

Research on the Blended Teaching Mode of Advanced Mathematics Based on Rain Classroom

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ABSTRACT

This article aims to give full play to the main body status of students, divide the teaching content into "online articles-offline articles-combined articles", and construct the advanced mathematics trinity of "before class-while class-after class" based on the application of Rain Class Mixed teaching mode. At the same time, a multiple intelligent teaching evaluation system with "multiple evaluation subjects, multiple evaluation methods, and multiple evaluation content" has been established. This model not only scientifically evaluates students' comprehensive performance, but also greatly improves students' learning interest and learning efficiency.

Keywords: Rain classroom, mixed teaching, intelligent teaching, evaluation system.

1. INTRODUCTION

Since the 19th National Congress of the Communist Party of China, China has embarked on a new journey of accelerating the modernization of education and building an educational power. Major universities are also keeping up with the pace, actively promoting "Internet + education", insisting on the deep integration of information technology and education and teaching, and building a networked, digital, intelligent, personalized, and lifelong education system. As for the higher mathematics course as a public basic course with a wide audience and greater influence in colleges and universities, many problems have become hot issues in today's education reform. Such as how to use information-based teaching methods, give full play to the network teaching platform, and change the traditional teacher-centered teaching mode where students are passively indoctrinated? How to improve students' learning interest and learning efficiency, enhance students' innovative spirit and practical ability and so on.

2. OVERVIEW OF RESEARCH STATUS AT HOME AND ABROAD

2.1. Current status of domestic research

On the one hand, some domestic scholars have conducted in-depth research and discussion on the blended teaching model, and the research on the reform of undergraduate advanced mathematics teaching is also very rich. One is from the perspective of higher mathematics teaching design and teaching methods. For example, Zhang Jumei's research on the reform of higher mathematics teaching

methods [1], Zhao Linlong's research on the reform of teaching content [2], and Guo Huijun's research on the reform of advanced mathematics blended teaching [3]. The method of "teaching" and the effect of "teaching". The other is based on MOOCs and micro-classes, emphasizing the in-depth integration of modern information technology and classrooms, and aims to build a digital and intelligent modern classroom environment to provide students with a broader space for learning. These studies pay more attention to the "learning" of students, and study the improvement of students' learning methods and the construction of learning platforms. For example, Yao Kejian and others have studied the application of modern information technology to the reform of higher mathematics courses, and Du Heng and others have studied micro-class teaching and many more. However, there are few researches on the mixed mode of teaching advanced mathematics using modern information technology, which is "before class-while class-after class", and it is not enough to analyse the correlation between student learning data and student performance based on the rain class.

On the other hand, under the background of the era of big data, traditional classroom teaching is facing new challenges and opportunities. Using learning data analysis to improve teaching behavior is an effective means to transform traditional classrooms. As a new type of hybrid teaching tool, "Rain Class" was born from the key online education project "Scalable Blended Teaching Mode Research and Practice" applied by Tsinghua University in 2015. It connects the smart terminals of teachers and students through WeChat service accounts. To realize the collection and analysis of dynamic learning data for the whole process of before class-while class-after-class teaching. The launch of Rain Classroom provides environment and technical support for the construction of smart classrooms. Using Rain Classroom to conduct blended teaching of higher mathematics is to meet the

needs of school classroom teaching reform and innovation under the background of education informatization and big data [4].

2.2. Current status of foreign research

In the context of "Internet +", many foreign educational institutions and departments attach great importance to the application of educational data mining and learning analysis technology. In 2012, the US Department of Education issued the "Promoting Teaching and Learning Through Educational Data Mining and Learning Analysis". In the report, many scholars have discussed the impact of emerging technologies on education. Foreign research on smart classrooms is biased towards smart classrooms in the physical environment, and the research time is earlier. Kumara, W.W. and others believe that with the development of the field of human-computer interaction, it is possible to use body movements to interact with computers or smartphones, and the integration of somatosensory applications and classrooms can make students' learning experience more active and happy. The researcher envisioned an evaluation system in a smart classroom environment, experimenting with teachers and students, and then used usability questionnaires to understand user feedback. The results showed that participants were satisfied with the system and the system was simple and easy to use. Evaluation can provide better functions and motivate students to learn [5].

