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Paper Title: **Effect of Blended Learning with Micro-course on Mathematical Reasoning Ability of University Students**

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Sincerely

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**Paid Reference OK**

## **Effect of Blended Learning with Micro-course on Mathematical Reasoning Ability of University Students**

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### **Abstract**

**Background and Aims:** With the rapid development of contemporary information technology, the online and offline blended learning model relies on information technology and mobile Internet to realize the organic combination of online and offline classroom teaching, creating a broader autonomous learning space for students. The purpose of this research is to evaluate the impact of blended learning with a micro course approach on students' mathematical reasoning abilities and satisfaction.

**Methodology:** This study sample selected were 30 freshmen students majoring in natural sciences at a university in Hainan which was derived from a single cluster random sampling method. The research tools are (1) Course lesson plan, (2) Mathematical reasoning ability test paper, and (3) Student satisfaction questionnaire. Conduct pre-test and post-test on the sample using mathematical reasoning ability test papers, and analyze the mean, standard deviation, and single sample t-test of the data using SPSS.

**Result:** After using the blended learning micro course teaching method, students' mathematical reasoning abilities were achieved by 77%, surpassing the predetermined criteria of 70%, and the difference is statistically significant at 0.05. Based on the scores from the statistical student satisfaction questionnaire, the overall results of the blended learning with micro course method by students are at a high level.

**Conclusion:** The study confirms that blended learning with micro-courses significantly enhances mathematical reasoning abilities and meets the individual learning needs of students majoring in natural sciences.

**Keywords:** Blended Learning with Micro Course; Mathematics Reasoning Abilities; Students Majoring in Natural Sciences; Educational Technology; Student Satisfaction.

### **Introduction**

With the rapid development of contemporary information technology, it gradually penetrates various fields. People's lives cannot be separated from the network environment, and education technology is also gradually networked. As a result, the curriculum reform of China's higher education institutions will also be in full swing. China's education policy (the ten-year development plan of education informatization (2011-2020) pointed out that the development of education informatization should be led by innovative educational concepts, based on high-quality educational resource construction and informatization learning environment, methods, and patterns are centered, innovative learning methods. Applying blended learning with micro course mode to the teaching of Advanced mathematics in universities and the goal is to increase student's mathematical reasoning ability to 70%

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or more. It fully conforms to the development policy of education informatization. Education informatization will surely become an inevitable trend in the development of education information technology.

Wei & Dong (2023) Advanced mathematics course is an important basic course of mathematics education in applied technology undergraduate colleges and universities. It plays an important role in developing students' logical thinking ability, scientific problem-solving ability, and students' sustainable development ability. Because the southeast coastal region of China is economically developed, the development of network information technology is close to maturity, and almost all schools in the southeast region are equipped with new multimedia teaching equipment. Therefore, this study chose a university in Hainan Province, China, as the research object. Advanced mathematical courses have the highest failure rate of any basic course for college students, with a failure rate of more than 50%. In traditional teaching, teachers must teach students at a fixed time and place. Students lack visualization of mathematical knowledge. Teachers pay more attention to the input of knowledge and ignore the output of knowledge. Students lack spatial imaginative ability and mathematical reasoning ability. In addition, the PPT display can no longer give full play to the advantages of information technology in teaching. Due to the limited teaching time, teachers have less time for group activities. Students lose enthusiasm for learning mathematics. Liu & Zhang (2018) To adapt to the development of the information age and improve traditional teaching, the state promotes the construction of online learning platforms for Chinese universities. Zhang (2021) While online learning platforms brought a new learning experience to learners, it was found that some learners did not complete the task of listening to the course after completing the curriculum registration. The high registration rate and low completion rate of the curriculum caused a waste of resources. Compared with traditional teaching methods, online teaching methods have improved, but their side effects are also large. For example, students have difficulty learning status management, poor teacher-student interaction, and low course completion rates.

Therefore, online and offline blended learning modes are imperative. He, (2014) Professor He Kekang pointed out that blended learning is a teaching mode that combines the advantages of online teaching and face-to-face classroom teaching to improve students' learning effects. It is characterized by retaining the advantages of online and offline and trying to avoid the disadvantages of online and offline. As a result of the use of the platform's information technology tools, teachers save a lot of classroom teaching processes, post-class organizing, record-keeping, and statistical work, improve work efficiency, and concentrate on teaching course content. Students use the online teaching platform to improve the efficiency of note-taking and organizing classroom information and are better able to concentrate on course content.

