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Research on a Blended Teaching Mode of Advanced Mathematics

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Abstract
Since the outbreak of the pandemic, the "Internet + education",an emerging teaching mode, has left a huge impact on teaching tools and educational concepts. This paper is thus aimed to discuss the innovativeness of the blended teaching mode, based on the Mosotech-aided advanced mathematics teaching. The advantages and disadvantages of blended teaching were analysed. Attention should be paid to the integration of online and offline teaching, while building up professional discipline teams, infusing ideological and political elements, and strengthening network security education, so as to cultivate innovative talents.
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1. Introduction

In April 2018, the Ministry of Education of China issued the "Action Plan for Education Informatization 2.0", which proposed to actively promote "Internet + education", advancing the sharing of high-quality digitalized educational resources through the deep integration between information technology and education, and establishing a networked, intelligent and lifelong education system(the Ministry of Education of China 2018). At the end of 2019, the sudden outbreak of covid-19 pandemic spread rapidly and swept the globe, and Ministry of Education has been faced with unprecedented challenges. In February 2020, the Ministry of Education of China issued the "Guiding Opinions on the Organization and Management of Online Teaching in Ordinary Colleges and Universities during the Period of Prevention and Control over the Pandemic", which proposed that colleges and universities should make full advantage of high-quality online teaching resources to carry out online teaching activities, so as to ensure teaching progress and quality and achieve "suspend classes without stopping learning"(the Ministry of Education of China 2020).

Blended teaching follows the concept of student-centered and teacher-led education, and combines traditional classroom teaching with online teaching through teaching designs(Song Fengquan et al. 2022). This new mode can complement the traditional single-way offline teaching mode, promote good interaction between teachers and students, and improve students' ability to solve practical problems(Guan Lihong et al. 2021). The research on blended teaching in China began in the early 21st century(Zhu Xuemei et al. 2018), but its development is still immature, with such problems as incomplete teaching systems, unskilled use of teaching tools, and serious dependence on networks of students. Through blended teaching practice in advanced mathematics courses, this study puts forward a few suggestions while trying to find its merits and demerits.

2. The necessity of implementing blended teaching for advanced mathematics

As a required basic course for non-mathematics majors, advanced mathematics is not only an important basic course for science and engineering majors, but also a required course for increasingly more liberal arts majors. Advanced mathematics has long hours of learning and carries many credits, and is a compulsory subject for most majors' postgraduate entrance examinations. It is imperative to carry out " online & offline" blended teaching for advanced mathematics.

2.1 Meet the new requirements in the pandemic era

In the post-pandemic era, with the possibility of small-scale outbreaks of the cases,"online & offline"blended teaching is still an important emergency teaching mode. Online courses break through the limitations in terms of time and space, and eliminate the non-repeatability of traditional offline teaching in advanced mathematics courses. In the context of the pandemic, blended teaching can take advantage of specific cases, thus not only ensuring teaching schedules and teaching quality, but also actively exploring effective digitalized teaching tools.

2.2 Usher in new changes in teaching methods

Advanced mathematics takes an important position in the teaching and training plans for undergraduates, and curriculum reform on it is a necessary measure for innovation in talent training. Blended teaching methods impose higher requirements for teachers to adopt online teaching tools, innovate teaching designs, and

incorporate rich teaching elements in advanced mathematics courses. This practice can promote teaching reflection and drive the teaching methods of advanced mathematics to the transformation of "education informationization". It is a key link in promoting teaching reformation.

2.3 Strengthen the autonomy in terms of learning methods

University students' learning are becoming increasingly more autonomous, and it is necessary to strengthen the cultivation of students' abilities of autonomous learning and inquiry learning. All sorts of teaching resources on online platforms correct the limitation of offline teaching hours. Students can do their pre-class preview and after-class consolidation by utilizing online teaching videos, teaching materials, etc. While making full use of online resources for autonomous learning of advanced mathematics courses, students can train their ability to discover, analyze and solve problems, thus effectively improving classroom efficiency.

