THE EFFECT OF AIDED-STUDY CLASSTEACHING MODE ON MATHEMATICS ACHIEVEMENT OF GRADE 4 STUDENTS IN PRIMARY SCHOOLS

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A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS
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ผลของวิธีสอนแบบช่วยเหลือกันในชั้นเรียน ที่มีต่อผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ของนักเรียนชั้นประถมศึกษาปีที่ 4 ในโรงเรียนประถมศึกษา

Zhang Ancheng

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตร

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บทคัดย่อ

การวิจัยนี้เป็นการวิจัยทดลองเบื้องต้น มีวัตถุประสงค์เพื่อ 1) เปรียบเทียบผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ของนักเรียนชั้นประถมศึกษาปีที่ 4 ก่อนและหลังการใช้วิธีสอนแบบช่วยเหลือกันในชั้นเรียน และ 2) เปรียบเทียบผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ของนักเรียนชั้นประถมศึกษาปีที่ 4 หลังจากใช้วิธีสอนแบบช่วยเหลือกันในชั้นเรียน กับเกณฑ์ร้อยละ 70 ของคะแนนเต็ม กลุ่มตัวอย่างที่ใช้ ได้แก่ นักเรียนชั้นประถมศึกษาปีที่ 4 จำนวน 30 คน จากโรงเรียนไบยี่ เมืองโจวโข่ว มณฑล เหอหนาน ประเทศสาธารณรัฐประชาชนจีน ภาคเรียนที่ 2 ปีการศึกษา 2564 โดยการสุ่มตัวอย่างแบบกลุ่ม เครื่องมือที่ใช้ในการวิจัย ได้แก่ 1) แผนการสอนโดยใช้วิธีสอนแบบช่วยเหลือกันในชั้นเรียน จำนวน 5 แผน 10 ชั่วโมง เรื่อง ทศนิยม เศษส่วน ค่าเฉลี่ย สี่เหลี่ยมด้านขนาน มีความเหมาะสมในระดับมากที่สุด 2) แบบทดสอบวัดผลสัมฤทธิ์ทางการเรียน มีความเชื่อมั่นเท่ากับ 0.71 สถิติที่ใช้ในการวิเคราะห์ข้อมูล ได้แก่ ค่าเฉลี่ย ค่าเบี่ยงเบนมาตรฐาน และการทดสอบแบบค่าทีกลุ่มเดียว

ผลการวิจัยพบว่า 1) ผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ของนักเรียนชั้นประถมศึกษาปีที่ 4 หลังใช้วิธีสอนแบบช่วยเหลือกันในชั้นเรียน สูงกว่าก่อนเรียนอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 และ 2) ผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ของนักเรียนชั้นประถมศึกษาปีที่ 4 หลังจากใช้วิธีสอนแบบช่วยเหลือกันในชั้นเรียนสูงกว่าเกณฑ์ร้อยละ 70 ของคะแนนเต็ม อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 ($\bar{X}$= 35.43, S.D. =2.62 จากคะแนนเต็ม 40 คะแนน)

องค์ความรู้ที่ได้จากการวิจัยในครั้งนี้ คือ ขั้นตอนการสอนของวิธีสอนแบบช่วยเหลือกันในชั้นเรียน ซึ่งมีการจัดการเรียนการสอน 3 ขั้นตอน ได้แก่ 1) ขั้นนักเรียนช่วยเหลือตนเอง นักเรียนในแต่ละคนเรียนรู้อย่างอิสระจากงานที่ได้รับมอบหมายจากครู 2) ขั้นนักเรียนช่วยเหลือซึ่งกันและกัน เป็นการเรียนรู้แบบร่วมมือ ร่วมกันคิดแก้ปัญหาจากสถานการณ์หรืองาน และ 3) ขั้นได้รับความช่วยเหลือจากครูซึ่งครูจะช่วยให้นักเรียนในแต่ละคนปรับปรุงงานของตนเอง วิธีสอนนี้เป็นแนวทางในการจัดการเรียนรู้ เพื่อยกระดับผลสัมฤทธิ์ทางการเรียนในระดับประถมศึกษาอย่างมีประสิทธิภาพ

