Research on precise teaching mode based on rain classroom—Take advanced algebra course as an example

Juan Gao[1,a,*], Tongbin Li[2]

[1]School of Mathematical Sciences, Harbin Normal University, Harbin, Heilongjiang, 150025, China
[2]School of Economics and Management, Harbin Normal University, Harbin, Heilongjiang, 150025, China
[a]gaojuan006@126.com
[*]Corresponding author

Abstract: *The emergence of modern technologies such as artificial intelligence and big data has provided new technological support for reforming and innovating traditional teaching models. This article analyzes the problems with traditional classroom teaching models and constructs a precise teaching model for advanced algebra from three aspects: precise teaching objectives, precise teaching content, and precise teaching assessment. By using big data technology from the "Rain Classroom" to analyze student learning situations, various functions of the "Rain Classroom" are employed for diversified classroom interactions. This approach aims to cultivate students' independent inquiry and innovation capabilities, enhance learning interest and efficiency, improve students' comprehensive qualities, and enhance teaching quality.*

Keywords: *Rain Classroom; Advanced Algebra; Precision Teaching*

1. Introduction

"Advanced Algebra" is a required fundamental course for majors in applied statistics. It is a highly theoretical and applicable mathematics course. The main objectives of teaching this course are to develop students' theoretical foundations in algebra, master methods of mathematical reasoning, acquire proficient calculation skills, and enhance their abilities to analyze and solve problems. This course lays a solid foundation for students to further study other mathematical knowledge. In order to promote teaching reform, improve teaching quality, and create efficient classrooms, our team attempted to use the "Rain Classroom" teaching platform. We conducted precise diagnostics of each student's learning situation before class and designed graded learning tasks tailored to students of different levels, achieving personalized teaching based on individual capabilities. The "Rain Classroom" is an intelligent teaching tool that integrates multimedia slides, MOOC resources, and WeChat. It is designed to connect intelligent terminals for interactive learning between teachers and students. "Rain Classroom" covers every aspect of teaching, including pre-class, in-class, and post-class, providing complete and three-dimensional data support for both teachers and students. It offers personalized reports and task reminders, making teaching and learning more transparent. Through the "Rain Classroom," teachers can provide students with pre-class materials, including PowerPoint slides, exercises, and recorded audio explanations, as well as high-quality MOOC teaching videos. During the class, students can access the teacher's lecture slides directly on their smartphones, use features like the "I don't understand" button, anonymous "barrage" comments, random roll call, and in-class quizzes for interactive learning. This effectively improves the efficiency of teaching and learning while increasing students' interest in learning. Moreover, it allows for the collection, statistical analysis, and improvement of student learning data. From a teaching perspective, teachers can transform their teaching concepts by making students the center of the learning process, encouraging creative learning. This article explores a precise teaching model for the advanced algebra course based on the "Rain Classroom" and blended learning.

2. Problems with Traditional Classroom Teaching Models

The vigorous development of information technology, increasingly integrated into modern

education, highlights several issues with traditional classroom teaching models.

2.1 Single Teaching Method

Traditional teaching primarily involves teachers delivering lectures in the classroom using chalkboards, multimedia, and textbooks, with students in a passive learning role. Teaching objectives are often vague and lack detailed breakdowns, making it challenging to select appropriate teaching methods for different objectives.[1] Some schools impose strict time constraints on teachers, leading them to focus solely on theoretical instruction during class and neglect practical teaching. This disconnect between theory and practice results in poor learning outcomes. Furthermore, lengthy attendance checks in class consume valuable time, and limited interaction between students and teachers makes it challenging for teachers to gauge student learning progress.[2]

2.2 Neglecting Individualized Student Development

Under the traditional teaching model, the educational approach is uniform, disregarding the individualized development of students. Student performance analysis is primarily based on teachers' existing teaching experiences, resulting in subjective and non-targeted analysis. This leads to blind and non-targeted teaching.[3] Superficial communication and interaction between teachers and students hinder teachers from understanding students' true thoughts, addressing their specific questions, and making timely adjustments, particularly regarding content organization and teaching strategy selection.