2.4 Promote the modernization of educational ideas

Information technology is constantly changing people's lives, as well as reshaping the forms of education. Great changes appear in teaching and learning, as well as in imparting and acquisition of knowledge. Blended teaching imposes higher requirements for teaching levels, educational mechanisms and the mastery of modern information technology, so as to promote the deep integration between modern educational concepts, such as people-orientation, comprehensive development, quality-orientation and individualized development, and curriculum teaching.

3. Design and practice of blended teaching for advanced mathematics based on the *Mosotech* platform

Mosotech is an auxiliary teaching platform that provides online interactive functions. It can create multiple teaching courses online. The courses offer many module functions, such as sign-in, brainstorming, testing activities, and classroom performance. These functions not only provide students with high-quality teaching resources and enriched course sections, but also offers feedbacks for teachers on the learning process. It is a set of functionally matured online teaching software(AI Qing 2022).

Using offline teaching, supplemented with a combined online teaching method of "*Mosotech* & Tencent Conference & QQ group", the author carried out blended online and offline teaching of advanced mathematics for 104 students majoring in e-commerce and logistics management enrolled in 2021. This practice has achieved good results.

3.1 The main design idea for blended teaching of advanced mathematics courses

Advanced mathematics can be divided into two parts: the theory of differential calculus and the theory of integral calculus. It researches the theory and application of calculus, with the content of limit, derivative and integral as its main line. It aims at improving students' comprehensive mathematical quality, cultivating their rational thinking, and laying a foundation for learning other courses.

3.1.1 Subject characteristics

In terms of subject characteristics, advanced mathematics entails a lot of calculation and derivation in teaching, classroom exercises, homework and group discussions. How to choose appropriate teaching software to assist in displaying the calculation process in online teaching is a necessary concern in the teaching design. Desmos (a drawing software), OneNote (a handwriting note-taking software), slide stylus and other tools have provided firm support for the online classroom of advanced mathematics.

3.1.2 The basic information of students

As to the basic information of students, the students majoring in e-commerce and logistics management include both science students and liberal arts ones, so their mathematical foundations are somewhat different. Therefore, the arrangement of course content shall follow a process from the shallower to the deeper; the staged assessment and evaluation shall be strengthened; and stratified teaching shall be promoted.

3.1.3 The OBE teaching concept

It is necessary to start from the OBE teaching concept; take a student-centered approach; and reversely design and construct the curriculum system and determine the teaching strategy(LI Na *et al.* 2022). Each module's content shall be arranged rationally based on its difficulty level as well as the relevance to subsequent courses, while learning objectives and tasks in different chapters and sections shall be refined.

3.2 Blended teaching practice for advanced mathematics courses

3.2.1 Preparation before class

Before class, select high-quality learning resources through online platforms as the carrier; upload e-books, micro-lecture videos, examples and thinking questions in advance; and set up learning tasks. Teaching announcements shall be published in QQ groups, including *Mosotech* learning guidance and the overall learning goals and staged goals in the semester, so that students can develop a good habit of previewing in advance. The

combination of micro-class videos and thinking questions can expand students' thinking and cultivate their learning interest. With *Mosotech*, the deadline for each task can be set; students who have completed their tasks on time will be rewarded with experience points, while the students who have failed to complete their tasks can be reminded in one click on *Mosotech*.

3.2.2 Implementation during class

In the formal teaching sections of online classes, the *Mosotech* platform can be used to "initiate sign-in", so as to quickly check attendance; further, it can realize real-time feedback and one-time export. During course teaching, all members can log in to the designated Tencent conference course platform; and the "Share Screen" function can be used to transmit course PPT, calculation process and speakers' voices synchronously to every student who are listening to the course online. In the question-and-answer session, combined with the function of "Class Performance" section of the *Mosotech*, such tools as "raise your hand", "quick answer" and"random selection of a person"are used to bring more fun to the class. Screen recording can be enabled during the entire teaching process, and students can review it immediately after the class.

