



Construction and Application of Primary School Mathematics Project-based Teaching Mode Based on Five-learning Class—Taking Huigu Primary School of Chongqing Science City as an Example

Zilei Wang, Lei Lei*

School of Computer and Information Science, Chongqing normal university, Chongqing, China
*1294169836@qq.com

Abstract. This article explores a new teaching model for primary school math, guided by the "Five Learning Class" framework and the curriculum standards. It aims to help students adapt to these standards and promote innovative teaching methods. The Five Learning Class lacks a mature model for practical classroom use, which poses challenges. To address this, the study constructs a project-based teaching model based on the curriculum standards and principles of the Five Learning Class. This model is tested in a real math class at Huigu Primary School in Chongqing Science City, aiming to provide value for practical teaching and reference for educational researchers.

Keywords: five-learning class; elementary mathematics; project-based instruction; digital instruction.

1 Introduction

In recent years, the national education policy has been updated and iterated, various new concepts of education have emerged, and all kinds of new vocabularies of education guided by promoting students' all-round development have become an indispensable part of the education strategy under the new curriculum standard. The five-learning class is a new innovative education model proposed by Chongqing Hi-tech Zone, which is committed to focusing on the overall development of students, advocating personalized teaching, and emphasizing the cultivation of habits and shaping of values. However, the concept has been less practiced in teaching, which does not provide teachers with referable cases of practice and feedback, and has not been deeply integrated with other educational reform concepts. Students need time to understand and digest new knowledge after class, and teachers need to sort out and explain it many times, so the traditional model faces difficulties. Therefore, this study introduces the five-learning class model of Chongqing Hi-Tech Zone, combines digital tools, and implements project-based teaching in elementary school mathematics, designing authentic activities, pre-designing feedback, optimizing the process, and evaluating the effects, so as to cultivate the comprehensive qualities and multiple abilities with the students as the center.

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2 The Theoretical Basis of Project-based Teaching in Elementary School Mathematics Based on Five-learning Class

2.1 Primary School Mathematics Curriculum

Elementary school mathematics curriculum is a key part of basic education, covering number concepts, arithmetic, spatial view and data analysis. The Ministry of Education's standard aims to cultivate mathematical literacy, solve practical problems, and lay the foundation for subsequent learning. The curriculum focuses on basic learning and skills training, is logically organized in a complete system, and emphasizes hands-on practice. The concept of “five-learning class” is in line with the curriculum and can be integrated into teaching to enhance efficiency and build a comprehensive quality education model.

2.2 Five-study Class

For the “five-learning class” teaching concept, a number of scholars have different perspectives and different connotations on their research. This study focuses on the practice theory of “five-learning class” proposed by Wang Hu in Chongqing Hi-Tech Zone^[1]. The five-learning class education concept in this research perspective refers to the overall disciplinalization and school-based teaching unit, and the construction of the regional structure of problem-led learning, context-created learning, activity-based mutual learning, digital learning, and evaluation-based superior learning. The teaching philosophy is to establish the basic objectives of teaching and learning based on students' comprehensive literacy, to set up structured teaching units, and to design course contents that reflect structured characteristics. Based on the above teaching concepts, this study combines the five-learning class with elementary school mathematics to provide a reliable teaching model that promotes the improvement of students' basic literacy^[2].

2.3 Project-based Teaching

Project-based teaching is the abbreviation of Project-Based Learning (PBL), which emphasizes that students apply what they have learned in practice through practical operation, exploration and innovation with the goal of solving real problems^[3]. In Project-Based Learning, teachers guide students to plan, design, and implement projects, and students complete project tasks through teamwork, research, and practice to achieve learning goals. This model is student-centered, based on actual projects, and involves the whole process of cultivating students' comprehensive ability and innovative spirit. The model originated from abroad, and then by the domestic education sector attention to research.

