



# Research on OBE Flexible Education Technology for Embedded Hardware Development

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**Abstract.** Through the analysis of embedded hardware development technology, achievement-oriented education concept and flexible education technology, the learning system of embedded hardware development OBE flexible education technology is proposed. Using OBE combined with flexible teaching mode, it fundamentally solves the difficulty of development and learning, and provides technical support for artificial intelligence development and learning of embedded hardware. Improve students' interest in embedded hardware development, solve the needs of the society for basic embedded hardware development talent training, and provide assistance for entering the era of embedded hardware artificial intelligence.

**Keywords:** embedded hardware development technology · OBE · flexible education technology

## 1 Introduction

Embedded hardware development is a relatively popular and promising IT application field. Embedded use is very extensive, involving many fields. The more applications, the more comprehensive the embedded development field, the more embedded talents are needed. At the same time, embedded hardware development plays a decisive role in the research of artificial intelligence (AI). The result-oriented education of 'embedded hardware development flexible OBE education technology' is based on the student-oriented education concept, guiding and assisting users to achieve the expected results. The 'embedded hardware development flexible OBE system' improves the teaching flexibility based on the differentiation ability of student users, and is not constrained by the system management. It uses personalization management, and develops the teaching system of 'chain course'. The flexible OBE system breaks through the fragmentation of teaching and learning to the Fragmentation-to-achievement aggregation effect and achieves Diversification.

## 2 Overview of Embedded Hardware Development OBE Flexible Education Technology

The OBE flexible education technology architecture of embedded hardware development can be divided into three parts: The first part is the differentiated ability-oriented learning behavior model [1]. Through the analysis mechanism, push mechanism, automatic screening mechanism and reasonable allocation mechanism, the PPT, video, document, multi-person competition and other teaching methods are assisted to complete the performance and implementation of the flexible form of embedded hardware development education and the breakthrough of diversified collection methods [2]. The second part uses the successful orientation characteristics of embedded hardware development and the development of flexible “chain” courses to gather multiple fragmented knowledge of embedded hardware development to the results. By learning the content of each stage, we can obtain the achievement results, and finally gather the results displayed in each stage as the final product [3]. We call it the breakthrough from fragmentation to achievement aggregation effect. The third part is to analyze the path of achievement output and sense of achievement [4]. It is concluded that the embedded hardware development flexible OBE system will develop towards a new learning environment and enhance students’ learning enthusiasm. The detailed technical architecture model as shown in Fig. 1:

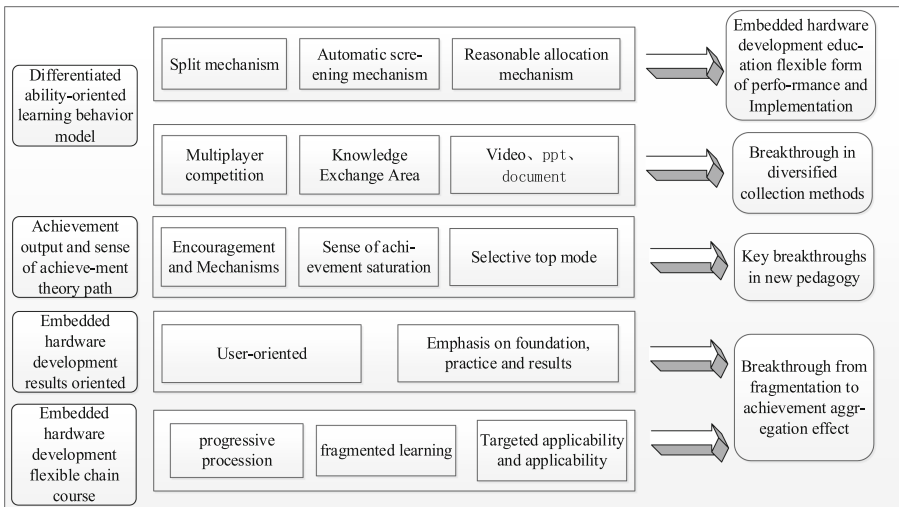


Fig. 1. OBE Flexible education technology architecture diagram (Self-drawn)

### **3 Embedded Hardware Development OBE Flexible Education Technology Construction**

#### **3.1 Establish a Differentiated Ability-Oriented Learning Framework**

Embedded hardware development OBE flexible education technology includes the differentiation of students' learning ability, learning basis and inertial teaching. The differentiated ability-oriented learning behavior model takes people as the center to improve teaching flexibility, is not subject to the constraints of system management, and uses personalized management and non-mandatory methods to enable students to consciously learn knowledge. This adaptive education respects students' thoughts [5].