This study adds the element of "micro-course" based on online and offline blended teaching, and proposes blended learning with a micro-course method.

Hu (2011) Micro course is also known as "micro-course", and its full name is "Micro video network course". According to the new curriculum standards and the actual teaching progress and situation of the classroom, the teacher will record the explanation or teaching task of a certain knowledge point, present it in the form of a short video, and integrate a new teaching mode of various learning resources (micro-video, micro-courseware, micro-evaluation, etc.). Micro-courses can be applied not only to before-class online platforms but also to offline face-to-face classroom teaching. Compared with the online part of the blended learning use of lecture videos, micro-courses are

characterized by being short, concise, focused, and diverse. If the micro course video is interspersed into the offline face-to-face classroom of blended learning, it will make offline teaching more flexible and interesting.

Therefore, the teaching philosophy of the "blended teaching method is dominated, micro-course is the means, teachers are guided, and students are the main body" teaching concepts. " Applicable to the teaching of advanced mathematics. The purpose is to improve the mathematical reasoning ability of college students majoring in natural sciences.

### **Research questions**

1. How is the mathematical reasoning ability of the students before and after learning through blended learning with micro-courses?
2. How is the students' mathematical reasoning ability after learning through blended learning with micro course compared with the determined criteria set at 70%?
3. What is the student's satisfaction with blended learning with micro-course independent after learning through blended learning with micro-course?

### **Research objectives**

1. To compare the mathematical reasoning ability of the students before and after learning through blended learning with micro-courses.
2. To compare the mathematical reasoning ability of the students after learning through blended learning with micro course with the determined criteria set at 70%.
3. To assess the student's satisfaction with blended learning with micro-courses.

### **Literature Review**

#### **1. Research on Blended learning**

The research on blended learning in Western countries started earlier. In the 1990s, the concept of blended learning emerged in relevant literature. After that, there was a small upsurge in research in related fields, with a significant increase in the number of literature. With the development of Internet information technology, blended teaching is becoming mature. Many scholars and scientific research financial institutions have made great contributions to the improvement and development of the blended learning management model theory.

Pan (2021) In 2011, Rastegarpour pointed out that this model is more scientific and more conducive to teaching effectiveness than every previous model. The development of a single teaching resource management model inevitably limits the scope of students' educational work plans or the transfer of key information technology expertise. In the blended learning model, students gain a richer learning experience through greater interaction, participation, and autonomy. As of 2013, 70% of American school leaders stated that they would add 40% of blended courses to existing professional courses for network engineering technicians and gradually expand their scope. The blended learning with micro-courses model has begun to be gradually applied to practical teaching in primary education. It has entered real-life classrooms in primary and secondary schools and has brought good results to students' independent learning. It will also bring good results to the reform of the curriculum standard system. One of its main advantages is flexibility and unconventionality. It can provide learners with such a free space to study independently for some time, away from the traditional daily classroom

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environment. Students can enjoy their learning and living experience wherever they like. This is interesting, especially for those with traditional educational backgrounds. This brought an opportunity to break out of the traditional "chalk conversation" learning environment and provide themselves with a new way of educating students.

Valiathan, (2002) Summary The three driving forms of the blended learning model are skill-driven, attitude-driven, and ability-driven. Professor Garrison from Canada applied the blended teaching model to higher education, It is divided into three categories: mixed teaching in small-scale classes, mixed teaching in large-scale classes, and mixed teaching in project-based development courses. Different teaching forms aim to improve the learning effect of students.

To sum up, in various studies on the blended learning model, researchers have implemented staged teaching based on a mixture of online and offline teaching, including in-class and extra-curricular, and also divided into Teachers' classroom teaching and students' independent learning. Regardless of the classification, it is believed that teachers and students can use online teaching resources in classroom teaching. When students conduct independent online learning outside class, they can also exchange information and communicate with teachers through online teaching platforms.

## 2. Research on micro course

As a medium for teaching assistance in the information age, micro-courses have put forward higher requirements for the education stage with the development of science and technology. Scholars at home and abroad have carried out research and innovation on it.

Wang (2021) In 1995, Napier University T. P. Kee proposed the One Minute Lecture (The One Minute Lecture), referred to as OML, which is the beginning of the application of micro-courses in teaching. Micro courses originated abroad and gradually developed in our country after continuous research by scholars.

