



Research on Application Mode of ADDIE Model in Programming Course

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Abstract. With the development of computer technology and the change of application requirements, traditional teaching methods can't meet the needs of students to improve the learning effect and teachers to improve the efficiency of teaching design. It is of great value to explore the application mode of ADDIE model in programming courses to improve teachers' teaching design efficiency and students' learning effect. Questionnaire survey and experimental design methods were used to analyze the influence of ADDIE model and traditional teaching methods on the efficiency of teachers' teaching design and students' learning effect, and to explore the reasons. The results show that the ADDIE model has a significant effect on the improvement of students' learning effect and teachers' teaching design efficiency. Therefore, we emphasize the importance of the application mode of ADDIE model in programming courses, and put forward some suggestions and measures to improve it, which provides a useful reference for the teaching of programming courses.

Keywords: ADDIE model · Teaching design · Programming courses · Learning effect

1 Introduction

In the field of computer, programming courses are of great significance to students' ability improvement and contribution to society. However, with the changing needs of teachers and students, traditional teaching methods can not meet the needs. ADDIE model is a classic instructional design model, including analysis, design, development, implementation and evaluation of five steps, has been widely used in various fields. However, there are still some problems in its application in programming courses, which need to be further explored and improved. This paper mainly uses literature review method to understand the application status and research progress of ADDIE model in programming courses, and discusses its existing problems and improvement measures. Two questionnaire surveys were conducted on the same group of teachers respectively to collect the methods commonly used in programming curriculum design and teaching and the application of ADDIE model, as well as their views on the application of ADDIE model in programming curriculum. Students were randomly divided into experimental group and control group for teaching practice based on ADDIE model and relevant data

were collected. The questionnaire and experimental data were analyzed to compare the differences between the two teaching methods on the efficiency of teachers' teaching design and students' learning effect, and to explore the reasons. This paper consists of three parts. In the literature review part, the application status and research status of ADDIE model in programming courses are summarized, and the existing problems and improvement measures are analyzed. In the part of research design, the design and implementation of the research are introduced in detail. In the part of research results, the data in the experimental process are analyzed, and the influence of ADDIE model and traditional teaching method on teachers' teaching design efficiency and students' learning effect is compared, and the reasons are discussed.

2 Related Work

ADDIE model is a classic curriculum design model, which is widely used in the field of education and training at home and abroad. It consists of five stages: Analysis, Design, Development, Implementation and Evaluation. These stages are considered to be the necessary process for designing an effective curriculum.

2.1 Relevant Research Status of ADDIE Model

In terms of theoretical research, domestic and foreign researchers have conducted in-depth discussions on the definition, characteristics, processes and implementation methods of each stage of the ADDIE model, as well as detailed research on the advantages and disadvantages of the ADDIE model, the scope of application and practical application [1]. Foreign researchers mainly focus on the application of ADDIE model in the field of education and training, including its application in online education, distance education and adult education. Domestic researchers mainly focus on the application of ADDIE model in the fields of college curriculum design and vocational training, as well as its comparison and integration with other curriculum design models. But some problems remain [2–3]: ① Cumbersome process: the five stages of ADDIE model need a lot of work. The analysis, design, development, implementation and evaluation of the ADDIE model require a large investment of time and human resources, which makes the application of the Addie model expensive. ② Lack of flexibility: the five stages of ADDIE model are in linear order. This fixed process restricts its application and is not conducive to different learning objectives and learners. Characteristics of personalized course design. ③ Lack of feedback mechanism: the evaluation stage of ADDIE model is usually in the course. After implementation, this evaluation mechanism lacks timely feedback, and it is difficult to find and solve the problems existing in curriculum design. ④ Lack of innovation: the process and method of ADDIE model have been relatively fixed, lack of innovation and flexibility, is not conducive to open. Issue innovative curriculum design to meet the needs of the new era. In practical research, ADDIE model has been applied abroad. In corporate training, medical education, online learning and other fields.

2.2 The Related Problems of Programming Course Teaching

In the aspect of teaching methods, some teachers pay too much attention to theoretical explanation, ignore practice, lack of interaction and flexibility, it is difficult to stimulate students' interest in learning and enthusiasm [4–5]. In terms of student groups, some students lack basic programming and mathematics, and it is difficult to understand and master the basic concepts and ideas of programming. In the aspect of innovation consciousness: some students lack of innovation consciousness and innovation ability, it is difficult to design a program with practical application value, need to cultivate their innovation consciousness and innovation ability through course design and practice guidance. In terms of international vision: some courses lack international vision and teaching content and methods in line with international standards, which makes it difficult to cultivate talents with global competitiveness.

