strategies to promote deep learning, and based on this mode, takes the computer network course as an example to carry out the blended teaching design and practice. The results show that the model has a certain role in promoting learners' knowledge mastery and ability training, and good emotional experience is conducive to learners' deep learning.

**Key words:** Deep learning, mixed teaching, teaching design.

With the enrichment of information resources and means such as MOOC, micro class, network teaching platform or mobile app, a variety of blending learning mode has emerged, which has become an important way to explore teaching reform. However, from a large number of teaching practice, blending learning can be said to be "lively scene, lack of connotation", and teaching reform advantage is not obvious, Li and Yanhong (2021). Based on the theory of deep learning, to explore the practical path of blended teaching can help the teaching reform to go deeper.

## Shallow performance of blending learning

### Formal "online + offline" mixed teaching

<sup>1</sup>Formal mixed teaching is mainly manifested in the teachers' understanding deviation of the teaching method of mixed learning. Some teachers think that

mixed teaching is the combination of "online + offline" teaching, the understanding is mainly based on the change of learning environment. The result is: teachers regard online learning as a supplement to classroom teaching, and online learning design is mainly based on information teaching platform, providing micro class, courseware or MOOC resources as preparatory and supplementary learning materials for students' autonomous learning. The lack of attention to students' online learning results also does not usually change the classroom teaching design based on online learning results. Therefore, there is no essential difference from the traditional classroom teaching, only the introduction of online learning in the form.

### "Informal" online autonomous learning

With the development of mobile technology, students have been used to "digital life", but have not prepared their attitude and ability for mobile learning. Since mobile tool-based online learning is still at the "life entertainment" level experience, they usually perform simple passive reception learning at some fragmented time. Fragmented, recreational and informal learning experience brings about "shallow knowledge", lack of

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deep thinking and active inquiry.

### **Extreme classroom autonomous learning**

In the blended teaching, the common mode is: students complete the cognitive learning of knowledge principles online in the classroom, and carry out application exploration, problem discussion or project learning. Therefore, there will be a complete decentralization of classroom to students. Because the effect of online pre-learning is not guaranteed, students do not have the knowledge ability to conduct independent exploration, and there is no teacher's timely guidance and feedback in the learning process. In order to complete the learning task, they can only deal with it hastily, and cannot concentrate on thinking, analyzing and creating.

Some of the above shallow learning performance has indeed aroused doubts about the mixed teaching reform. In fact, any teaching mode cannot naturally bring the improvement of the teaching effect. The introduction of online learning brings not only the changes in the way of knowledge transmission, but also the systematic changes of rethinking teaching space-time connection, teaching interaction and other aspects.

### **Strategies for Promoting Deep Learning**

#### **Nature and characteristics of deep learning**

The concept of deep learning (Deep Learning) originated from research on artificial neural networks and was introduced into education in the 1970 s. The meaning is "the general term that learners can actively participate in teaching", which aims to enable scholars to seek the link between meaning, knowledge and experience, explore common paradigms and principles, ponder the criticality of evidence testing and discussion, and recognize the level of self-understanding. (Songlin and Shuang, 2020)

Based on the empirical analysis of the deep learning scale, Nelson Laird and others have found that integrated learning, advanced learning, and reflective learning are the three essential components of deep learning. Among them, integrated learning means that learners integrate knowledge from multiple disciplines based on their own life experience and cognitive structure, and learn knowledge through different ways and means. Advanced learning means that learners apply higher level cognitive ability to knowledge construction and problem solving; Reflective learning refers to learners' cognition, monitoring and regulation of their own thinking mode, learning strategy and problem-solving process. Nelson Laird *et al.* (2006)

#### **Internal mechanisms of deep learning.**

##### **Generation mechanism of deep learning: situation-induced-problem-driven**

The occurrence of deep learning needs to trigger the

subconscious motivation of learning. Without the inherent motivation, it is difficult for students to connect the old and new knowledge, not to mention deep processing and understanding of new knowledge. Constructivist learning theory emphasizes the importance of the learner's previous experience and daily experience, focuses on the factual situation of knowledge, Once, it is separated from a specific situation, knowledge has no meaning. With the help of situation induction and problem-driven, it not only triggers students 'deep motivation, but also strengthens the connection between old and new knowledge, driving students' meaningful construction of knowledge.