Wang (2021) In November 2010, to encourage and promote the use of micro-courses, the Guangdong Foshan Education Bureau launched the first "excellent micro-course" collection and review activities. Hu Tiesheng, micro-courses are on the rise in China. Liao (2014) Also in 2011, teacher Li Yuping produced a small teaching and research video to show the research methods and results of the "Three Primary Schools", which was widely welcomed by teachers and was later called "micro-course". The development steps and approaches of the "micro-course" resource bank looked forward to the application prospect of "micro class" in education and teaching, which opened the prelude to the development of the micro course.

Zhu et al (2020) The school conducts teaching in the form of micro-courses through the network platform. Zhu Xiao and others put forward the basic principles of making micro-courses for Chinese online teaching. It can be seen that the concept of the micro course was put forward earlier, but the real research on its practice started later, but it is now in the development stage of research. Micro is generally used together with teaching methods, such as micro courses with flipped classroom teaching methods, micro-courses with project teaching methods, etc. This study uses micro courses with online and offline blended learning methods together.

In summary, foreign educational information technology has achieved some results in the research on blended learning with micro course models, which provides a valuable reference for future generations to further study the development of blended learning models through investigations for students. However, there are few studies on the application of blended learning models in advanced mathematics classroom teaching, and there are also few studies on the combination of blended learning with micro course models and advanced mathematics classroom teaching. The author attempts to apply

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the blended learning model to advanced mathematics teaching in universities to fill the gap in this field

### Research Conceptual Framework

Based on the content of this study, The Independent variable is learning management using with blended learning with micro-courses based on Constructivist theory and People-oriented learning theory (Yang et al, 2023). The dependent variables are Mathematical reasoning ability and Students' Satisfaction.

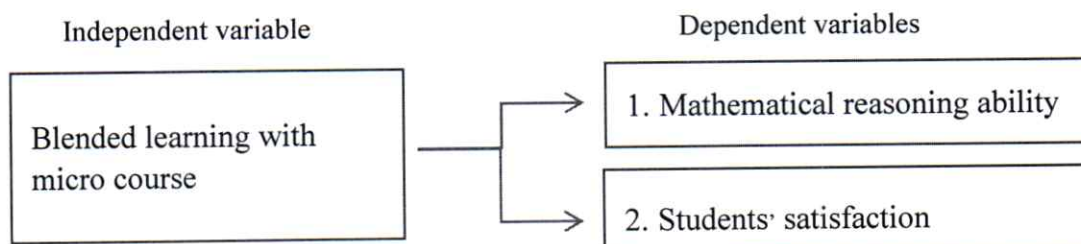


Figure 1: Research Conceptual Framework

### Research Methodology

#### 1. Population and sample

1.1 Due to the developed economy of the southeast coastal region of China, the development of network information technology is close to maturity, and almost all schools in the southeast region are equipped with new multimedia teaching equipment. These are the necessary factors needed for this study. Therefore, this study chose 180 freshmen students (6 classes) majoring in Economics and Management at Hainan Normal University in Hainan Province, China as the research object.

1.2 The sample selected in this study were 30 freshmen students (1 class) majoring in Economics and Management at Hainan Normal University, which used cluster random sampling.

#### 2. Research instruments

Research instruments were the tools for collecting data. The research instruments which were used in this study were:

##### 2.1 Instruments for measuring Students' Mathematics Reasoning Ability

Evaluate blended learning with the micro course. The researcher created the evaluation form of lesson plans.

2,1,1 An expert group composed of five experts evaluates the evaluation form. The experts were required to hold the title of professor or associate professor and have at least 10 years of research experience in the relevant field. The five experts include two experts in mathematics-related fields, two experts in education-related fields, and one expert in information engineering-related fields. After collecting data, analyze the collected data to determine the appropriateness and consistency of the lesson plans. If the average score of appropriateness and consistency assessed by a group of experts is higher than 3.51, it means that the components of the lesson plans have good appropriateness quality and internal consistency. After obtaining the expert evaluation results, the developed teaching model was revised and improved according to the expert's suggestions. The lesson plans to be assessed are specifically categorized into four areas, which are learning aspects (e.g. Learning objectives covered the learning behaviors in terms of knowledge, skills, and attitude), instructional strategies aspects (e.g.

