# Construction of Computer-Aided Hierarchical Teaching Model for Higher Mathematics Courses

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**Abstract.** The basic idea of this model is to use the hierarchical structure of mathematics to develop teaching methods that can be used in all higher mathematics courses. The main goal is to provide students with good mathematical knowledge and skills, which is crucial to their future study. The project consists of two parts: (1) establish a preliminary computer-assisted learning environment; (2) Formulation and evaluation of new teaching methods based on hierarchical teaching model. This paper introduces the construction of such a model, which includes not only the content, but also the teaching method. In addition, it also describes how to use this new teaching model as the basis for further research on computer-assisted learning methods in higher mathematics courses.

**Keywords:** Computer-aided · Advanced mathematics courses · Layered teaching model

## 1 Introduction

How to do layered teaching well in higher mathematics class? Hierarchical teaching is a teaching mode that faces all and teaches students in accordance with their aptitude. It emphasizes that "teachers' teaching should adapt to students' learning and" teach students in accordance with their aptitude. Today, the small series brings us effective teaching methods of higher mathematics.

Teaching objectives are the starting point and destination of classroom teaching, and play a role in regulating, guiding and controlling the whole teaching process. Teachers can carefully study the teaching materials before class, grasp the key and difficult points of the outline and teaching materials, consider the actual situation of students, and combine their own teaching to correctly formulate teaching goals at different levels, basic teaching goals and personal goals that everyone can achieve. In class teaching, I will let each student set a practical goal according to his own situation -- who I want to surpass, let each student find his own direction of effort, challenge him, and let the challenged child accept the challenge, and both sides obtain the learning goal at the same time.

The questions raised in the classroom should be carefully designed, and the questions raised by teachers should be similar to the students' thinking level, so that they can think


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about it and solve it. At the same time, the questions raised should stimulate students' interest and thirst for knowledge, and also pave the way for the connection between new and old knowledge. In order to ensure that students at all levels have equal learning opportunities in the process of classroom questioning and make students at different levels think actively [1], I consciously divide it into upper, middle and lower levels when designing questions, among which basic questions such as review and basic questions are for group C students; Intermediate questions are for group B students; Difficult problems, such as those that can be solved by comparison, analysis and other thinking methods, are for group a students.

Homework can timely feed back the knowledge of students at different levels, reflect the teaching effect of a class, and achieve the purpose of initially consolidating knowledge. The different levels of homework are not only reflected in the amount of knowledge and thinking components, but also in the depth of knowledge and the level of thinking. Therefore, assignments should be carefully arranged, and assignments with different questions and difficulties should be designed for students at different levels. The homework of students at level C focuses on the memory and understanding of basic knowledge [2]. The homework of students at level B focuses on grasping concepts and general problem-solving methods. The homework of students at level a focuses on deepening the understanding of concepts and flexible and skilled application, considering the ideological methods and ability training of higher mathematics. In short, the amount and degree of homework should be based on the principle that every student can do his best to complete it, and try to meet the learning needs of students at different levels, so as to mobilize the learning enthusiasm of students at all levels, stimulate their learning hobbies, and mobilize the positive role of all students' non intellectual psychological factors. Based on this, this paper studies the construction of computer-aided hierarchical teaching model of higher mathematics curriculum.

## 2 Related Work

### 2.1 Computer Assisted Instruction

Computer aided instruction (CAI) is a variety of teaching activities carried out with the help of computer. It discusses the teaching content, arranges the teaching process, and carries out the methods and techniques of teaching training with students in the form of dialogue [3]. Cai provides students with a good personalized learning environment. The comprehensive application of computer technologies such as multimedia, hypertext, artificial intelligence and knowledge base overcomes the shortcomings of single and one-sided traditional teaching methods. Its use can effectively shorten the learning time, improve the teaching quality and efficiency, and achieve the optimal teaching objectives.