The concept of “learning by doing” put forward by American educator John Dewey emphasizes the promotion of students' learning and development through practical activities, and David Kolb's experiential learning theory also emphasizes that students acquire knowledge and skills through practical experience^[4]. According to Prof. Liu Rude of Beijing Normal University, project-based teaching can help students establish the connection between knowledge and the real world and cultivate their problem-solving ability. Professor Xu Binyan of Nanjing Normal University, on the other hand, proposed a project-based learning model that emphasizes students' initiative and autonomy in projects^[5].

Several Opinions of the Ministry of Education on Comprehensively Improving the Quality of Higher Education suggests “implementing a variety of teaching methods, such as problem-based learning and project-based learning, to promote students' active learning and innovative practice”; China Education Modernization 2035 also emphasizes the need to “innovate the way of cultivating talents, implement project-based and cooperative learning, and develop their ability to solve problems. The Modernization of China's Education 2035 also emphasizes the need to “innovate talent cultivation methods, and implement teaching modes such as project-based, cooperative, and research-based learning”^[6].

It can be seen that project-based teaching has significant advantages, emphasizing students' subjectivity and autonomy, taking actual projects as the carrier, combining with real life and social practice, and enhancing learning interest and practical ability. Focusing on process evaluation and the performance and development of students in the project, it is easy for teachers to identify problems and give guidance. These features provide a theoretical basis for the development of new teaching models.

3 Constructing Primary Mathematics Project-based Teaching Mode Based on Five-learning class

The core of the project-based teaching mode of primary mathematics based on the five-learning class lies in the organic integration of the five positions: problem-led learning, context-created learning, mutual learning activities, digital learning, and evaluation of excellent learning.

3.1 Authentic Teaching Activity Design

This study applies the teaching model's design thinking to real teaching activities, integrating deeply with the model to guide students in solving real problems. The chosen themes are relevant to students' lives to enhance practical skills. The goal of designing suitable teaching activities is to engage students and test the model's effectiveness. The project-based teaching structure includes five stages: "problem-led - context-created - activity - digital - evaluation." Understand curriculum and students' needs, setting clear, measurable goals^[7]. Choose authentic problems related to student interests, ensuring they are challenging. Design logical activities with available resources, encouraging student involvement in resource gathering to develop independence and collaboration.

Teachers should guide and encourage active student interaction. Evaluate outcomes effectively to refine teaching designs and improve results^[8]. The project-based teaching model of elementary school mathematics based on the “five-learning class” is shown in Figure 1.

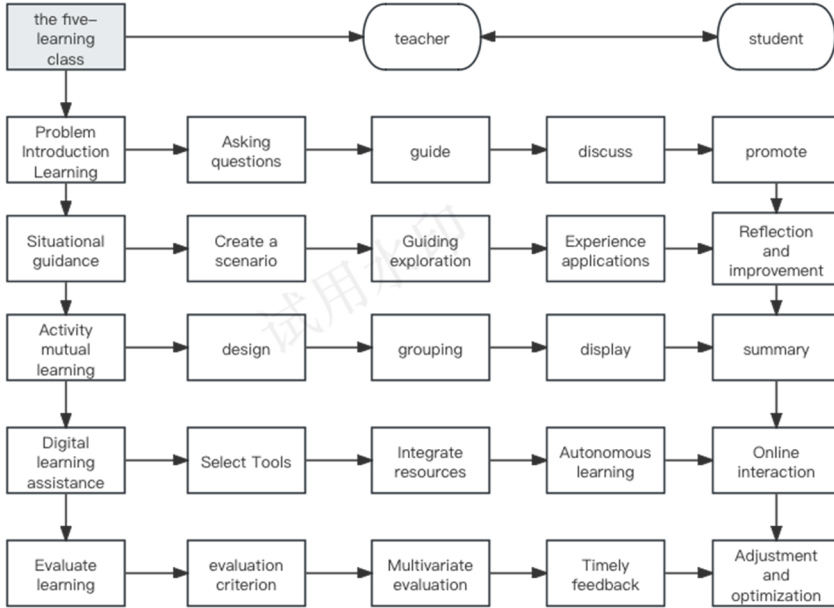


Fig. 1. Primary mathematics project-based teaching mode based on “five-learning class”.