In the offline sections of a class, students are guided to carry out group discussions, and certain targeted consolidation exercises and tests can be arranged based on the procedural data acquired from *Mosotech*. After a course has been launched for a period of time, students can be stratified according to their learning effectiveness, with new goals and tasks proposed for students at different levels.

3.2.3 Evaluation after class

The *Mosotech* platform can deliver multi-dimensional learning evaluation, including process evaluation and result evaluation. The process evaluation comprises of feedbacks on students' learning content, such as pre-class preview, in-class leaning, classroom practice, and after-class homework. The process evaluation data from *Mosotech* can display multi-dimensional learning information of each and very in bar charts, line charts, radar charts and other forms. Such process evaluation data can help teachers adjust teaching schedules and rhythms in time during the teaching process, give attention to students who need help, and provide diversified tutoring for students at different levels. The result evaluation mainly relies on mid-term and final assessments. In addition, a comparative evaluation of online and offline courses for new teaching content can also be launched, so as to comprehensively measure the learning effect of courses in multiple dimensions.

Table 1. Task points of blended teaching based on *Mosotech*

Object	Before class (online)	During class (online & offline)	After class (online)
Teacher	Publish teaching resources, assign pre-class tasks, and supervise the progress of completion	Instruct knowledge points, make group discussions, and conduct in-class tests	Give assignments, check assignments, and make hierarchical Q&A
Student	Make self-study, complete preview tasks, and record difficult knowledge points	Sign in online, complete in-class exercises, and provide learning feedback	Complete assignments, review and consolidate the class content, and make extended thinking
Tools	*Mosotech* and QQ group	Tencent conference, *Mosotech*, and multimedia teaching	*Mosotech* and QQ group

3.3Outcomes of the blended teaching of advanced mathematics courses

After one semester of"online & offline"blended teaching, the 104 students of the advanced mathematics acquire their final grades shown in Table 2. The average score of the class is 76 points for a moderately difficult test. So the average score is within the reasonable range. However, the highest score is 100 points, while the lowest is 44, indicating a big gap between the lowest and highest scores. There are still a small number of students with poor learning effect. The failure rate is 13.46%, indicating that most students have achieved the desired results in the blended teaching process. The number of students distributed in high and low score points is the least, with most of the students' scores concentrated in the section of 60-89 points, so the distribution of the scores is also reasonable. Overall, the blended teaching of higher mathematics has delivered a good result.

Table 2. Final scores for advanced mathematics [1]

Excellent	Good	Medium	Passing	Failed	Highest	Lowest	Average
8.65%	36.54%	26.92%	14.42%	13.46%	100	44	76

[1] The full score is 100 points; 90 and above are excellent; 80-89 are good; 70-79 are medium; 60-69 are passing; and 60 or below are failed.

4. Refection on the blended teaching mode of advanced mathematics courses

4.1 Advantages of"online & offline"blended teaching for advanced mathematics

4.1.1 More innovative

The "student-centered" teaching principle attaches great importance to the cultivation of students' abilities, including problem-solving ability, cooperation ability and innovation ability. In the process of blended teaching of advanced mathematics, teachers shall select high-quality teaching resources and arrange students to study independently online before each class. For the freshmen, this is an indispensable process for cultivating their independent inquiry abilities. Pre-class quizzes can arouse students' thinking, drive up students' learning initiative, change traditional study habits, and promote in-depth learning.

4.1.2 More comprehensive evaluation

Traditional teaching modes tend to stress the results, but ignores the process, thus lacking a understanding of students' comprehensive and real learning process. There are a large number of students in advanced mathematics courses, so it is not easy for traditional large-scale classes to know about the learning situation of each student in a timely manner. However, the online and offline blended teaching methods based on such platforms as *Mosotech* can timely and effectively collect the learning data of each student. The feedback from the learning process can promote continuous adjustments to teaching. The shortcomings of online learning can be corrected with offline group discussions and layered guidance. In general, the formative assessment plus the summative assessment can showcase students' learning pictures more comprehensively.