The teaching method is consistent with the teaching objectives), instructional media aspects (e.g. Teaching methods include individual activities and group activities), and Assessment of teaching (e.g. Learning outcomes can be applied to the real-life situations)

2.1.2 It was found that the mean score of the learning aspects was at 4.47 and the standard deviation was at 0.78 which means the learning aspects of lesson plans had the quality at the high level. The instructional strategies aspects were at 4.68 and the standard deviation was at 0.62 which means the instructional strategies aspects of lesson plans had quality at a very high level. the instructional media aspects were at 4.40 and the standard deviation was at 0.63 which means the instructional media aspects of lesson plans had quality at a high level. The assessment of teaching aspects was at 4.65 and the standard deviation was at 0.59 which means the Assessment of teaching aspects of lesson plans had the quality at a very high level. The mean score for the appropriateness of the overall lesson plan was 4.57 and the standard deviation was 0.64 which means the lesson plans had quality at a very high level. Therefore, applying the lesson plans of blended learning with micro-courses to the teaching of students majoring in Economics and Management at Hainan Normal University can improve students' mathematics reasoning ability

## 2.2 Instruments for collecting data

An instrument for measuring: Test paper of Students' mathematics reasoning ability and satisfaction questionnaire.

### 2.2.1 Test paper of Students' mathematics reasoning ability

The Mathematical Reasoning Aptitude Test (MRAT) paper consists of 30 multiple-choice questions, each of which has four alternatives with one correct answer. These 30 questions are categorized into 7 topics. They are the following concept and properties of limit; computing and applications of limit; concept of derivative; properties of applications of derivative; finding first order derived function of simple functions; finding nth order derived function of simple functions and asymptote of function. The test of mathematical reasoning ability should include two factors: 1) the factor of the mathematical thinking process and 2) the factor of solving practical problems. Each factor shall consist of 15 questions each, distributed among seven topics.

The mathematical reasoning aptitude test paper assessment needs to test three aspects which are item discrimination, item difficulty, and item reliability. The formula is given in the table below

It was found that the Index of Item Objective Congruence (IOC) value of 30 items in the test paper was 0.80 at the lowest and 1.00 at the highest. The result of analyzing the IOC value showed that all test items were appropriate and could be used in the test. The test paper difficulty (p) was between (p=0.67-0.77), and item discriminability (r) should range from (r=0.36-1.00) and more than 0.20. The test paper reliability is 0.774 and more than 0.7 (Richardson, M. W., & Kuder, G. F., 1939: 681-687).

### 2.2.2 Satisfaction Questionnaire (5-point Likert scale)

The questionnaire is provided to five experts for content validity check and suggestions. The quality of the questionnaire is considered according to the Index of Item Objective Congruence (IOC) obtained from the achievement test evaluation form. The content of the student satisfaction questionnaire consisted of 13 questions, which were specifically divided into four areas, which are Students' satisfaction with the form of teaching (e.g. Satisfaction of whether the online and offline blended learning model of the advanced mathematics course has practical); Students' satisfaction with the content of the course (e.g. Satisfaction of whether the teaching content of the advanced mathematics course has practical); Students' satisfaction with teaching aids (e.g. Satisfaction with whether the combination of teaching resources and media of the advanced mathematics course has practical) and

Students' satisfaction with the results of the course (e.g. Satisfaction with the extent to which test scores in advanced math courses can be improved)

The result of analyzing the IOC index showed that the IOC of each item of the satisfaction questionnaire was between 0.80-1.00. And 13 items in the satisfaction questionnaire were appropriate and could be used in the satisfaction evaluation of the Adaptive learning system. The Cronbach's Alpha coefficient of the reliability of the student satisfaction questionnaire is 0.704, which is greater than 0.70 (Cronbach, 1951). This showed that the internal consistency of the student satisfaction questionnaire met the requirements.

### 3. Data collection

The procedures of data collection were as follows:

3.1. The samples were given the pretest by measuring mathematical reasoning ability with a mathematical reasoning ability test.

3.2. The samples were taught by using blended learning with a micro course. The overall experiment lasted for one month, which included teaching time (14 days), extracurricular time (14 days), and testing time (2 days). The teaching part was subdivided into 3 parts: before class, in class, and after class. The micro-course was used in all 3 parts. In the part before class, students studied independently on the web platform, mainly using the knowledge point explanation type micro course, which accounted for 100%, in the part in class, a small part of the knowledge point explanation type micro course was used, which accounted for 30%, and after class, students watched the exercises explanation type micro-course on the web platform according to the tasks assigned by the teacher, which accounted for 100%. According to the data statistics in the background of the web platform, teachers can count the attendance rate of students before and after class and the completion of homework after class.