2.3 Application of ADDIE Model in the Field of Education

Some researchers have applied ADDIE model to curriculum design to improve the quality and effect of curriculum. ADDIE model is also applied in the design of teaching methods and teaching evaluation, but there are still some problems such as lack of practicality, lack of flexibility, lack of educational theory support, lack of technical support and so on [6]. Therefore, the application of ADDIE model in the field of education needs to be further explored.

3 Research Methods and Design

3.1 Problem Analysis

This part mainly investigated 20 first-year program design course teachers in a university, and successfully collected 20 data. There were 18 valid data and 2 invalid data, with an effective rate of 90%. The main contents of the questionnaire include the investigation of teachers' basic information and the investigation of teaching design status. Basic information includes basic information: gender, age, education, teaching years, teaching objects; The present situation of instructional design mainly includes the degree of emphasis on the teaching process, instructional design tools, instructional evaluation tools, students' personalized needs, and instructional support system. Under the traditional teaching background, the questionnaire survey of teachers is analyzed as shown in Figs. 1 and 2.

Through the analysis of the questionnaire data, it can be seen that in traditional instructional design, teachers who pay attention to the teaching process and those who do not pay attention to the teaching process both have certain time pressure in instructional design. In these two types of teachers, the main sources of time pressure in the completion of instructional design are insufficient resources for teachers to refer to in instructional design and individual differences of students. When the 18 respondents completed the teaching design of programming courses, they all believed that the difficulty in quickly finding the teaching design ideas was the biggest problem for teachers in teaching design. To sum up, the efficiency of teachers in teaching design is low in the current teaching mode, and new teaching modes and technologies are urgently needed to help teachers carry out teaching and complete teaching design.

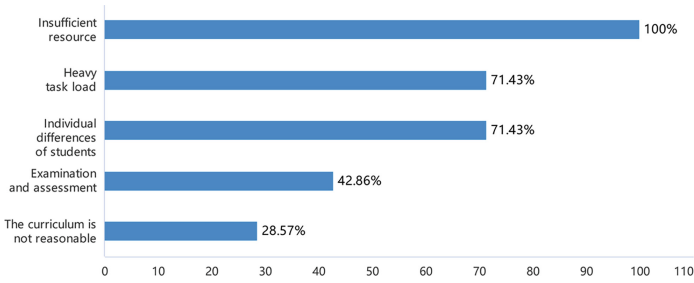


Fig. 1. Sources of time pressure in traditional instructional design

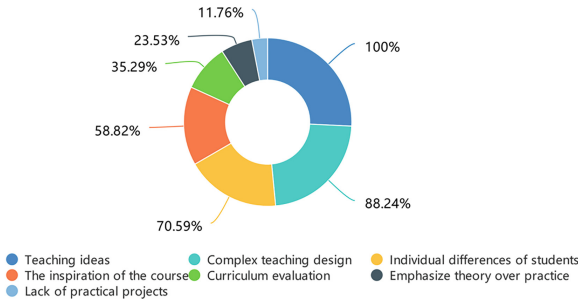


Fig. 2. Main difficulties in teaching design

3.2 Application Pattern Design of ADDIE Model in Programming Course

This teaching background applies ADDIE model to every link of teaching based on the mixed teaching mode of online, online and offline (Fig. 3).

Analysis phase

In the early stage of analysis, mainly for learning objects and teaching objectives of the analysis. The target students are mainly first-year computer related majors. Due to the different foundation of each student and each student has its own characteristics, that is, before the theoretical course teaching of programming courses, the teacher uses the ADDIE auxiliary system to analyze students' learning situation and adjust the teaching method. So as to guide the cultivation of students' innovation ability. With the aid of ADDIE, teachers analyze curriculum standards and textbooks and determine teaching objectives. Teaching objectives include knowledge and skill objectives, ability objectives and emotional cultivation objectives.

Design phase

The design stage mainly refers to the design of teaching content and teaching strategy. The teaching content is the theoretical knowledge of freshman Python courses. The teaching content is mainly related knowledge points in the structure of the program, including sequence, branch and cycle structure. After determining the teaching content, the ADDIE auxiliary system classifies the knowledge points into three levels: simple,