3. THE "ONLINE+OFFLINE" BLENDED TEACHING MODE OF ADVANCED MATHEMATICS BASED ON THE APPLICATION OF RAIN CLASSROOM

With the gradual introduction of modern information technology, the traditional higher mathematics teaching process also needs to be further optimized and simplified. "Teaching" and "learning" cannot be used as separate elements to construct the teaching process, but centered on "student-centered" [6], pay attention to the mutual penetration and integration of "teaching" and "learning" to build a learning community. Therefore, combined with the characteristics of the weak foundation of private undergraduate colleges and the lack of basic class hours, we fragmented the knowledge points of the undergraduate advanced mathematics syllabus, combined with the characteristics of the teaching content and the students' learning foundation, and divided the teaching content into "online modules" —Offline module — blended module". Online module, that is, students complete the course content through self-study by watching the online MOOC; offline module, that is, the student will concentrate on learning the content of the course through the teacher's explanation in the class; mixed module, that is, the student divides the study group and learns through the online MOOC first, Understand the knowledge structure system,

and then adopt the form of flipped classroom, let students summarize the learning content by themselves, in order to achieve the purpose of gradual consolidation.

3.1. Online module

Regarding the teaching content of the "online module", we take the "spatial curve equation" as an example to assign learning tasks to students in advance, so that students can watch the online MOOC seriously, so as to check the learning content in the rain class within one week after learning. At the same time, students can also discuss content with teachers through the Rain Classroom platform. After testing, students' score rate for online learning content is 82.1%, indicating that most students have been able to adapt to the "online + offline" teaching model, but there are still some students who have weak self-learning awareness and poor learning initiative, we need to try more in the future to cultivate students' autonomous learning ability.

3.2. Offline module

Based on the research on the blended teaching mode of advanced mathematics, combined with the technical characteristics of Rain Classroom, a trinity of advanced mathematics blended teaching closed loop of "before class-while class-after class" is created [7]. That is: before class, teachers use the pre-learning materials to conduct statistical analysis and detection of pre-learning status, continuously deepen the emotional analysis, and optimize teaching design; while class, teachers can use Rain Classroom to check attendance in time for students, or send bullet screens and follow-ups. Class tests, real-time learning data analysis and feedback, adjustment of teaching strategies and teaching process; after class, teachers can also push out expanded learning materials through statistical analysis of homework data, and provide targeted guidance to students, so as to realize students' personalized learning [8]. The technical support of Rain Classroom provides real-time dynamic learning data collection, analysis and intelligent push for the entire learning process of "before class-while class-after class" for undergraduate advanced mathematics. Teachers make full use of online and offline resources to fully realize the integration of classroom teaching and online learning.

3.3. Blended module

Firstly, the teacher assigns tasks to the students in advance, clearly informs the learning goals and learning difficulties, and allows students to watch online MOOC content. The students are divided into groups, the learning content and knowledge points are broken down, and each group draws lots to determine the learning task. At the same time, let each group of students determine the course main lecturer,

deputy lecturer, role playing and video recording according to their own specialties.

Secondly, the teacher should give full play to the student's dominant position when teaching in class, let the students to do the self-summarize task and explain the learning content to all students through the preview group study. After each group's explanation, the teacher should make a simple comment on each group's explanation, and combine the students' explanation to further summarize the key points and correct doubts.

Finally, each group of students will display the lesson preparation records, lecture notes, teaching videos, mind maps, blackboard design and other content through PPT. The teacher will use the rain classroom voting function to allow the whole class to conduct the preparation and explanation of each group. Vote to determine the class performance of each group member in this class.

4. ESTABLISH THE MULTI-WISDOM TEACHING EVALUATION SYSTEM OF "MULTI-SUBJECT, MULTI-METHOD AND MULTI-CONTENT OF EVALUATION"[9]

First of all, teachers must change the previous single assessment method and strengthen the management of students' learning process. Through the Rain Classroom, the students' learning data from before-class, while-class, and after-class are sorted out as the main basis for the assessment of students' usual learning process. Finally, it is determined that the student's comprehensive score = process assessment (30%) + summative assessment (70%). In the process assessment, the data of rain classroom learning accounts for 20%, the homework accounts for 20%, the rain classroom test accounts for 30%, the extension homework accounts for 30%.