3.3. After finishing the instruction, the samples received the post-test by using the same instrument that was used in the pretest.

3.4. The samples were given the students' satisfaction questionnaire.

### 4. Data analysis

In this study, data were analyzed by using the statistical program according to the research objectives:

4.1 This study data must meet the following requirements: Dependent variable that is continuous (i.e., interval or ratio scales) The paired measurements must be recorded in two separate variables. In related samples, the subjects in each sample are the same. This means that the subjects in the first group are also in the second group. Random sample of data from the population normal distribution (approximately) of the difference between the paired values no outliers in the difference between the two related groups. There are two hypotheses they are the null thesis  $H_0: \mu_{pretest} = \mu_{posttest}$  and the alternative hypothesis  $H_1: \mu_{pretest} < \mu_{posttest}$ . If the sample mean is equal to the population mean, the one-sample t-test can be expressed as  $H_0: \mu = X$ . If the sample mean is not equal to the population mean the one-sample t-test can be expressed as  $H_{01}: \mu \neq X$ .

4.2 Compare mathematical reasoning ability test scores before and after receiving blended learning with the micro course by using a t-test for the dependent sample.

4.3 Compare mathematical reasoning ability test scores with the determined criteria set at 70 percent by using a t-test for one sample.

4.4 Assess the student's satisfaction with blended learning with the micro course by using arithmetic mean and standard deviation.



## Results

The results were presented according to the research objectives as follows:

1. The result of comparing the mean score of students' mathematics reasoning ability before and after learning through blended learning with the micro course method.

The below table shows descriptive statistics and t-tests as analyzed by the statistical package program. This table aimed to answer the research objective about whether blended learning with the micro course method was able to enhance mathematics reasoning ability. Comparison of Mean Mathematics Reasoning Ability Scores Before and After Blended Learning with Micro Course Intervention.

Table 1 The result of comparing the mean score of mathematics reasoning ability before and after learning through blended learning with the micro course method.

Group	N	Pretest scores		Posttest scores		t	p
		M	S.D.	M	S.D.		
Experimental group	30	18.20	4.11	23.20	4.24	30.10*	0.000

\* $p < 0.05$

As presented in Table 1, the mean scores of the pretest of students' mathematics reasoning ability were ( $M=18.20$ ,  $S=4.11$ ) and the post-test of students' mathematics reasoning ability was ( $M=23.20$ ,  $SD=4.24$ ). The result of this table showed that after learning through using the blended learning with micro course method students' mathematics reasoning ability was higher than before at a .05 level of statistical significance ( $t_{29} = 30.10$ ,  $p=0.00 < .05$ ). The average scores of the study developed increasingly higher than pretest.

Table 2 The result of comparing the mean score of compare mathematics reasoning ability of students before and after learning through blended learning with the micro course method with the determined criterion set at 70 percent of full scores


Group	N	Full score	Criteria score	M	S.D.	t	p
Experimental group	30	30	21	23.20	4.24	2.84*	0.000

\* $p < 0.05$

As presented in Table 2, the mean scores of students' mathematics reasoning ability after learning through blended learning with the micro course method were 23.20 and the standard deviation was 4.24. which was statistically higher than the criterion of 70% at a .05 level of statistical significance ( $t_{29} = 2.84$ ,  $p=0.00 < .05$ ).

According to the research results, we can draw the following conclusions:

The average score and standard deviation of the students who adopted blended learning with micro course mode were 23.20 points (out of 30 points) and 4.24 points, which was higher than the standard of 70% at the level of statistical significance of 0.05. It can be seen that the math scores of the students who accept blended learning with the micro course model are higher than 70%.

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2. To assess the students' satisfaction with the blended learning with the micro course method.