2.3 Inaccurate Formative Assessment of Students

Traditional teaching relies on subjective assessments of student progress, including attendance records, participation, and mid-term tests.[4] These assessments are predominantly teacher-driven, with minimal objective criteria. For example, classroom participation opportunities are limited, denying some students the chance to showcase their abilities. Consequently, students' continuous assessments lack precise, quantifiable criteria, leading to issues of fairness. Such assessments fail to accurately reflect teaching effectiveness, provide precise feedback, or support improvements in content, teaching methods, or overall teaching quality.[5]

3. Advantages of the "Rain Classroom" Teaching Platform The "Rain Classroom" offers several advantages:

3.1 Precise Focus on Student Learning

The "Rain Classroom" boasts robust data collection capabilities, recording all aspects of the teaching and learning process. Teachers can use the platform's data to precisely focus on student learning behaviors and understand student learning situations. Features like attendance tracking not only reduce attendance-taking time but also generate attendance records at the end of each class, facilitating teachers' assessment of student attendance.[6] The platform provides insights into student participation levels and activity in various classroom activities, such as answering questions, voting, participating in discussions, completing in-class assignments, and engaging in group tasks. This information helps teachers gauge student attendance and their level of engagement, contributing to more targeted and effective classroom teaching.

3.2 Tailoring to Individual Student Needs

Through the "Rain Classroom," data is collected throughout the course, allowing teachers to monitor individual student learning during pre-class, in-class, and post-class phases. Based on data analysis of student learning patterns, teachers can understand students' individualized needs and provide timely personalized guidance.[7] For example, students who perform poorly in pre-class preparation or tests can receive personalized support based on their pre-class learning data, helping them address weaknesses. Likewise, students with strong self-learning abilities or a solid foundation can access supplementary learning materials of varying difficulty levels, encouraging them to expand their knowledge independently and enhancing their learning. Over time, teachers can develop tailored teaching plans based on platform feedback, taking into account student learning patterns, levels, and individual needs.[8]

3.3 Accurate Implementation of Formative Assessment

The "Rain Classroom" teaching platform collects extensive data on student learning behaviors, creating a comprehensive picture of student learning trajectories. It analyzes student learning activities and generates visual assessment reports that enable teachers to monitor student learning during pre-class, in-class, and post-class stages accurately.[9] Teachers can gauge student participation, activity levels, course completion rates, and other critical aspects based on this data. Consequently, teachers can provide precise "formative" assessments at each learning stage, motivating students, enhancing their enthusiasm for learning, and promoting active engagement in the learning process. Student evaluations are more comprehensive and detailed, as the platform presents data on all aspects of the course, including pre-class preparation, in-class activities, and post-class assignments. This detailed data ensures that student evaluations are more accurate and persuasive, fostering a sense of fairness among students.[10]

4. Precision Teaching Model Based on the Rain Classroom Platform

We have applied the precision teaching model of the "Rain Classroom" to the teaching practice of "Advanced Algebra" for the 2022 cohort of Applied Statistics majors. This application encompasses teaching objectives, teaching content, teaching methods, and formative assessment. Leveraging the Rain Classroom platform, we collect personalized characteristics of student learning behaviors and learning needs, dynamically adjust teaching content and methods, and aim to foster students' intellectual development by constructing an intelligent and efficient precision classroom within the integration of modern information technology and traditional teaching.

4.1 Precisely Defined Teaching Objectives

Teaching objectives guide classroom teaching activities. In the design of teaching objectives, it is essential to describe the knowledge that students should master in a detailed and precise manner. Each chapter and section's objectives should be broken down into numerous sub-objectives, with each small objective translated into corresponding teaching tasks. Through the Rain Classroom platform, we set up relevant exercises and tests to understand the achievement level of these objectives promptly. This allows us to adjust teaching tasks in real-time with specific goals in mind. For the "Advanced Algebra" course in Applied Statistics, to emphasize its applied nature, we divide teaching objectives into theoretical and practical objectives that complement and reinforce each other. For instance, when teaching matrix rank determination, the theoretical objective is to learn how to determine the rank of a matrix using elementary transformations, while the practical objective is to learn how to determine matrix rank using Matlab software. Using Matlab for practical rank determination validates the accuracy of theoretical solutions, and this interplay between theory and practice enhances learning interest and effectiveness.