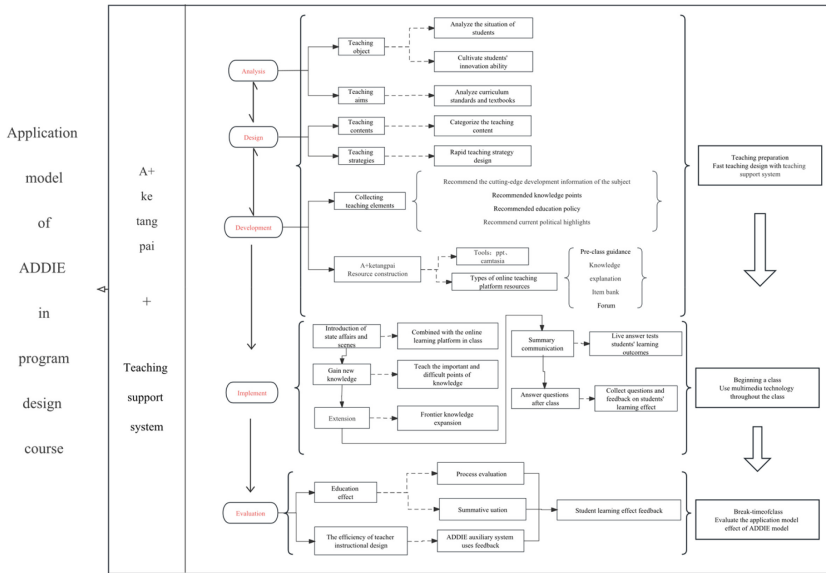


Fig. 3. Teaching model frame diagram based on ADDIE model

medium and difficult. The purpose of knowledge point classification is for teachers to carry out teaching contents for students with different foundations. Simple knowledge points will be studied and tested by students on the online learning platform, while medium and difficult knowledge points will be learned by students on the online platform before class and taught by teachers in offline class. This combination of online and offline teaching after classifying knowledge points can greatly improve teaching efficiency and help students with different foundations to master more knowledge. Based on the analysis of teaching objects and teaching contents, ADDIE provides teachers with teaching strategies for reference.

Development phase

The development stage refers to the construction of teaching resources, including the collection of teaching elements and the construction of online teaching platform resources. ADDIE auxiliary system has a large number of teaching elements data. The system can recommend different types of resources to teachers. For example, teachers can obtain subject industry information, subject frontier development information, knowledge point information, education policy and current political news in this system. Teachers will integrate the acquired information into the construction of teaching resources on online platforms and offline classroom teaching. Multiple teaching elements can continuously improve students' interest in learning and enhance teachers' professional quality. Online teaching platform mainly uses A + ketangpai. The platform's resources include pre-class guidance, knowledge points, test bank and so on. The construction of online teaching materials can be through ppt recording. The solid development stage lays the foundation for teaching. The three stages of analysis, design and development are the stages

of lesson preparation for teachers. These three stages exist in parallel. With the help of ADDIE auxiliary system, teachers can quickly design teaching schemes.

Implementation phase

The implementation stage is the key link of teachers' teaching. Before class, the teacher assigned study tasks. Teachers publish the relevant content for students to preview on the online platform. Students go to the platform to learn videos. Before class, the teacher checks the accuracy of the completion of exercises. Teachers collected various teaching elements before class; In the class, the teacher introduces the scene and carries out the theme according to the current political and important news in accordance with the lesson. The teacher analyzed and explained the key and difficult points of this learning unit, and answered them one by one according to the high-frequency doubts collected before class. Teachers combined with the classroom teaching platform to post questions, students immediately take photos and upload answers. Teachers can combine the modern teaching tools to analyze the learning situation of each student, which is convenient for the development of personalized teaching. In the classroom teaching, it is not only the explanation of knowledge points, but also the expansion of frontier knowledge in knowledge points; After class, I assigned homework by class, collected feedback data from students, and analyzed data to feedback students' learning effects with the aid of ADDIE. In the implementation stage, teachers use multimedia technology throughout the classroom.

Evaluation phase

The purpose of the evaluation stage is to evaluate the application effect of ADDIE model in programming courses. The effect of this model mainly analyzes whether the efficiency of teachers' teaching design is improved or not and whether the learning effect of students is improved. There are common problems in traditional evaluation system of student learning effect. After the whole semester of teaching, the assessment of students should be diversified. The assessment components proposed here include the following aspects: classroom performance, online platform learning, homework completion, and final and therein test scores. This method of evaluation also provides teachers with more research data to help improve their teaching quality.

4 Experimental Design

In this experiment, a total of 80 freshmen majoring in computer science in a university were selected and randomly divided into two classes with 40 students in each class. One class was randomly selected as the experimental class (control group 1) and the other as the ordinary class (control group 2). Select structure and loop structure in Python programming language as experimental teaching content. Each experiment lasted for one class, and the experiment site was the computer classroom. Firstly, the traditional teaching design method was used for the teaching design and classroom teaching of Python branch structure for control group 2, and the ADDIE model-based teaching design method and classroom teaching of Python branch structure for control group 1. The data of classroom learning and homework completion of students in two classes are