The main research contents of CAI technology include:

(1) Cai mode: at present, there are six kinds of teaching modes commonly used in the CAI System: (1) exercises: including arranging questions, comparing answers and registering scores, which are usually used as a supplement to normal teaching;
(2) Individual guidance: including teaching rules, evaluating students' understanding and providing application environment;

(3) Dialogue and consultation: also known as "Socrates" teaching mode, which allows students to have a relatively free "conversation" with computers;
(4) Game: create a competitive learning environment, and the content and process of the game are related to the teaching objectives;
(5) Simulation: use computers to simulate real phenomena (natural or man-made phenomena) and control them, such as simulating chemical or physical experiments and aircraft, vehicle and ship driving training;
(6) Problem solving: let students use rules and concepts in various ways to get the solution of the problem, which requires students not only to know the correct answer to the problem, but also to master the solution process. In the specific teaching process, according to the needs of teaching content expression and the requirements of teaching purpose, it is necessary to cross use these teaching modes in different contents of the same course or different teaching links[4].
(7) Making CAI Courseware: the core of CAI system engineering is courseware. It is compiled by the courseware designer with CAI writing tools or computer language according to the teaching requirements.
(8) Cai writing tools and environment: CA writing tools are the writing environment for course teachers to compile courseware. Good writing system and development tools are the key to improve the efficiency of CAI courseware development.

### 2.2 Advanced Mathematics Courses

As a basic discipline of natural science, mathematics not only plays a positive role in the progress of material civilization and human understanding of the world, but also has a very important impact on the development of human thinking. This impact will become more and more important and obvious with the advent of the information age.

The inquiry teaching mode of higher mathematics is actually a simulated scientific research activity, which includes three interrelated aspects: on the one hand, it is a learning environment centered on learning; The other is to provide students with necessary help and guidance to ensure that students can successfully discover scientific principles and concepts after scientific inquiry; The third aspect is the mathematical experiment link [5]. How to apply the explored principles to practice is the key to quality education. Today, when students' practical ability is vigorously advocated, it is of great help to carry out mathematical experiment courses so that students can experience the tool learning points and charm of basic mathematics in the experiment, so as to improve students' learning interest and exploration spirit.

The organic combination of higher mathematics and layered teaching has formed a teaching mode that meets the requirements of the times and has the characteristics of the times. The research on such problems is relatively few. This paper is about how to implement the construction of computer-aided hierarchical teaching model of higher mathematics, improve students' practical ability, and give an appropriate evaluation and analysis of the teaching effect of the hierarchical teaching model. The analysis is based on the statistical materials of the author's teaching practice in recent years, and the statistical materials are analyzed and sorted out by means of sampling survey and data analysis and processing, The corresponding evaluation index and evaluation model are given.

### 2.3 Computer Aided Hierarchical Teaching Model Construction of Higher Mathematics Courses

The construction of computer-aided hierarchical teaching model of higher mathematics courses refers to a teaching method and teaching concept that emphasizes the interaction between teachers and students and gives full play to students' subjective initiative and creativity by taking problem research as a means and comprehensively mastering and skillfully using the learned knowledge to solve practical problems [6]. The essence of inquiry learning based on problem solving is to cultivate students' problem awareness, habits of critical thinking Aiming at the ability to generate new knowledge and the quality of collaborative learning, we pay attention to the learners' subjective participation in the learning process, and highlight the problem-centered organization of the whole teaching and learning process. Figure 1 below shows the hierarchical teaching model framework.