3.2 Teacher's Teaching Mode Flow

In the five-learning class, teachers play the roles of guide, facilitator and supporter, and carefully design and organize the teaching links to help students effectively achieve the teaching goals and comprehensive development. At the same time, teachers emphasize the cultivation of students' independent learning, cooperative spirit and inquiry ability, so as to lay a solid foundation for their future learning life^[9]. The core concept of the five-learning class is integrated with the project-based teaching mode, and its teaching model is shown in Figure 2.

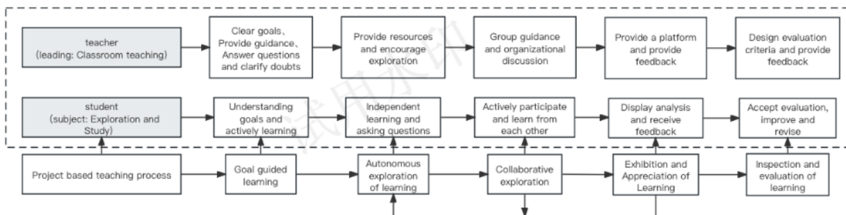


Fig. 2. "Five Learning Classroom" Teaching Model

3.3 Integration of the Five-study Class Concept

Under exam-oriented education, classrooms often overlook student agency. The five-study class concept emphasizes autonomy, cooperation, and inquiry, empowering students to transition from passive to active learners. This shift is crucial in Math and Intelligence, where teachers become facilitators rather than mere knowledge transmitters. They design activities that guide learning, help solve problems, and achieve goals, focusing more on student needs and development. The concept also promotes cooperative spirit and inquiry skills among students^[10]. Timely evaluation and feedback are key, allowing for adjustments in learning strategies, improvements in methods, and better outcomes. Digital resources further enhance teaching efficiency by breaking classroom silence and utilizing advanced tools.

3.4 Cultivation of Students' Comprehensive Quality

Cultivating students' comprehensive quality is the unchanging goal of education. The five-learning class helps cultivate students' comprehensive quality with its unique concepts and methods: independent learning, cooperation and communication, critical innovation, self-management and reflection, and social responsibility. Project-based learning guides problem solving, promotes innovative critical thinking, enhances team communication, cultivates a sense of professional identity, and comprehensively improves overall quality^[11]. Integrate the five-learning class and project-based learning to cultivate comprehensive quality in depth.

3.5 Evaluation of Learning Effect

Learning evaluation is crucial in education, helping teachers grasp the situation and guide weak links. The "Evaluation of Excellent Learning" emphasizes a comprehensive framework, process evaluation, self-reflection, and relevance. Multiple and intelligent evaluations focus on student development. The intelligent teaching platform monitors the teaching process for efficient collaborative evaluation.

4 Practice of Primary School Mathematics Project-based Teaching Mode Based on Five-learning Class

This study takes Huigu Primary School of Chongqing Science City as the practice classroom, and takes "Simple Roadmap" in the second book of the third grade of the Humanistic Version of Primary School Mathematics as an example. The content of this classroom mainly includes three parts: recognizing the eight directions, learning to express the directions and describe the relative positions, and learning to use the knowledge of the directions to solve the simple route problems. The project-based teaching mode based on the five-learning class is adopted, and the teaching process of problem-led learning, context-created learning, activity-based mutual learning, digital learning, and evaluation of excellent learning is demonstrated.

4.1 Learning Design and Session Planning

The course is designed to achieve the teaching objectives through three learning sessions, which are gradually designed according to the students' knowledge of directions, namely, "Introducing the Direction Game", "Recognizing the Direction on the Floor Plan", and "Designing the Tourist Route for Tourists". Designing a tour route for tourists". By asking the students the question "Counterpoint", it guides the students to review what they have learned in the previous lesson and introduces the content of this lesson. Create a life situation "zoo guide map", close to the students' lives, to attract their interest in learning.