คำสำคัญ : วิธีสอนแบบช่วยเหลือกันในชั้นเรียน คณิตศาสตร์ในชั้นประถมศึกษา ผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์

Zhang Ancheng. (2022). The Effects of Aided-study Class Teaching Method towards Mathematics Achievement of Grade 4 Students in Primary Schools. Master of Education (Curriculum and Instruction). Advisors: Assoc. Prof. Dr. Suwana Juithong, Dr.Phithack Nilnopkoon

ABSTRACT

The objectives of the current quasi-experimental research were to; 1) compare the mathematics achievement of grade 4 students before and after implementing Aided-study Class Teaching Method, as well as 2) compare the mathematics achievement of grade 4 students after implementing Aided-study Class Teaching Method based on criterion-referenced at 70%. The research sample was 30 grade-4 students from a primary school, academic year 2-2564, in Bayi Road, Zhoukou City, Henan Province, Republic of China. They were selected by cluster random sampling. The research instruments were, 1) five lesson plans using Aided-study Class Teaching Method on the topics of decimals, fraction, average number, parallelogram with the highest level of suitability, 2) an achievement test with the reliability of 0.71. The statistics used to analyze data were mean, standard deviation, and t-test.

The results of the research were as follows: 1) Mathematics achievement of grade 4 students after implementing Aided-study Class Teaching Method was higher at the statistically significant level of 0.05. In addition, 2) the mathematics achievement of grade-4 students after implementing Aided-study Class Teaching Method was higher than the standard of 70% at the 0.05 statistical significance level ($\bar{x}$= 35.43, S.D. = 2.62 from total 40 scores).

The explicit knowledge gained from the research were discovered as follow: the Aided-study Class Teaching Method was composed of three steps: 1) The student self-help step: Each student learns independently from the tasks assigned by the teacher. 2) Students help each other through collaborative learning in which each group consisted of high-achieving, middle-achieving and low-achieving students, helping each other to solve problems from a situation or task. Moreover, 3) to get help from the teacher: The teacher helps each student to improve their own works. This teaching method can be used as a guideline for learning management to improve learning achievement of mathematics in the elementary level effectively.

Keywords: Aided-study Class Teaching Method, Mathematics in Primary School, Mathematics Achievement

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Zhang Ancheng

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1
INTRODUCTION

1.1 Background introduction

For primary education, Chinese Ministry of Education has issued a guidance document titled "Mathematics Curriculum Standards for Primary Schools", which suggests that "the educational work on the mathematics curriculum, while committed to achieving the training objectives of the compulsory education stage, should be oriented to all students". In 2020, the government of Henan Province issued the "Implementing Opinions on Deepening Education Teaching Reform and Comprehensively Improving the Quality of Compulsory Education", which proposed to "optimize teaching methods and teaching links, focus on inspiring, interactive and inquiry-based teaching, emphasize contextual teaching, and promote research-based, project-based and cooperative learning. (www.henan.gov.cn)Therefore, on how to achieve good mathematics education for all, everyone can get in the field of mathematics to adapt to the development of their own abilities, become the goal of educators continue to explore.

Since the middle of the 20th century, the rapid development of modern information technology has greatly advanced the development of applied mathematics and mathematical applications, making mathematics penetrate into almost every scientific field and every aspect of people's lives. For example, the invention and continuous updating of computers. On the one hand, it depends on the need for the development of mathematics. On the other hand, it reflects the wide application of mathematical knowledge. This great invention has not only promoted the development of various scientific fields. And has a huge impact on people's lives. The deep development of natural science is more and more dependent on mathematics, while social science and humanities are also more and more resorting to mathematical knowledge and its methods of thought. Mathematical knowledge not only solves some problems in these disciplines, but also strongly promotes the development of these disciplines.

Mathematics as the language of science, as an important tool to promote the forward development of science. It has an irreplaceable role in the history of human development, and will play a greater role in the future development of society. Learning mathematics, students cannot just stop at the level of mastering knowledge. Rather, they must learn to apply it. Only in this way can the mathematics learned be vital and the value of mathematics be truly realized, which requires that we must pay attention to the development of mathematics education.