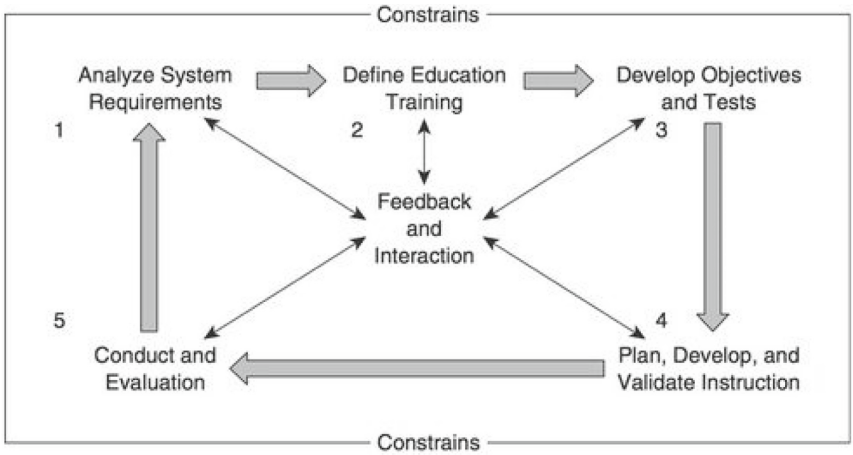


**Fig. 1.** Hierarchical teaching model framework

To design a computer-aided hierarchical teaching model of higher mathematics, we should grasp the two core concepts of "Computer-aided" and "hierarchical teaching". When applying computer-assisted instruction, we should fully consider the characteristics of computer-assisted instruction [7]. Therefore, when making computer-assisted instruction, we should grasp the micro principle and develop video. In terms of individual students, teaching content, learning objectives, after-school homework, evaluation and other aspects, we should consider the principle of hierarchical design, and formulate different teaching content, learning objectives, after-school homework and evaluation according to different levels of students. And we should also pay attention to the coherence of knowledge system while designing it hierarchically, that is, we should consider the systematic design. In addition, considering the current learning situation of college students, we should also pay attention to the interesting selection of computer-aided content when designing and developing the model, so as to attract students to study independently [8]. Finally, when designing the teaching implementation process, we

should also pay attention to the interaction of students' activities. Only when students are more active in the construction of knowledge and experience, can students master the initiative of the classroom.

The introduction of computer-assisted instruction into layered teaching classroom greatly reduces the difficulty of teachers' layered teaching. Students at each level can learn differentiated knowledge in the same class, and after watching computer-aided video, they can carry out five links: hierarchical test, group discussion, teacher question answering, hierarchical homework and hierarchical evaluation. Students' differences are fully reflected in each link. Students with a good foundation will further expand the breadth and depth of teaching content, and increase the difficulty in tests and assignments, so that students with a good foundation can obtain more sense of achievement at the knowledge level [9]; For students with poor foundation, the breadth and depth of teaching content will be slightly simpler, and the difficulty of subsequent tests and assignments will also change. For students with poor foundation, it is more to let them enhance their self-confidence and interest in learning.

In addition, in the process of stratification, we should also pay attention to protecting students' self-esteem and self-confidence. Stratification does not divide students into three, six, nine grades and treat them differently, but for better teaching, which should be clearly told to students. And in the follow-up teaching process, teachers should also be consistent with their words and deeds, so that students can truly feel the equal treatment of teachers in emotion [10].

Generally speaking, Addie teaching design model tells us three aspects: what to learn, how to learn, and how to test the learning effect. In addition, the theory also has three advantages: first, systematic, integrating the five parts of analysis, design, development, implementation, and evaluation into a systematic process, avoiding the one sidedness of the development process and making it more complete; 2, Pertinence, according to the analysis stage of curriculum development, it avoids the blindness of curriculum resource development and meets the individual needs of each learner; 3, Supportability: ensure the quality of curriculum development through timely and effective evaluation of all links, combined with Addie teaching design model, as shown in Fig. 2.

Addie instructional design model is adopted as the model of computer-aided hierarchical instructional design, mainly because its advantages are more consistent with the requirements of instructional design expected by the author, which can make the effect of developed teaching resources better, and also ensure the orderly progress of quasi experimental research.

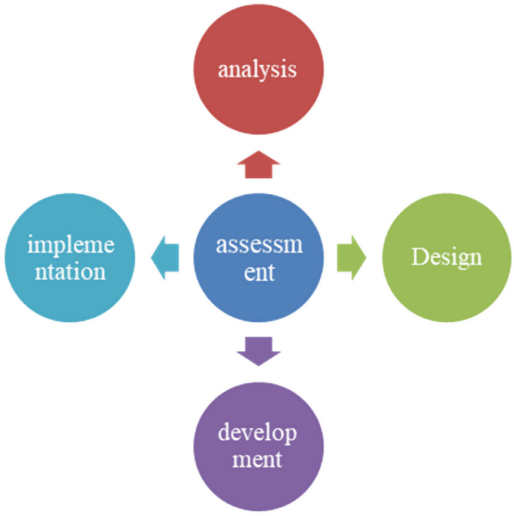


**Fig. 2.** Addie instructional design model

## 3 Conclusion

It is a new way to design computer learning materials to build a computer-aided hierarchical teaching model for higher mathematics courses. The purpose of this project is to develop an interactive system, which can be used as the basis for developing and implementing different types of multimedia textbooks (such as courses, exercises, tutorials, etc.). The main idea behind the development process is to create a graphical interface in which users can define mathematical topics and concepts. Provides a set of tools to facilitate the creation process.

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