4.2 Shortcomings of"online & offline"blended teaching for advanced mathematics

4.2.1 The blended teaching system has yet to be improved

While the quantity of online teaching resources is increasing rapidly, how to ensure the systematization and high quality of teaching resources becomes an important issue currently. When deploying an online and offline blended course for advanced mathematics, the fit between online resources, on the one hand, and offline teaching schedules and the key and difficult points in teaching, on the other hand, becomes a key factor affecting the quality of teaching. Teachers are designers and decision-makers of teaching activities. In order to connect all teaching sections well, they have to consider many factors. The immature blended teaching system has brought huge pressure on teachers in their teaching preparation, and this is also an important factor affecting students' experience.

4.2.2 The blended teaching methods are heavily dependent on network technology and electronic equipment

Many tasks, such as pre-class preview, check-in and roll call, in-class interaction, in-class practice and after-class homework, all need to be delivered through the functions of network platforms. On the one hand, in the case of failures with communications and equipment, the online section of blended teaching cannot be carried out, and the expected teaching effect will be greatly compromised due to the influence of external factors. On the other hand, the advancement of learning tasks entails both teachers and students becoming fully familiar with the functions and applications of online platforms. However, such online platforms are mostly based on mobile phones and other devices, so this pattern raises higher requirements on students'self-control ability. Without good self-management, students will develop a bad habit of indulging in electronic products.

5. Some proposals on"online & offline" blended teaching of advanced mathematics

- Focus on the integration of online and offline teaching modes.
  Blended teaching is the integration of online and offline teaching. The rich teaching elements of online teaching must be combined with the face-to-face offline teaching, and the advantages of traditional offline teaching modes cannot be ignored.
- Build a professional subject team
  For the public courses like advanced mathematics, it is necessary to assemble the wisdom of teams in creating an innovative online and offline teaching mode, refining all teaching sections, and improving teaching evaluation system.
- Infuse ideological and political elements
  Morality cultivation is the fundamental task of education. It is necessary to make full use of online platforms, a critical resource carrier, to optimize teaching resources and incorporate ideological and political elements.
- Strengthen network security education
  Online education comes with new risks, so college students must have the necessary awareness of network security, so as to adapt to the new education mode in a better manner.

6.Conclusion

Under the background of the pandemic, and with the rapid development of 5G network technology, the learning channels of college students have been diversified. Among them, the "online + offline" blended teaching has

gained increasing popularity in colleges and universities. Teachers are required to constantly update educational ideas and master advanced teaching techniques. Students should establish proper network security awareness and improve self-learning abilities. Therefore, only with the joint efforts by both teachers and students, may the expected teaching effect be achieved.

References

[1] Song Fengquan, Tang Qiong & Sun Xiaoxia. (2022).Research and practice of blended teaching Mode Reform of College Physics Course, A Case study of Hefei University of Technology. *Heilongjiang Education (Higher Education Research and Evaluation*,07, 35-37.

[2] Guan Lihong & Zhu Tianxiao.(2021). Discussion on the blended teaching reform of Higher Mathematics Course in the era of "Internet +". *Journal of changchun university*,10,101-104.

[3] Zhu Xuemei & Lei Jie. (2018). Blended teaching: Teaching reform in the era of "Internet +" . *Digital Teaching of Primary and Secondary Schools*,4-7.

[4]AI Qing. (2022).The Application of *Mosotech* In Blended Teaching: A Case Study of English Reading and Writing Comprehensive Practical Course. *Journal of Sanmenxia Vocational and Technical College*,02,51-55.

[5] LI Na,LI Zheng,WANG Peng,LIU Jie & WANG Lei. (2022). Teaching Reform and Practice of Operating System Curriculum under the CONCEPT of OBE. *Software Guide*,07, 122-125.

[6] Wu Yanmin.(2021). Research on classroom Teaching reform of higher Mathematics. *Horizon of science and technology*, 29, 29 and 30, doi: 10.19694 / j.carol carroll nki issn2095-2457.2021.29.12.