Table 1. Sensor network experimental results

Taylor formula test-Classroom situation									
Student ID	Name	Sign-in information		Classroom interaction information	Topic information-2.3Taylor formula test				
		Sign-in method	Sign-in time	Cumulative score	Total score	Question 1 ACD 4.0 points	Question 2 B 2.0 points	Question 3 A 2.0 points	Question 4 B 2.0 points
20191040101	Xu Wang	Scan the QR code	2019-11-08 08:49:45	8	8	AD	B	A	B
20191040102	Zhou Hao	Scan the QR code	2019-11-08 08:49:48	8	8	CD	B	A	B
20191040103	Lu Mengkai	Scan the QR code	2019-11-08 08:49:41	6	6	BD	B	A	B
20191040104	Ren Jixiang	Scan the QR code	2019-11-08 08:49:34	10	10	ACD	B	A	B
20191040105	Guan Lei	Scan the QR code	2019-11-08 08:49:55	8	8	AD	B	A	B
20191040106	Cheng Zhaoyue	Scan the QR code	2019-11-08 08:49:45	8	8	AD	B	A	B
20191040107	Wang Ruitian	Scan the QR code	2019-11-08 08:49:46	8	8	CD	B	A	B
20191040108	Zhu Xiaojie	Scan the QR code	2019-11-08 08:49:42	6	6	CD	A	A	B
20191040109	Zhu Qing	Scan the QR code	2019-11-08 08:49:44	8	8	AC	B	A	B
20191040110	Zhang Ke	Scan the QR code	2019-11-08 08:49:55	10	10	ACD	B	A	B
20191040111	Dang Xiangyao	Scan the QR code	2019-11-08 08:49:41	8	8	AD	B	A	B
20191040112	Liu Jihang	Scan the QR code	2019-11-08 08:49:42	8	8	ACD	B	B	B
20191040113	Wang Linjie	Scan the QR code	2019-11-08 08:49:42	8	8	CD	B	A	B
20191040114	Zhang Jie	Scan the QR code	2019-11-08 08:49:42	8	8	AD	B	A	B
20191040115	Cui Aixing	Scan the QR code	2019-11-08 08:49:46	4	4	BD	B	B	B
20191040116	Zhang Tianchao	Scan the QR code	2019-11-08 08:49:43	8	8	AD	B	A	B
20191040117	Zhou Changxu	Scan the QR code	2019-11-08 08:49:42	10	10	ACD	B	A	B
20191040118	Gao Shangjin	Scan the QR code	2019-11-08 08:49:45	8	8	AD	B	A	B

Table 2. XX class advanced mathematics score summary

Student ID	Name	Rain class academic performance	Rain Classroom Test	Formative evaluation	summative evaluation	final scores
20191040101	Xu Wang	84	60	75	53	60
20191040102	Zhou Hao	87	65	80	65	69
20191040103	Lu Mengkai	75	88	84	61	68
20191040104	Ren Jixiang	89	98	93	97	96
20191040105	Guan Lei	87	90	82	68	72
20191040106	Cheng Zhaoyue	87	95	92	84	86
20191040107	Wang Ruitian	64	96	83	78	79
20191040108	Zhu Xiaojie	65	76	78	71	73
20191040109	Zhu Qing	83	78	82	65	70
20191040110	Zhang Ke	75	88	88	75	79
20191040111	Dang Xiangyao	70	95	82	62	68
20191040112	Liu Jihang	58	83	79	33	47
20191040113	Wang Linjie	80	84	86	79	81
20191040114	Zhang Jie	74	96	83	88	86
20191040115	Cui Aixing	67	88	83	67	72
20191040116	Zhang Tianchao	69	98	89	75	79
20191040117	Zhou Changxu	91	98	91	87	88
20191040118	Gao Shangjin	84	100	95	78	83