Table 1. Experimental data of teaching mode based on ADDIE model

Experimental data of teaching mode based on ADDIE model									
Theme	Object	Duration (class time)	Average length of class work (minutes)	Class assignment pass rate	Average length of homework (minutes)	Average correct number of homework	Average correct rate of homework	Average learning efficiency (minutes)	Gap (minutes)
Python branch structure	Group 1	1	5.11	34/40	43.86725	4.1	82%	32.24083	3.91327
	Group 2	1	6.35	29/40	48.92675	3.35	67%	36.1541	
Python loop structure	Group 1	1	6.03	36/40	48.01625	4.03	81%	35.41963	3.1178
	Group 2	1	7.92	34/40	51.65875	3.53	71%	38.53743	

obtained respectively. For control group 2, the teaching design and classroom teaching of Python loop structure were carried out based on ADDIE model; for control group 1, the teaching design method and classroom teaching of Python loop structure were continued to be carried out based on ADDIE model. The data of classroom learning and homework completion of students in two classes are obtained respectively. To realize the horizontal experiment and longitudinal experiment of the application mode of ADDIE model, and obtain the learning effect of students. Each student in control group 1 and control group 2 were respectively obtained the time for completing class homework on branch structure and cycle structure topics, the passing of class tests, the time for completing homework and the correct amount of homework (the total number of homework is 5) (Table 1).

5 Experimental Results and Analysis

The average homework completion time of each class is calculated according to the completion time of each student’s homework, the passing rate of each class is calculated according to the passing time of each class’s homework, the average homework completion time of each class is calculated according to the completion time of each class, and the accuracy rate of each student’s homework and the average accuracy rate of each class are calculated according to the correct amount of homework. Learning efficiency = homework time * 30% + homework time * 70% (Figs. 4 and 5).

In the branch structure teaching, the abscissa represents the time for students to complete homework, and the ordinate represents the quality score of homework completed by students. Blue is control 1, green is control 2. Control group 1 spent 30–35 min in finishing homework, and its quality score was about 90 points, mainly distributed in the second quadrant, which reflected the students’ good learning efficiency and results. Control group 2 was scattered in the fourth quadrant, which showed that students’ learning results were relatively insufficient and their learning efficiency was relatively low. This fully proves that teaching design using ADDIE model has more positive influence on students’ learning outcomes than traditional teaching model. In the teaching of circular

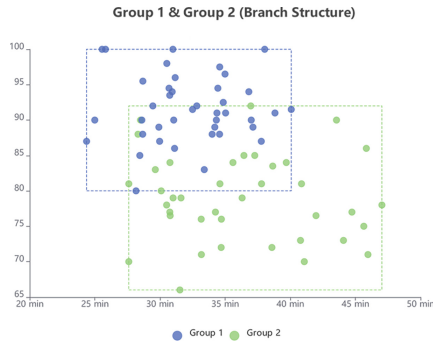


Fig. 4. A comparison of student effects in branch structure teaching

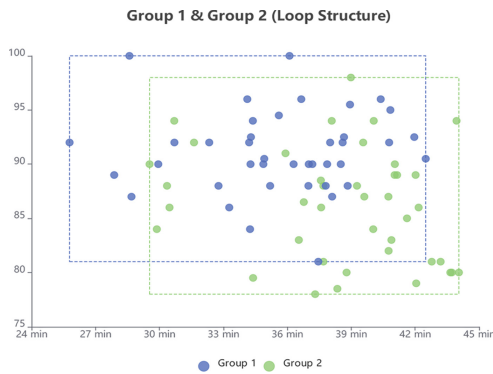


Fig. 5. A comparison of the effect of cyclic structure teaching

structure, the regional gap between control group 1 and control group 2 was narrowed, but the overall learning effect of control group 1 was still better than that of control group 2. It is also proved that the ADDIE model has a positive impact on students' learning outcomes compared with the traditional teaching model (Fig. 6).

After the experiment was completed, the same 20 teachers were surveyed again. 90% teachers are satisfied with the application of ADDIE model in the teaching of programming courses.

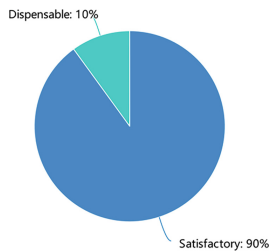


Fig. 6. Teachers' experience of the application of ADDIE model in curriculum

6 Discussion and Conclusion

The five stages of ADDIE model complement each other and form a complete teaching closed loop. This model combines multimedia technology and ADDIE model based auxiliary system. The system provides teachers with a variety of teaching elements, analyzes students' learning situation, and helps teachers quickly design the teaching design in line with the teaching objectives. Applied to teaching, the model integrates teaching resource design, teaching activity design, teaching strategy design and teaching evaluation design to help teachers accurately grasp the whole teaching process and optimize various teaching elements. Through experiments, it is found that after ADDIE model is applied in the selection structure and cyclic structure in Python programming language, the efficiency and quality of teachers' teaching design are improved, and the learning effect of students is improved. Therefore, the application of this model to the teaching practice of programming courses is helpful to improve the efficiency of teachers' teaching design and students' learning outcomes. The application of this model is the program.

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