4.2 Group Learning and Task Arrangement

Design group activities for students to design zoo tour routes according to their starting places and destinations, and let them use their knowledge of directions to study the route problems in the process of designing routes. Use the digital teaching platform to realize the intelligence of the roadmap designed by the students, and let the virtual digital man play the role of tourists, act as the second teacher, and visualize the roadmap designed by the students.

4.3 Results Sharing and Teaching Evaluation

Results sharing and teaching evaluation are crucial for testing learning effects. The evaluation should reflect diversification in subjects, methods, and tools, using the XIVO platform and scientific means like forms and questionnaires to analyze group evaluations intelligently. It should combine process and summarization, self-evaluation with other evaluations, and adopt students' and groups' suggestions. The "simple roadmap" unit requires group evaluations to select the best roadmap, guiding students to explain their choices based on the lesson content. In project-based teaching, it's essential to emphasize student roles, use IT tools, and develop teamwork, mathematical thinking, and problem-solving skills. The teaching case design is shown in Table 1.

Table 1. Case study of project-based teaching of elementary school mathematics based on the "five-learning class".

Teaching content	Teaching content	Teacher		student
		Human Teachers	Virtual Digital Human Teacher	
Problem Introduction Learning	Summarize the question of "password," prompt a review of prior directional knowledge, present the planning problem in the lesson's learning guide, encourage focus on daily life issues, and enhance the application of directional knowledge to solve problems.	Ask directional questions and guide students to review the knowledge points they have learned before.	Assist teachers in verifying student answers to questions, display them on the screen, and visually correct student errors.	Review the 8 previously learned directions and think about the problem.
Situational guidance	Create a scenario for students to study a zoo map and identify attractions' positions. Then, have them create a tour route map, addressing route issues in the process.	After explaining relative positions, students should group up and	Assist teachers in showing the application of this knowledge point in life, displaying unknown concepts	Prepare for the group activities as

		design various tourist routes.	on large screens, and helping students understand.	per the teacher's explanation and digital media presentation.
Activity mutual learning	Through group collaboration, students design travel routes to enhance teamwork and independent learning.	Have each group report on the designed tour route.	Act as the second teacher and showcase the routes designed by each group, allowing them to watch and think.	Carry out group activities
Digital learning assistance	Create interactive learning environments like whiteboards, online platforms, and VR tech to enhance classroom teaching and make abstract concepts easier to grasp.	Guide students to clarify that there are different ways to travel to the same destination during the reporting process.	Display the roadmap of each group on the smart whiteboard.	Report your group's roadmap and explain the design reasons to enhance students' overall abilities.
Evaluate education	According to each group's design roadmap, evaluate works through self and peer evaluations for diversified teaching. Use digital platforms for intelligent analysis and qualitative/quantitative evaluation of students' work.	Guide groups to critique the roadmap, identify shortcomings & reasons, record data, modify teaching based on student shortcomings, and pinpoint weaknesses.	Using NLP and ML, auto-evaluate student roadmaps, give feedback & suggestions, and offer teaching improvement tips. Provide emotional interaction and personalized guidance for students.	Revise timely based on teacher & peer evaluations, reflect & improve.

5 Summary

The "five-learning class" concept, incorporating various educational theories, hasn't been integrated into real teaching modes for practice. This study constructs a five-learning class teaching model suitable for elementary school mathematics classrooms based on the project-based teaching model and applies it in actual teaching. The results show that this model can implement student-centered development, improve learning efficiency, and cultivate students' comprehensive application ability. It also allows teachers to pay attention to the overall teaching of the unit and explore the path of subject-oriented and school-based practice. Therefore, the organic combination of the five-study class and project-based learning has formed a new teaching mode, which provides reference to the new mode of educational integration and contributes to the research of teaching disciplinization practice to a deeper level of development and innovation.

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