When logging into the system, users are divided into different levels through a questionnaire, including junior scholars, intermediate scholars, senior scholars and mature scholars. It is very important for junior scholars to learn the theory. Such users first push the video and basic knowledge documents of theoretical knowledge, and set up exercises after each part of learning. The theoretical study of intermediate scholars has entered a stage that can support practical operation, but it is far from enough to carry out theoretical and practical operation at the same time. Senior scholars need to record video teaching explanations while practicing [6].

#### **3.2 Course of Embedded Hardware Development Flexible Chain**

The flexible chain course of embedded hardware development should deeply dissect the embedded hardware development. The embedded hardware development course is divided into multiple branches and then the branches are continuously simplified and integrated into multiple small courses.[7] From the most basic learning, from shallow to deep, step by step, interlocking. This flexible chain course should explore the course according to the development of the market industry, and set up the corresponding vocational course to emphasize the pertinence, applicability and application of knowledge. We should increase the operability of the user's system settings to allow users to maximize the understanding of autonomous learning [8].

#### **3.3 Path of Achievement Output and Sense of Achievement Embodiment Theory**

First of all, people are a perceptual animal. When the increase of things done is recognized and appreciated, the heart will produce a sense of satisfaction and achievement, but this sense of achievement and satisfaction will fade over time, so we need to use the system's user self-setting top model to increase the sense of satisfaction and achievement [9]. There is a certain restrictive relationship between achievement output and sense of achievement, and the system needs to balance the two. Think about problems from the perspective of users, so that users can enjoy the experience of Saturate in the process of learning, so as to improve students' enthusiasm for learning. From another perspective, OBE network flexible teaching can shorten the cycle of achievement generation [10].

## 4 Embedded Hardware Development OBE Flexible Education Technology Implementation

The first step: The flexible form of embedded hardware development flexible OBE system mainly relies on curriculum optimization and distribution. According to the user's diversified flexibility (Flexibility), the humanization of teaching procedures, the balance of classroom questioning and communication, and the intelligent teaching environment, the flexible form of embedded hardware development OBE is constructed.

The second step: curriculum optimization and flexible allocation according to user diversity, respectively, to construct an automatic screening mechanism to optimize the teaching mode and cater to the diversity and difference of individual learning needs. Flexible allocation of suitable courses for individual learning needs. The AutoFilter mechanism judges whether the teaching content is high-quality, can improve students' interest in learning, and has a high content of teaching information content when teachers publish teaching content. The most suitable teaching mode, teaching plan, teaching content, etc. are matched according to the different learning abilities, learning habits, and needs of students. On the basis of improving teaching flexibility, students' interest in learning can also be enhanced through adaptive teaching methods.

The third step: the distribution group discussion of the balance of questioning communication is based on the summary of classroom exercises after video teaching to consolidate the knowledge application ability difference balance rule to match the discussion group members, fundamentally with the stronger and the middle to make progress together and lead the poor to improve the discussion after joining the discussion learning group to discuss and maintain the flexibility of the classroom questioning discussion.

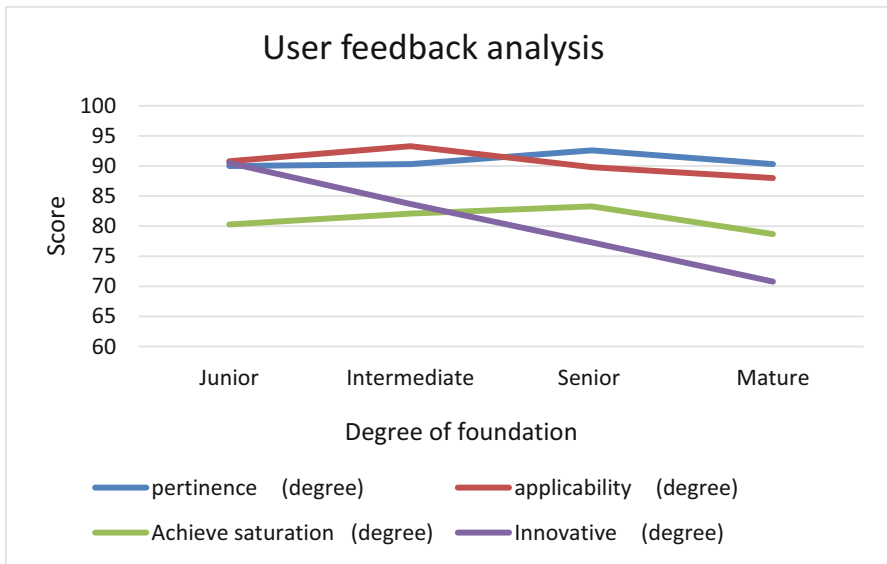
The fourth step: the intelligent and flexible application of the teaching environment. The system teaching environment mechanism is used to provide a customized learning environment to support the flexibility of the teaching environment according to the diversification of individual students. The mechanism jointly provides a customized teaching environment and system intelligence. The change teaching environment function supports the intelligent development of the teaching environment towards flexible development.