And primary school mathematics as a key starting stage of mathematics learning, the introductory learning of addition, subtraction, multiplication and division will have a profound impact on students' further learning in the future. As an primary

school teacher, in my daily teaching, I am deeply aware of some current unscientific and unreasonable teaching status and have been reflecting on the current confusion and problems faced in primary school mathematics education and teaching, trying to find an effective way to solve the problem. In the process of teaching, I found that the current primary school teaching mainly exists in the following aspects.

1. Ignoring the main position of students in teaching

The new curriculum is more concerned about the main position of students in classroom teaching, but in primary school mathematics classroom teaching activities, there are still many teachers using a single "indoctrination" teaching method to guide primary school students to learn mathematical knowledge. This single teaching guidance cannot meet the cognitive characteristics of primary school students, primary school students generally have a poor quality of learning mathematics course, is not conducive to the in-depth learning of mathematical knowledge of primary school students. (Cen Rongying,2018)

2. Neglecting the cultivation of students' interest in mathematics

Interest is the best teacher, in primary school mathematics classroom teaching activities, teachers need to base on the personality characteristics of primary school students to carry out teaching design, through a rich variety of classroom teaching activities, primary school students quickly brought into the mathematics classroom learning activities, feel the fun of mathematics learning, the formation of good independent learning ability in mathematics. However, many teachers currently ignore the cultivation of students' interest in mathematics, the classroom teaching atmosphere is relatively boring, classroom learning activities are often shrouded in a depressing atmosphere. (Cen Rongying, 2018)

3. Ignoring the effective interaction of classroom teaching

Under the background of the new curriculum, teachers need to pay attention to the effective interaction of classroom teaching, to create a good communication platform for primary school students, so that every primary school student can actively express, actively create, and pay attention to the cultivation of primary school students' comprehensive learning ability. However, many teachers currently ignore the value of effective interaction in classroom teaching. In classroom teaching activities, they only instruct primary school students to learn knowledge and memorize knowledge silently, but ignore the important influence of teaching interaction on primary school students' learning of mathematical knowledge, which has a certain hindering effect on the development of primary school students' multiple intelligences. (Cen Rongying, 2018)

These problems have led to students' low motivation and initiative in learning, poor learning results and poor performance. Therefore, I think the mathematics classroom should focus on the cultivation of students' mathematical literacy and on the cultivation of creative consciousness and practical ability. Therefore, we introduce the " aided-study class teaching model" in our classroom to

ignite primary school students' interest in learning mathematics and improve their mathematical achievement.

The "aided-study class" promotes "research before teaching". In China, there are also some experiments of "study before teaching", "micro-lessons" and "flipped classroom", but the results are not satisfactory. What we usually see as "learning before teaching" means that teachers give teaching objectives after the class starts, and then supplement them with materials such as "pre-reading questions" for students to "learn first" in class, and to a certain extent, this achieves the purpose of making students learn on their own. However, we found that the breadth and depth of learning was limited by the time and space available for learning. In addition, learning resources cannot be fully utilized and the freedom of learning is not enough, resulting in more acceptance than innovation, low learning efficiency and low learning quality. The "micro-lesson" is a pre-course learning, but the learning mode is receptive, so it does not achieve the expected effect. (Zhong Guangqun, 2014)

Innovations in this teaching method

Unlike the above practice, we moved the "research" activity to the pre-class, and unlike traditional teaching, we eliminated some of the homework assignments and developed a self-learning strategy of "one exploration, two studies, and three doubts" to accompany it. One "exploration" is to avoid the simple practice of equating self-study with reading a book or watching a video, which turns students' pre-study into passive acceptance or simple imitation. Therefore, we usually arrange a difficult problem for students to think about first, and then arrange activities such as reading, operating, experimenting, and collecting information if they cannot understand, so that students can explore learning throughout the pre-study process. The "learning" that follows is the action that follows the exploration, and each individual proceeds according to their own exploration. Learning at this point may be a further "determination" after "exploration" or a "recharge" after "exploring the impossible." In short, learning after students' independent inquiry is not optional, but some kind of learning with the desire to inquire and accompanied by psychological expectations." Doubt" is a reflection of deep learning, reflection, questioning, and inquiry after learning, and the depth of doubt reflects the depth of pre-reading and thinking. Students come to school with their questions, which in turn energizes subsequent learning.