##### **Maintenance mechanism for deep learning:**

Experience Participation-Problem solving

Experience participation and problem solving are two essential conditions for maintaining deep learning. Only when students are personally involved in problem solving and experience the process of problem generation, analysis, solution and verification, can they gradually understand the problem from shallow to deep and from knowledge to practice. Just as Cooper elevated the experience to the source of human learning and development. Problems solving helps to enhance the sense of self-efficacy and learning achievement, and is also the most direct manifestation of profound learning.

##### **Promotion mechanism of deep learning: Practical Reflection-Advanced Development**

One core of innate learning is the development of high-order thinking abilities, such as analysis, synthesis, evaluation and innovation. The development of these abilities is not overnight, but needs systematic cultivation. After a problem / stage of experience interaction and problem solving, carrying out targeted expansion and exploration, through continuous practical reflection, lets the learning go deep, and inspires new learning.

##### **Support mechanism of deep learning: Mixed learning-selective focus**

Many studies have shown that online learning and virtual reality technology have an understandable supporting role in the advanced mental process. From the perspective of learning environment, the construction of a mixed online and offline learning environment, giving full play to the richness of online resources, the convenience of online interaction, the visualization of virtual environment, the authenticity of offline communication, face-to-face rich emotional experience, all provides important support for deep learning.

### **The Deep Learning Implementation Strategy**

This study builds a blending learning mode of "3 stage-2 platform", and 3-stage refers to MOOC self-study, classroom deep teaching and after-class extended learning. 2-Platform refers to the MOOC resource

platform and course management platform (Huan and Yu, 2016). Here, the hope for optimization reflects the mixed-based possibilities of teaching to realize the demands of intense learning.

**Self-study before pre-class:** the foundation of deep learning

In this stage of learning, learners' shallow processing and simple memory of knowledge are the basis of deep learning.

High-quality self-study resources: Provide targeted and experienced learning resources. It can be reference resources, including high-quality college construction sharing resources, MOOC and social resources, such as meters Open Class, Tencent classroom and B station. It can also be self-developed integrable ware resources, SPOC, etc.

**Self-study guidance:** Provide learning guidelines for learners' self-study, explain learning objectives and tasks, clear learning resources and problem feedback methods and forecast the second stage of classroom teaching arrangement.

**Self-study test:** Conduct the knowledge mastery test based on the task instruction after students finish MOOC and other studies before class according to the task instruction to understand the students' self-study before class and carry out targeted classroom teaching. Huang *et al.* (2009)

**High-Interactive Classroom Teaching:** The Core of Deep Learning. (Eric and LeAnn, 2009)

Offline classroom teaching, teachers and students, students and students can directly conduct face-to-face communication and group cooperation. Good emotional interaction is more conducive to stimulating learning and participation, divergent thinking, and in-depth discussion.

The pertinence of classroom teaching: according to the pre-class self-study, master the learning difficulties and missing points, and set up classroom teaching objectives and activities according to the nearby development area.

Comprehensive nature of classroom teaching: the design of classroom teaching activities and tasks is not the re-detection of self-study knowledge before class, but on the basis of self-study before class, through application, analysis, comprehensive tasks and evaluation.

Interactivity of classroom teaching: the interaction here includes three levels: One is collaborative learning or deliberative learning between learners; The second is the interaction between learners and learning content, the analysis of learning tasks / problems, the formation of solutions and the accurate expression of learning results; The third is the interaction between learners and teachers, teachers' guidance of learning process and timely feedback of learning state.

**Open after-class reflection:** The Development of Deep Learning

After completing the task of classroom learning, students have experienced the application, analysis, synthesis and problem-solving of knowledge, and have personal experience of knowledge principles. Through peer cooperation, discussion and evaluation, they can absorb some new perspectives and viewpoints, and then reflect, enrich and innovate after class, which is of great significance to cultivate high-quality and innovative talents. (Zhong, 2021)

Open learning tasks: after-school learning tasks can be developed, enriched and innovative based on classroom learning tasks; or you can also set a comprehensive new task separately.

Open learning requirements: do not do hard requirements for learning participation. Students can voluntarily choose to complete or not, can explore independently, or group cooperation.

Targeted teaching guidance: for the students who have the spare time to learn, the teachers can do targeted guidance, supervision, and use the appropriate time to display and share, and set up a learning model.

### Mixed teaching design

Based on the online MOOC platform and cloud class teaching management platform, this study combines online MOOC platform teaching with offline face-to-face classroom teaching. Taking computer network as an example, it designs a blended learning oriented to deep learning from the aspects of learning situation analysis, goal analysis, content design, environment design, activity design, method design and evaluation design.

### Academic Situation Analysis

Computer Network is a fundamental professional course for students majoring in electronic information, which begins in the second semester of the sophomore year. Before that, the students take the introduction to computer science and have some basic knowledge of computer, computer system (software and hardware). And then they are proficient in the common applications of computers and computer networks. Combined with the rational application, setting up appropriate discussion topics and project tasks can stimulate students' interest in the learning of computer network principles.

### Target Analysis

Knowledge and Skills Level:

(1) Master the basic knowledge of computer network theory that is, basic concepts, architecture, working

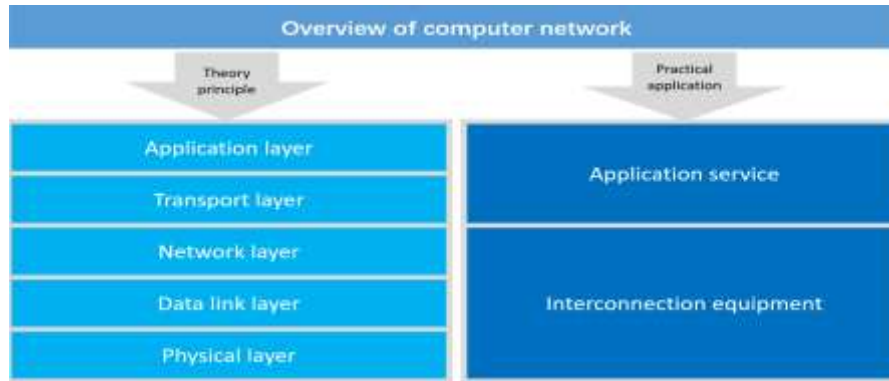


Figure 1. Teaching Content Design and Organization

principles and typical protocols.

(2) Understand the packaging format of messages at each layer of the network reference model, Grasp the meaning of the key fields, and can utilize the network protocol analysis tools to analyze messages, understand protocol and analyze faults.

(3) Master the composition, structural characteristics and working principle of typical network interconnection equipment; be able to use switch routing equipment for network planning and design, configuration management and deployment application.

Process and method level:

(1) Learn to use elementary methods to analyze and solve complex network problems, such as tiering principles and strategies.

(2) Learn the general methods of networking engineering practice: requirement analysis-planning-configuration-deployment-management-evaluation, etc.

Emotional and attitude level:

(1) Cultivate the learning ability of independent thinking and cooperative exploration.

(2) Cultivate the professional quality of clear responsibility, good cooperation and adhering to the original aspiration.

(3) Cultivate the craftsman spirit of the network era of superior technology, high standards, integrity and innovation.

(4) Cultivate students' awareness of competitive growth and safety bottom line

### Content Analysis and Design

Based on the main line of the five layer reference model of the compromise ISO / OSI seven layer reference model and TCP / IP four layer reference model, the teaching content is organized from the two dimensions of principle and practice around how information is transmitted from the source to the destination (as shown in Figure 1): One is about the working principle of each layer of the network and the data encapsulation of typical

protocols. The second is about the working principle and network application of typical interconnection equipment. Third, according to the characteristics of the computer network course, combined with the requirements of Ideological and political education and the professional certification standards of engineering education, the socialist core values are infiltrated from the basic principles of network and engineering practice, and many elements such as harmony, tolerance, equality, legal system, integrity, professional ethics, craftsmanship spirit, safety awareness are integrated into the whole teaching process in simple terms

### Teaching Activity Design

Before class, students conduct MOOC self-study under the guidance of learning guidelines, complete the learning of elementary knowledge, basic principles and skills, and achieve the goals of low-class areas such as memorizing and understanding. In the classroom, common problems are solved targeted, and in-depth teaching is carried out through teaching activities such as classroom homework, topic discussion, project cooperation, sharing of exhibition reviews, so as to achieve high-level goals such as application, analysis, comprehensive and evaluation. Expand homework after-class, carry out the training of promotion and innovation. The course teaching realizes the whole process cloud management by means of the push of resource sharing and teaching activity organization by using the cloud class (APP and website service). As showing in Figure 2 below:

### Teaching environmental design

In this study, the teaching environment includes online MOOC platform teaching environment, offline classroom teaching environment and cloud class teaching management APP, which is designed from teaching

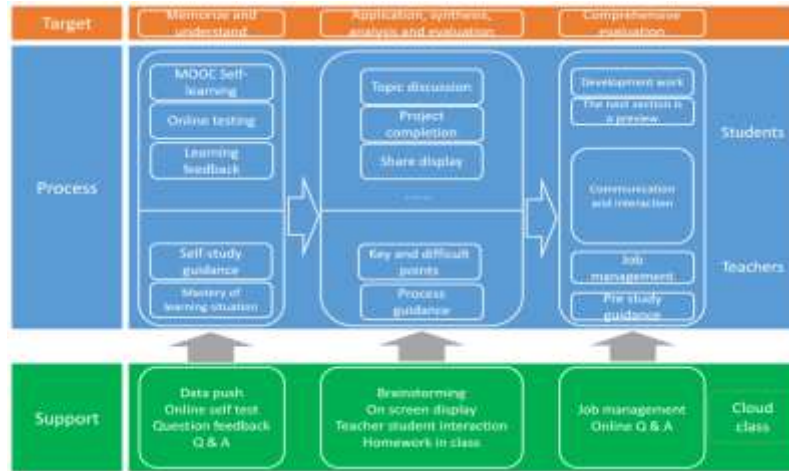


Figure 2. Classroom Teaching Design of "Stage 3-2 Platform"

Table 1. Teaching environment design

Dimension	Specific indicators	Design application
Teaching resources	Referenced resources	MOOC video, case courseware, unit test questions, etc.
	Resources for design and development	Learning task list, self-test questions before class, class discussion questions, learning projects, etc.
Teaching tools	Interactive tools	Cloud class
	Communication tools	Private chat and discussion area of cloud class
	Construction tools	Mindmaster mind map making tool

resources and teaching tools, as shown in Table 1:

**Learning evaluation Design**

Combine the formative evaluation and the summary evaluation, record the learning process with the help of the information teaching platform, and set the evaluation indicators and weight according to the three-dimensional objectives. As showing in Table 2 below:

**Teaching Implementation and Effect**

Taking the course teaching of computer network (soft engineer (experimental class of a university) as an example, the action research was carried out for one semester. After the course, the teaching effect was investigated.

From the perspective of students ' knowledge mastery, the average score of the final examination of "Computer Network" in the experimental class was 85.3 points, ranking second among the total of 15 classes in the

school.

From the evaluation situation, in the unified organization of the school evaluation of teaching, the praise rate of the course was 100%.

Through the course teaching survey of cloud class, almost all students gave praise and expressed acceptance and appreciation for the mixed teaching based on MOOC and cloud class.

**CONCLUSION**

Under the guidance of deep learning theory and based on MOOC resource platform and teaching management platform, this study builds a "3 stage-2 platform" for concentrated learning in three stages: before, during and after class. This learning mode promotes a progressive hierarchy of deep learning and integrates it into the whole-process of design, development, utilization, management and evaluation before, during, and after class. Through teaching practice, the effectiveness of the model is verified to promote students ' deep learning. However, due to the limitation of class hours, the

**Table 2.** Learning evaluation

Assessment method	Knowledge and skills	Process and method		Emotion and attitude
Process assessment (50%)	MooC video learning (40%)	Experiment (30%)	Dual computer interconnection (30%)	Classroom performance (20%)
	Unit testing (30%)		Design and implementation of VLAN (30%)	
	Course assignments (30%)		Design and implementation of network interconnection (40%)	
Final examination (Closed book)	Multiple choice questions (20 points)	Calculation questions (20 points)		0
	Short answer questions (30 points)	Design questions (15 points)		
		Comprehensive application questions (15 points)		

\*Total score = process assessment score x 50% + final examination score x 50%

research cycle is a little short and the research coverage is limited, which needs to be improved in the future teaching practice.

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