## 5 Experimental Analysis

The embedded hardware development flexible OBE system takes its own users as the main body and teachers as the auxiliary. The curriculum design makes the fragmentation of related knowledge points, more in-depth tightness connection to the results-oriented aggregation and the aggregation of distinguishable knowledge points. The embedded hardware development course is divided into multiple branches and then the branches are continuously simplified and integrated into a number of small courses. From the most basic learning, from the shallow to the deep, step by step, interlocking, leading students to transform from fragmented learning to achievement aggregation learning according to the learning level. The basic data of OBE flexible educational technology users as shown in Table 1:

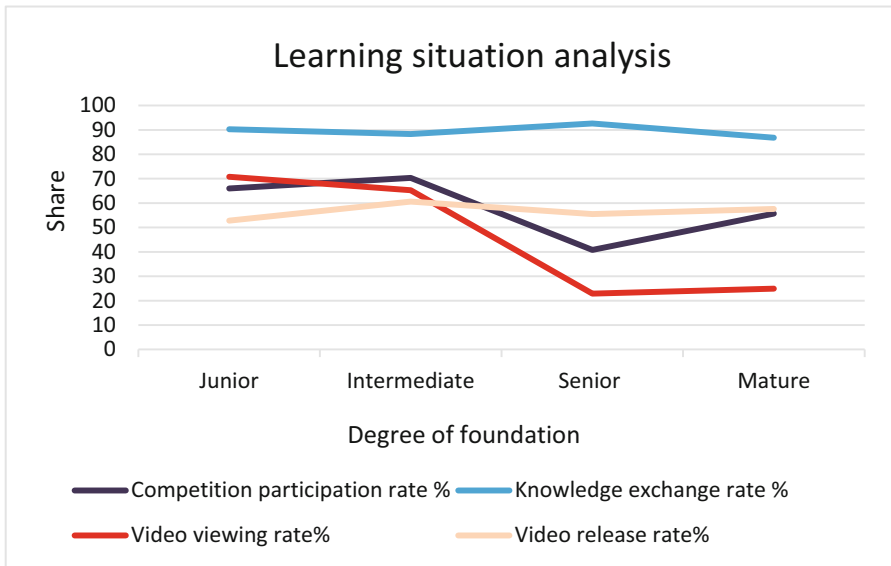
**Table 1.** Basic data analysis table of OBE flexible education technology users (Self-drawn)

user	Junior	Intermediate	Senior	Mature
<b>pertinence(degree)</b>	90	90.3	92.6	90.3
<b>applicability(degree)</b>	90.8	93.3	89.8	88
<b>Achieve saturation(degree)</b>	80.3	82.1	83.3	78.7
<b>Innovative(degree)</b>	90.5	83.7	77.3	70.8
<b>Competition participation rate %</b>	66	70.3	40.8	55.7
<b>Knowledge exchange rate %</b>	90.3	88.3	92.6	86.8
<b>Video viewing rate%</b>	70.8	65.3	22.9	24.9
<b>Video release rate%</b>	52.8	60.6	55.5	57.6



**Fig. 2.** User feedback analysis (Self-drawn)

The embedded hardware is used to develop a flexible OBE system, and the data and questionnaire results used by different basic users after opening to the outside world. As shown in Fig. 2 and Fig. 3: Analyze the usage data of different basic users, the video viewing rate of junior and intermediate scholars reached 70%, while that of senior and mature scholars was only 23%. The competition participation rate has reached more than 40% to meet expectations, and the knowledge exchange rate of various groups of people has reached more than 90%, which exceeds the expected results; the video release rate of each group of people belongs to 55% of the rules. Through the analysis of the questionnaire, it is concluded that the pertinence and applicability of the system have basically reached an average score of 90 points for all groups of people, and the expected



**Fig. 3.** Learning situation analysis (Self-drawn)

results have been achieved. The scores of innovation and achievement saturation have the opposite trend, and the average score is controlled in the controllable range of about 80 points. On the whole, most of the data meet the expectations, and the research on system and education model is successful.

## 6 Conclusions

The construction of flexible OBE system for embedded hardware development caters to the needs of big data, the development of the times and other trends. It has gradually promoted the formation of a flexible teaching platform for embedded hardware development courses that combines the OBE teaching mode with flexible form teaching and adopts the optimal education in the new era. It has realized the collection of needs such as embedded hardware development learning and personnel training. In the system program design, it should be based on reality, cater to the market demand for talents and the development of the times, implement the OBE teaching mode, the fragmentation to the result aggregation effect mechanism, the diversified collection mechanism, and adopt the flexible form to build a more simple learning embedded hardware development and training. A teaching system that integrates multiple talents.

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