The result of comparing the mean score of Satisfaction after learning through blended learning with the micro course method. The below table shows descriptive statistics and t-tests as analyzed by the statistical package program. This table aimed to answer the research objective about whether blended learning with the micro course method was able to enhance satisfaction

Table 3 Data analysis result of Students' satisfaction questionnaire

NO.	ITEM	M	S.D.	Level of appropriateness
<b>Students' satisfaction with the form of teaching</b>		<b>3.98</b>	<b>0.75</b>	<b>High</b>
1.	Satisfaction of whether the online and offline blended learning model of the advanced mathematics course is practical.	4.10	0.76	High
2.	Satisfaction of whether the Micro course assisted with the advanced mathematics course has practical.	3.83	0.75	High
3.	Satisfaction of whether the online and offline blended learning with micro course model improves interest in learning.	4.00	0.74	High
NO.	ITEM	M	S.D.	Level of appropriateness
<b>Students' satisfaction with the content of the course</b>		<b>4.03</b>	<b>0.78</b>	<b>High</b>
4.	Satisfaction of whether the teaching content of the advanced mathematics course is practical.	4.10	0.71	High
5.	Satisfaction of whether the teaching content of the advanced mathematics course is easy to understand.	4.03	0.89	High
6.	Satisfaction with whether the teaching content of the advanced mathematics course explains the teaching content clearly.	4.00	0.79	High
7.	Satisfaction with whether the teaching content of the advanced mathematics course can stimulate.	3.97	0.67	High
8.	Satisfaction with whether the teaching content of the advanced mathematics course is new.	4.03	0.85	High

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NO.	ITEM	M	S.D.	Level of appropriateness
<b>Students' satisfaction with teaching aids</b>		<b>4.09</b>	<b>0.80</b>	<b>High</b>
9.	Satisfaction with whether the combination of teaching resources and media of the advanced mathematics course is practical.	4.03	0.81	High
10.	Satisfaction with whether the combination of teaching resources and media improves students' interest in learning advanced math.	3.93	0.83	High
11.	Satisfaction with whether the combination of teaching resources and media of the advanced mathematics course is new.	4.30	0.75	High
<b>Students' satisfaction with the results of the course</b>		<b>4.09</b>	<b>0.77</b>	<b>High</b>
12.	Satisfaction with the extent to which test scores in advanced math courses can be improved.	4.10	0.80	High
13.	Satisfaction with the extent to which mathematics reasoning ability in advanced math courses can be improved.	4.07	0.74	High
<b>Overall Total</b>		<b>4.04</b>	<b>0.78</b>	<b>High</b>

Based on the results, we can state the following:

As shown in Table 3, the overall results of the blended learning with micro course method by experts are at a high level with (M=4.04, S.D. = 0.78). Thus, it was concluded that students' satisfaction with the blended learning with the micro course method was high.

### Discussion

1. Blended learning with the micro course method can improve students' mathematics reasoning ability. This may be because the blended learning with the micro course method is based on the instructions of the steps. Before class, students watch the teacher's pre-recorded teaching micro-course to complete the tasks assigned by the teacher, and the teacher organizes the students' questions after watching the micro video. In class, the teacher explains the students' pre-class questions, explains the new lesson in detail, and assigns group discussion tasks, students discuss in depth in small groups, and after presenting their views, the teacher comments and summarizes the lesson. After class, the teacher combines the students' mastery level with some of the knowledge points for extension. So mathematics reasoning ability is going to be higher than before.

2. Using the blended learning with micro course method results in an average score of 70 percent higher than the established criteria for previous mathematics reasoning ability test scores. This may be because pre-class pre-study content and post-class knowledge development content are learned outside the classroom by the e-learning platform students independently, and in the classroom teachers and students carry out high-quality learning activities to allow students to learn in specific contexts. This includes student-directed learning, independent problem-solving, and inquiry-based activities. Students will be able to better understand what they are learning by discussing in groups and sharing different opinions in the classroom. So this will be higher than the standard of 70%.

3. Blended learning with the micro course method improves students' satisfaction with advanced mathematics courses. The reasons may be related to the following aspects: 1) Students' satisfaction with the form of teaching was at a high level. Blended learning with micro course teaching method is more flexible and interesting than the traditional teaching mode, which is conducive to increasing students' intrinsic interest and making the learning process more entertaining. 2) Students' satisfaction with the content of the course was at a high level. The content of the course "Advanced Mathematics" is practical. 3) Students' satisfaction with teaching aids was at a high level. The teaching aids have also added some other multimedia teaching tools, such as micro-video, e-learning platforms, and so on. 4) Students' satisfaction with the results of the course was at a high level. After learning to teach the advanced mathematics course through blended learning with micro course teaching, the students' post-test scores were significantly higher than the pre-test scores of mathematical reasoning ability.

## Conclusion

Through comparative analysis of the students using blended learning with micro course pretest and post-test, after the intervention of blended learning with the micro course, the impact of the blended learning with micro-course on students' mathematics reasoning ability is obtained. The conclusion is as follows:

1) Mathematics reasoning ability test scores of the students after using blended learning with the micro course were higher than before at a statistically significant level of 0.05.