The structure of the classroom is different when students work independently first. The " aided-study class " is also "flipped" in that it allows students to present their ideas while the teacher "teaches by learning" and provides the necessary guidance and assistance. In the classroom, students are first presented with their ideas (in a deliberate sequence from simple to complex, general to advanced) and then guided to evaluate and optimize their findings. The teacher moderately withdraws and hands over the podium to the students, who express their ideas boldly in front of them like little teachers, while other children evaluate, add to, and correct

them, and students on and off the stage focus on the problem, engaging in intense communication and debate.

For these reasons, and by comparing the two teaching modes of the traditional classroom and the learning support classroom, we can see that in the traditional classroom, the teacher is the transmitter of knowledge, the supervisor and manager of classroom learning, and the students can only passively receive knowledge; In the aided-study class, the teacher plays the role of the guide and facilitator of student learning in the classroom teaching activities, and the students become the main role of learning in the classroom. classroom activities, teachers play the role of instructors and facilitators of students' learning, while students become the main actors of learning in the classroom, and the classroom is no longer completely mastered by teachers, who have to organize teaching and learning activities around all students in the classroom." (Pu Desuo, 2015) According to previous educators' research on the two classroom teaching models, the " aided-study class teaching mode " does have more obvious features and advantages compared with the traditional classroom teaching model, but there are also unsatisfactory aspects that need to be continuously improved.

In this paper, we explore the advantages and shortcomings of the two teaching modes through our own mathematics teaching activities, and hope to explore the effects of the aided-study class teaching mode in a local context, such as in a classroom setting.

1.2 Research questions

1.2.1 How does the mathematics achievement of the students before and after receiving Aided-study class teaching mode?

1.2.2 How does the students' mathematics achievement comparing with the determined criteria set at 70%?

1.3 Research objectives

1.3.1 To compare mathematics achievement of the students before and after receiving Aided-study class teaching mode.

1.3.2 To compare mathematics achievement of students after receiving Aided-study class teaching mode with the determined criteria set at 70 % of the full marks.

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1.4 Research hypotheses

1.4.1 Mathematics achievement of Grade 4 students after receiving aided-study class teaching mode is higher than before.

1.4.2 The mathematics achievement of the Grade 4 students who received

aided-study class teaching mode is higher than 70%.

1.5 Delimitation of study

1.5.1 Population and Sample

The population of this study was 230 students (4 classes) in the Grade 4 of primary schools in Bayi Road, Zhoukou City, Henan Province.

The sample for this study was 30 students derived from cluster sampling.

1.5.2 Variables

The independent variable was aided-study class teaching mode.

The dependent variable was mathematics achievement.

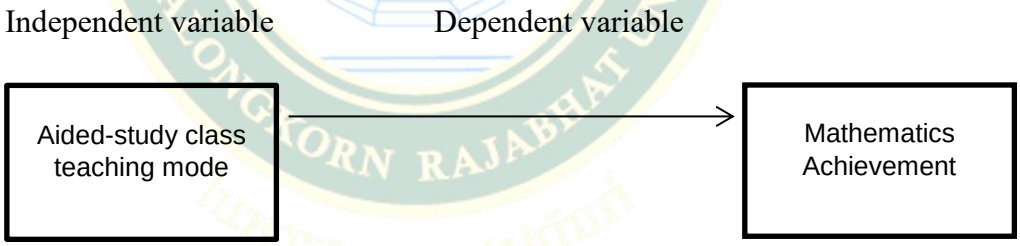
1.5.3 Area of Content

Content: Fourth grade mathematics, including decimals, fraction, Law of operation, average number, parallelogram.

The experiment took 5 weeks, 2 lessons per week, 90 minutes per lesson.

Duration: 1 month, September to October 2021.