4.1.1 Precise Theoretical Teaching

Using the Rain Classroom, teachers prepare and upload relevant learning materials, including presentations, audio, video, etc., based on the requirements of learning objectives. They design test questions and promptly push them to students via the platform for pre-class preparation. Students engage in self-directed learning, complete tests, review materials, communicate with peers, and seek clarification on any unclear aspects, fostering their proactive approach to learning. Teachers, through the Rain Classroom platform, monitor students' learning status, including metrics like pages viewed, duration and frequency of video resources viewed, time taken to complete quizzes, and scores obtained. This data empowers teachers to make timely, targeted adjustments to teaching content and strategies. During in-class teaching, teachers use problem-driven and case-based teaching methods to integrate the content based on the pre-class learning analysis from the Rain Classroom. Through activities such as group discussions, teacher explanations, in-class quizzes, and real-time teacher feedback, they facilitate diverse interactions between teachers and students, deepening students' understanding of the material. When students encounter difficulties, they can provide feedback to teachers through the Rain Classroom. Teachers use this feedback data from the platform to address common issues in class and provide individualized intervention and guidance. From class level to group level to individual level, every student eventually masters the required knowledge specified by the teaching objectives.

4.1.2 Precise Practical Teaching

Our team incorporates practical teaching into the "Advanced Algebra" course for Applied Statistics majors by integrating Matlab software. While teaching the theory in the classroom, teachers use this software to simplify complex algebraic calculations, making the class engaging and improving teaching effectiveness. This approach enhances students' understanding of the material and cultivates their innovative thinking. For example, Matlab has powerful computation capabilities for matrix operations and solving systems of linear equations, which constitute the entire content of Advanced Algebra 1. Students can efficiently perform these calculations using Matlab. Once students grasp the methods for solving linear systems, teachers can demonstrate solving higher-dimensional systems using Matlab, helping students achieve a more comprehensive understanding. Additionally, students can use Matlab to verify their manual calculations, ensuring accuracy and enhancing their learning. Instructions for Matlab commands can be presented in class through real-time demonstrations by the teacher or via video resources and study materials pushed to students through the Rain Classroom. Completing practical assignments using Matlab, students upload evidence of their work to the Rain Classroom platform. This approach enhances students' hands-on skills, breaking away from the traditional "paper-based" approach. Students gain proficiency in using Advanced Algebra as a mathematical tool in their subsequent studies. After class, teachers assess students' grasp of practical content by reviewing completion statuses and analyzing data provided by the Rain Classroom platform. They identify areas of difficulty in practical work, address them in class, and ensure precise practical teaching.

4.2 Precise Teaching Evaluation

Traditional teaching evaluation often relies on subjective assessments, such as attendance, classroom participation, assignments, mid-term, and final exam scores, with assessment criteria influenced by individual cognitive levels and emotional factors. Such evaluations lack comprehensive, objective data support, failing to provide a holistic, unbiased assessment of student learning processes. In a smart education environment, the Rain Classroom platform offers the ability to perceive and dynamically collect vast assessment data during classroom teaching. The precision teaching evaluation system is data-driven, with analysis and assessment of student learning data spanning pre-class preparation, in-class teaching, and post-class assignments. By utilizing Rain Classroom's data analysis technology, it becomes possible to establish an effective real-time tracking and assessment system for student learning status, offering personalized guidance. Furthermore, teachers can provide guidance for the next stage of teaching based on platform data.

5. Conclusion

The rapid development of information technology has facilitated the integration of big data technology into education and teaching, driving the reform and innovation of precision teaching models. The precision teaching model based on the Rain Classroom platform primarily relies on data-driven decision support to conduct various teaching activities. It aims to transform teachers into guides and students into active participants, fostering online and offline multidimensional, interactive learning interactions. This model involves a continuous cycle of teaching and learning, where behavioral data help assess students' grasp of knowledge and their adaptability to teaching methods. Teachers, leveraging individual differences among students and analyzing learning platform data, dynamically update teaching objectives, plans, and content. They adjust teaching approaches, optimize teaching methods, and implement differentiated instruction in the classroom. This personalized guidance ensures comprehensive skill enhancement among students. This approach places students at the center of education, enhances teaching quality, and improves teaching effectiveness, ultimately achieving precision teaching.

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