2) The mathematics reasoning ability test scores of the students after using blended learning with the micro course were higher than the standard of 70% at the 0.05 statistical significance level ( $M=21.03$ ,  $S.D.=5.06$ ).

3) In this study, the satisfaction of teaching and blended learning with the micro course method approach was assessed using SPSS software. The results indicate that student satisfaction is high level ( $M=4.04$ ,  $S.D.=0.78$ ) of blended learning with the micro course method.

Therefore, blended learning with the micro course method was feasible in advanced mathematics teaching, which helped to improve students' mathematics reasoning ability. The experimental results verified the research hypothesis.

The classroom practice of blended learning with the micro course method improves students' independent learning ability and meets their individual learning needs. It helps to improve students' mathematical reasoning ability.

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## Recommendation

### Recommendation for implication

Based on the findings from the study, the following recommendations are made:

1) Teachers need to strengthen the knowledge reserve to make micro course videos, teachers should have the ability to select and produce excellent teaching micro course videos, micro videos must be short, with vivid voice and humorous language, and it is best to record them in cooperation with other teachers, to attract the attention of the students, the content of the video should be focused and structured, which is conducive to students' systematic learning.

2) In teaching, blended learning with the micro course method takes students as the main body and teachers as the lead to complete the teaching organization. Although the teacher is the guide, the teacher cannot leave the students alone, because the teacher guides the students to learn actively, so the students become the subject of learning.

3) Teachers should also guide students to actively learn the content of this lesson, and always keep supervision and guidance so that students will not deviate from the topic during the learning process.

4) Increase educational technology-related content in classroom teaching. Let students majoring in natural sciences be familiar with the operation of various commonly used teaching equipment so that they can use educational technology to optimize the teaching process and promote the reform of education and teaching.

5) Blended learning with the micro course method can effectively improve students' mathematical reasoning ability in the actual classroom teaching process. Therefore, if conditions permit, Blended learning with the micro course method should be prioritized in the classroom.

### Recommendation for further research

With the rapid development of contemporary information technology, blended learning with micro-course methods in the field of education is becoming increasingly widespread. In the future, there are several research prospects in the following areas:

1) The practice time of blended learning with the micro course method is relatively short and the number of classroom experiments is limited. Teachers also need to use blended learning with micro-course methods to conduct more effective empirical research in the classroom for a long period.

2) All of the students are from one Hainan provincial university. One school cannot represent all ordinary colleges and universities, so blended learning with micro course methods still needs to be verified in more ordinary colleges and universities, to make the experimental results more convincing.

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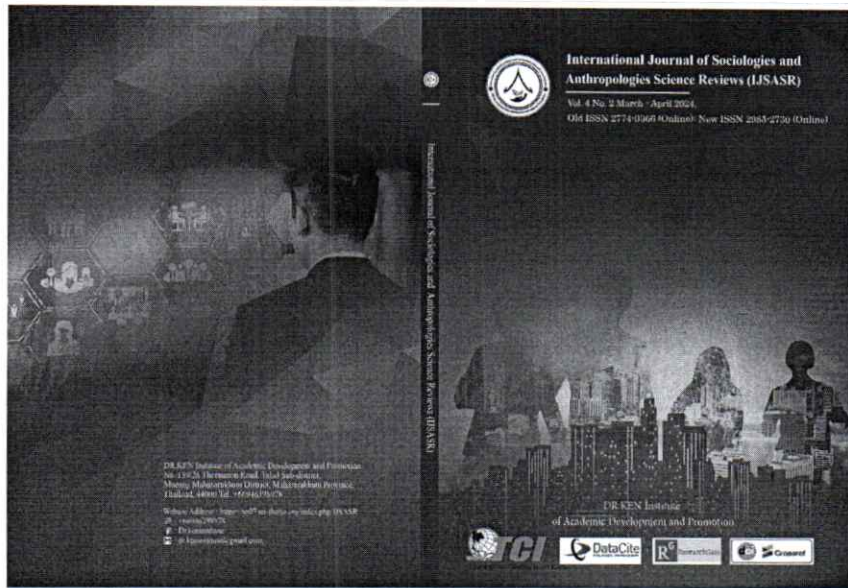
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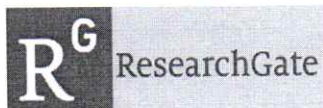


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