1.6 Conceptual framework



1.7 Operational definition

1.7.1 Independent variable: Aided-study class teaching mode

Aided-study class teaching mode operational definition:

Aided-study class is a kind of classroom teaching mode that helps students learn, It can be understood as both a philosophy and a method of teaching. As a concept, it aims to emphasize that learning is essentially a student's own business and is irreplaceable, and that the role of teaching is to help, facilitate, and stimulate this behavior. As a teaching method, the classroom emphasizes the "three helps" (three steps):

Step 1: self-help, advocating research before teaching (Students learn independently through tasks assigned by teachers), under the guidance of help sheets to continuously improve students' independent learning ability;

Step 2: mutual assistance (cooperative learning), setting appropriate task-driven situations, allowing students to fully demonstrate through questions, supplementation, questioning, debates and other forms, the independent inquiry and group cooperation, peer exchanges and other forms of mutual aid learning can be implemented;

Step 3: teacher assistance (the teacher helps students improve according to their learning situation), the teacher changes the traditional method of all-inclusive teaching, based on learning to teach, on the basis of the correct diagnosis of the learning situation, delete the complicated and simplify, reasonable force, the implementation of targeted teaching and learning to match the needs of students. We will also make time and effort to develop students' higher-order thinking skills and put into practice their innovative spirit and practical skills. Specifically, the order of traditional "teaching" and "learning" is reversed. The teacher will set up appropriate questions (help sheets) to let students explore first, and then let them show their learning results, discuss, question, and collaborate in the classroom, and then determine what to teach and how to teach after students' "different ideas" have fully stirred and collided in the classroom. (Zhong Guangqun, 2014)

1.7.2 Dependent variable: Mathematics Achievement

Mathematics Achievement operational definition:

Students’ mathematical achievements refer to results of a test (Multiple choice tests with 4 alternatives) constructed by the researcher which included calculations (addition, subtraction, multiplication and division of fractions) .

1.7.3 Criteria set at 70 % refers to the average score required by school cluster.

1.8 Significance of this study

1.8.1 This research provides the educational innovation quality.

1.8.2 Teacher can apply this innovation for helping students in learning in the classroom effectively.

1.8.3 This study provides practical guidance for mathematics teachers in basic education, to provide a guiding framework for front-line mathematics teachers to improve the effectiveness of classroom implementation.

CHAPTER 2
REVIEW OF LITERATURE

The literature review in this study is related to aided-study class teaching mode on mathematics achievement, target group: 230 students in the grade 4 of the in Bayi Road, Zhoukou city, Henan Province.

2.1. Basic information

The literature review of this study is to discuss the effect of aided-study class teaching mode on mathematics achievement of Grade 4 students in primary schools. The research site is located in Chuanhui District, Zhoukou City, Henan Province.

This chapter covers the following topics:

2.1.1 Course Information

Primary school mathematics as a key starting stage of mathematics learning, the introductory learning of addition, subtraction, multiplication and division will have a profound impact on students' further learning in the future. In teaching, our school uses the eleventh set of primary and secondary school textbooks published by the People's Education Publishing House, which is based on the Compulsory Education Mathematics Curriculum Standards (2011 Edition), and is formed after a comprehensive and systematic revision that incorporates the comments and suggestions made by teachers, students and the community on the textbooks over the past decade or so. The course I teach is the Grade 4 of primary school mathematics, which includes: the meaning and properties of decimals, addition and subtraction of decimals, the four operations, the laws of operations, triangles, the motion of figures, observing objects, averages and bar graphs, mathematics wide angle and integrated and practical activities. The meaning and properties of decimals, addition and subtraction of decimals, the laws of operations, and triangles are the focus of this textbook. (Zhong Guangqun, 2013)

2.1.2 School Information

The study will be conducted in Bayi Road Primary School in Zhoukou City, Henan Province, which was established in 1981 and covers an area of more than 20 acres, with 18 classes, 1480 students, 43 teachers, 14 senior primary school teachers, and 28 primary school teachers.

2.1.3 Student Information

The sample for this study was 30 students derived from the grade 4 of in Bayi Road, Zhoukou City. In this class, many children don’t like learning or hate learning. They feel that the teacher speak too much, they are not taken seriously, they are forced to learn, and they regard learning as an additional burden. Therefore, I want to introduce aided-study class teaching mode for teaching to help students increase their interest in learning and their ability to learn independently, so as to improve their mathematics achievement.

2.2 Independent variable: Aided-study class teaching mode

2.2.1 Principle, