

Activity-oriented blended learning in higher engineering education

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ABSTRACT: The core of the success of higher engineering education reform lies in the present course reform. The way to deepen the integration of teaching and information technology by using an *activity-oriented* blended learning model is the key to the curriculum reform. In this article, the authors present the development of a Web application system that is the core course of the *Internet of Things Application*, which is taken as an application case for study and analysis, when the teaching design is undertaken with an activity-oriented blended learning mode.

INTRODUCTION

The Education Ministry in China pointed out in *Certain Suggestions on Comprehensively Improving Teaching Quality of Higher Engineering Education* that it would be an important trend of development of higher engineering education to strengthen the application of information technology in a teaching model.

In December 2003, the concept of *blended learning* (mixed type of teaching) was introduced in China, causing a profound change in the ideological concept in the field of domestic educational technology. It was seen as a breakthrough point in the current teaching reform, changing the teaching structure of information technology education. This has had a major impact on the activities of higher engineering institutions in China.

CONNOTATION OF ACTIVITY-ORIENTED BLENDED LEARNING MODEL

Blended learning refers to how modern education can

...combine the advantages of traditional learning style and e-learning (the digital or network learning), that is to say, not only the teachers play the leading role such as guiding, inspiring and monitoring in the process of teaching, but also the students' initiative, enthusiasm and creativity as a learning agent is fully reflected in the process of learning [1].

Whether one can design a diversified teaching model based on different teaching objectives and teaching content is the key to implementing the blended learning model. Ye Rongrong and other scholars put forward an *activity-oriented* blended learning model to realise blended teaching of various teaching models through a series of learning activities based on this idea, which is that *...the teachers flexibly choose and design all kinds of learning activities according to the teaching objectives and teaching situation, thus students can learn by participating in activities [2]* and further optimise the implementation effect.

The connotation of the activity-oriented blended learning model to the curriculum reform of higher engineering education is realised in the following two steps:

- Design the teaching process of the course according to the sequence of students' learning activity. The activity-oriented blended learning model is oriented by activity. Its core stresses that all teaching could be regarded as activity, making the learners' cognitive thinking ability externally manifest. The design of learning activities is the key to the successful implementation of the teaching process.

Teachers need to decompose the contents of the teaching into a series of learning activities based on the teaching objectives and theme of the task [3]. Operation sequence, regulatory rules, evaluation rules, results output, interaction, learning resources and interactive support, etc, are included to complete the learning activities.

- Choose an appropriate teaching model according to the type of learning activity. Different teaching models that correspond to different teaching goals and learning activities are selected. For learning activities of factual knowledge, the predominant mode is initiative learning by presenting vivid learning content with multimedia technology. For conceptual knowledge, the teaching models of classroom teaching, discussion and communication and concept map are adopted. For learning activities of procedural knowledge, teaching models of negotiation and discussion, case analysis and problem-solving are adopted.

THE TEACHING DESIGN OF AN ACTIVITY-ORIENTED BLENDED LEARNING MODEL

The *Development of Web Application System*, the core course of *Internet of Things Application* is taken as an application case for study and analysis, and for the teaching design of the blended learning mode, which is activity-oriented.

Confirmation of the Theme Task of Learning Activities

The course *Development of Web Application System* aims to cultivate students' ability in Web application analysis, planning, design, programme development and test release. The teaching content is divided into six learning activities according to typical tasks of developing a Web application system. The main tasks and activities of each of the learning activities are indicated below:

1. Learning activity 1:

Demand the analysis and planning. The objective of this activity is to understand general process of system demand analysis. According to the customer description, the student is required to plan the functional structure of the system, form a system analysis plan, complete a database E-R chart analysis, and master the basic operation method of data sheet construction and data relation design.

2. Learning activity 2:

Design and beautify the Web page. The objective of this activity is to master the basic knowledge of the DIV+CSS Web page layout, conduct Web page distribution and beautify the CSS pattern according to the design sketch, and to apply various multimedia elements into the Web page and to realise special effect editing in a Web page with Java Script statements.

3. Learning activity 3:

Design a public document. The objective of this activity is to understand the function of the three-layer structure, master the basic idea of object-oriented programming, pack the call method with the class file, master the application of ADO.NET to access the database and use the operation object of the data sheet.

4. Learning activity 4:

Realise front encoding. The objective of this activity is to master the basic properties and functions of the server control and verify the control.

5. Learning activity 5:

Realise the management of background encoding. The objective of this activity is to master the properties, events and methods of data binding controls, and to implement querying, adding, deleting and modifying data with data binding controls.

6. Learning activity 6:

Integrate publishing with testing. The objective of this activity is to master the basic method of Web site publishing and the installation method of IIS, configure the IIS environment correctly, publish and test the Web site.

Blended Design of Various Teaching Models

The selection of a specific teaching mode in accordance with different themes of learning activity is the next step of this development. According to the theme of the activities, one has to analyse related knowledge content and design

supportive learning activities. The selection of teaching mode aims to optimise the teaching content under the objective guide and knowledge classification. Following this way of learning, students can actively construct knowledge.

In the *Development of Web Application System* course, the summary of the teaching model of the learning activity is shown in Table 1.

Table 1 Types of activity-oriented blended learning models.

No.	Learning Activity	Teaching mode	Typical activity
1	Learning activity 1: demand analysis and planning	Demonstration teaching, initiative learning, collaborative learning and problem-solving	Demonstrate, read, make a plan, data collecting and processing, case analysis, project participation, submit school work, post school work, discussion and communication
2	Learning activity 2: design and beautify Web page	Initiative learning, collaborative learning and problem-solving	Case analysis, data collecting, problem solving, submit school work, post school work and evaluate the work
3	Learning activity 3: design public document	Demonstration teaching, initiative learning, problem-solving and interpersonal interaction	Demonstrate encoding, initiate encoding, debug the code, submit school work, post school work, work demonstration, and discussion and communication
4	Learning activity 4: realise front encoding	Demonstration teaching, initiative learning, problem-solving and interpersonal interaction	View results, initiate encoding, discussion and communication, debug the code, submit school work, post school work and work demonstration
5	Learning activity 5: realise to manage background encoding	Demonstration teaching, initiative learning, problem-solving and interpersonal interaction	View results, initiate encoding, discussion and communication, debug the code, submit school work, post school work and work demonstration
6	Learning activity 6: integrate publishing and testing	Demonstration teaching, initiative learning, problem-solving and collaborative learning	View results, debugging environment, post the system, work demonstration and evaluate the work

Design of the Operating Sequence of Learning Activity

After determining the theme of learning activities and the corresponding teaching mode, the activities of the framework and the specific link need to be determined. The basic sequence of learning activities must be set up. The curriculum of the *Development of Web Application System* is based on the work process of system development using the following strategy: *demand analysis* → *summary design* → *detailed design* → *encoding* → *test*, and the sequence design of the learning activity is shown in Figure 1.

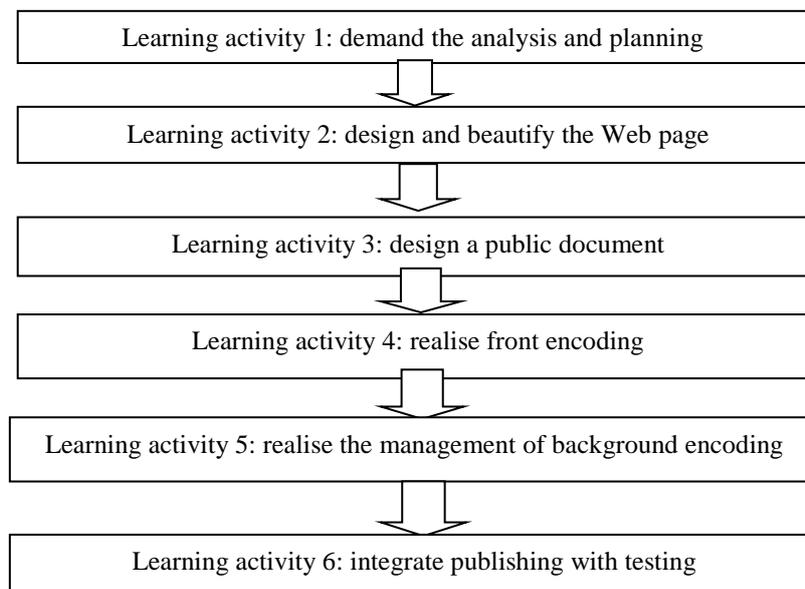


Figure 1: Operation sequence of learning activities.

Evaluation of Design of Learning Activities

The evaluation rule is the only standard to measure the students' learning activities. The main indicators of learning activities include the participation and degree of involvement of students in the process of activities, as well as the student's contribution in completing the learning activities tasks. The objective of the evaluation pays more attention to the students' learning process in the activity, and sets the students' performance of knowledge learning and problem-solving in the process as the evaluation basis.

IMPLEMENTATION PROCESS OF ACTIVITY ORIENTED BLENDED TEACHING

The process of Activity-oriented Blended Teaching

The core concept of designing activity-oriented blended teaching is to organise the teaching content in the form of learning activity where students can learn from it. The teacher's teaching design task is actually to plan the activity task and the operation process of the activity and trace students' learning process. The implementation of teaching is shown in Figure 2.

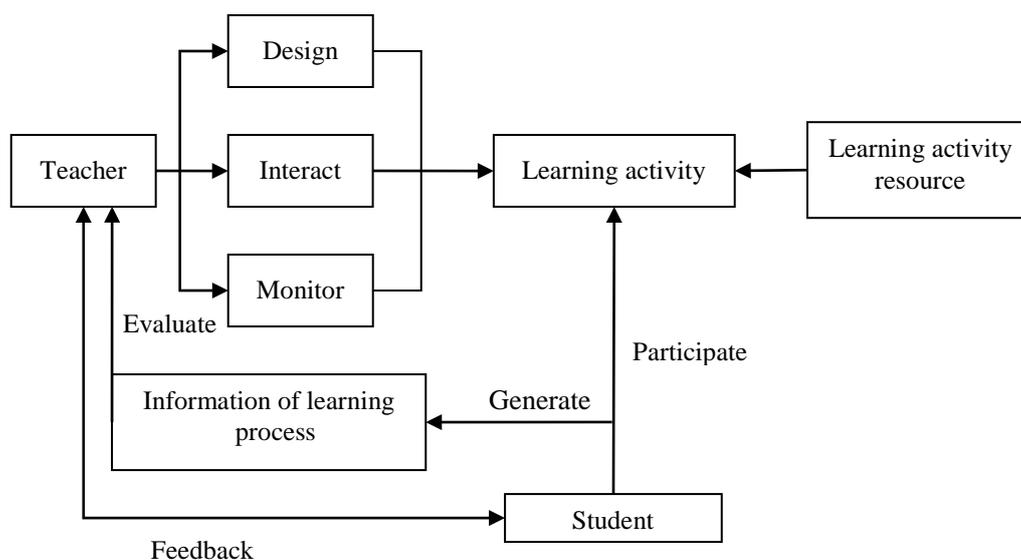


Figure 2: Activity-oriented blended teaching process.

The teachers design learning activities under the task goal of learning activities and form the sequence of learning activity, so that students can participate in the learning activities. The teachers keep on monitoring students during the learning activities and interact with students from time to time. Meanwhile, the learning process information produced in the learning activities is used to record students' learning information in each learning activity. This process information is an important part of formative assessment, which determines the effectiveness of students' learning activities, and teachers are required to make evaluations and to provide feedback to students.

Blended Learning Process with Activity-oriented Teaching

After completing the sequence of learning activity, the students can see the activity sequence in the course of study, and can enter into the operating window of the learning activity by clicking on the name of activity sequence. Students can learn curriculum knowledge from the activity task, support initiative learning through related resources, such as the case and animation, and determine whether their learning activities reach the learning requirements through a test.

In the learning process, students can choose various learning modes, such as collaborative learning and initiative learning, according to their own needs and the requirements of learning activities until they complete all learning activity tasks of the course in accordance with the process graph shown in Figure 3.

Evaluation Stage

The evaluation of *activity-oriented* blended learning is made according to different standards of evaluation at different learning stages. On the one hand, evaluation of students' on-line learning is completed by the teacher, focusing on the learners' ability in initiative learning, initiative exploration and collaborative communication.

On the other hand, evaluation of face-to-face discussion is completed by students, emphasising the student's ability in language expression, coordination and contribution to the group discussion. The mutual evaluation of students should

be done after completing the teaching process of each content module, which can make the evaluation result more accurate. Meanwhile, group members will also undertake self-reflection based on the evaluation, which will contribute to stimulating the learner's enthusiasm.

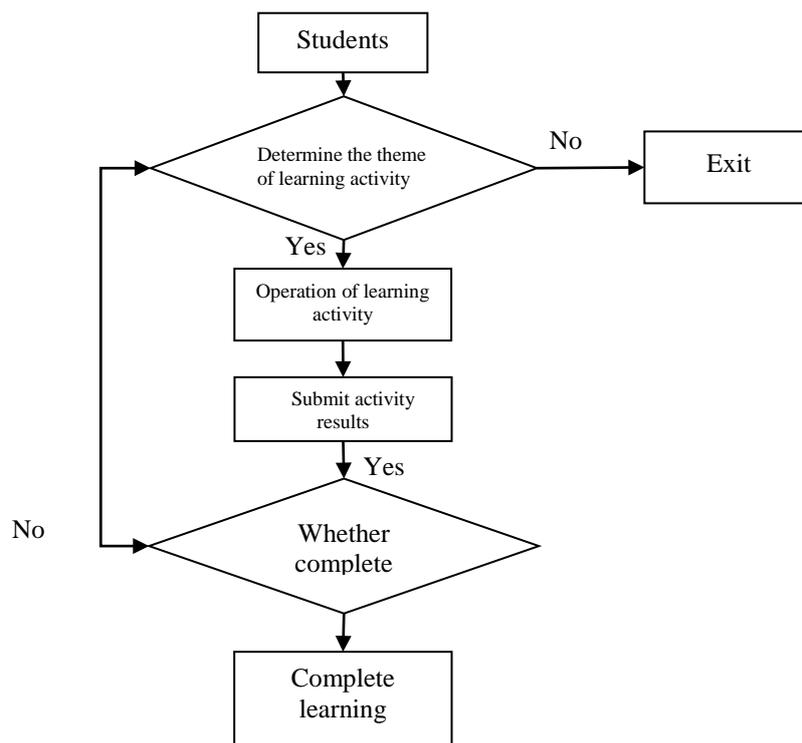


Figure 3: The process of students participating in learning activities.

CONCLUSIONS

Blended learning is a kind of promotion of learning concepts, which can change the students' cognitive style, and the teacher's teaching mode, teaching strategy and role. This change is limited in form, but it improves students' cognitive effect by fully using the complementary advantages of on-line teaching and classroom teaching based on an analysis of students' demand, teaching content and the actual teaching environment.

Blended learning emphasises the achievement of the best learning goal with the best learning technology in an appropriate time. The activity-oriented blended learning model advocates the combination of the advantages of traditional and digital teaching because better teaching results will be obtained, if the advantages of both sides are complemented.

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