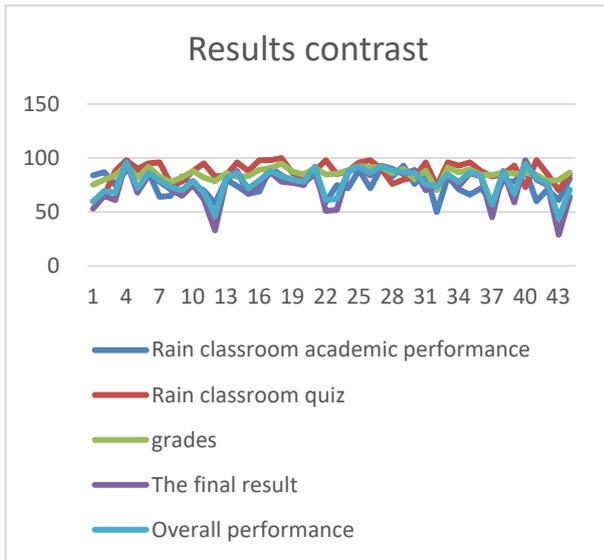


Figure 1. Comparative analysis of performance

Through the comparative analysis of the rain classroom academic performance, the rain classroom quiz, the usual results, the final score, and the overall evaluation score, it can be seen that the student academic performance based on the rain classroom is more consistent with the student overall evaluation score. The reform based on the blended teaching mode of the Rain Classroom platform can scientifically evaluate the comprehensive performance of students.

5. CONCLUSION

5.1. The effect of the blended teaching reform based on the Rain Classroom platform

Firstly, the students' learning enthusiasm has been greatly improved, which has been generally recognized by the students. According to the questionnaire survey, 65.94% of the students are very satisfied with the reform of the mixed mode of higher mathematics teaching based on rain classroom, 30.73% of the students are quite satisfied, and most of the students think that their independent learning ability has been greatly improved.

Secondly, teachers use information technology to improve classroom teaching efficiency. Using Rain Classroom can not only complete tasks such as student sign-in and immediate questioning, but also make classroom teaching more vivid. Especially in the classes in the shared classroom, the number of people is large and the seats are not fixed. Teachers can hardly pay attention to the students' learning in class. After using the rain class, the students' attention is more concentrated, and the students take learning more seriously [10]. In addition, advanced mathematics classroom teaching is tight in time and heavy tasks. After using the rain class, you can post preview tasks before class to introduce mathematics culture and

enhance students' math literacy. Multi-level exercises can be released after class, and postgraduate exams can be released for students of different levels to learn more specifically.

Thirdly, the student-centered hybrid teaching model has increased students' interest in learning. Students can mark the questions they don't understand in the classroom learning with rain, and the teacher can answer the questions in a targeted manner after class to make learning more efficient. In the classroom, students can promptly report questions to the teacher through bullet screens and submissions. Teachers can answer and send red envelopes to reward students on the spot, which greatly improves students' initiative and enthusiasm.

5.2. Directions for future improvement

Continuously improve the informatization teaching ability of young teachers and cultivate the awareness of applying smart teaching tools. Strengthen the monitoring of students' learning effects in teaching, gradually improve students' learning experience, enhance the interest of the classroom, and improve the quality of talent training.

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REFERENCES

- [1] Zhang Jumei, Research on the Reform of University Mathematics Teaching Method-Review of "University Mathematics Teaching and Learning" [J], Educational Development Research, June 2019.
- [2] Zhao Linlong, Practice and Understanding of Case Design of Teaching Content of Advanced Mathematics Course [J], Advanced Mathematics Research, January 2020.
- [3] Guo Huijun, Research on the online and offline "hybrid" teaching mode of higher mathematics courses [J], Science and Technology Vision, April 2019.
- [4] Jiang Wenyin, Yang Fenhong, Fan Luning, Research on the Construction and Application of Smart Classroom Supported by Rain Classroom [J], China Education Informatization, Issue 5, 2017.

[5] Chen Ting, Research on the Design and Application of Smart Classroom Teaching Mode under the Background of "Internet + Education" [M], Jiangsu Normal University, May 2017.

[6] Jiang Lingling, Yin Hai, "Advanced Mathematics" mixed teaching model based on SPOC + Rain Classroom [J], Science and Education Wenhui, May 2019.

[7] Fan Lele, Zhong Hua, Long Luying, Application of "Rain Classroom" in Large Class Teaching of Advanced Mathematics[J], Educational Modernization, December 2018.

[8] Zhou Dujuan, Jia Yuntao, Advanced Mathematics Teaching Practice Based on Rain Classroom [J], Science and Technology Vision, November 2019.

[9] Hao Xingxia, Evaluation of the effect of "Rain Classroom" smart teaching tools in classroom teaching [J], Decision Exploration (Part 2), January 2020.

[10] Li Sha, Design and Practice Research of Mixed Teaching Model Based on "Rain Class" [M], Gannan Normal University, June 2019.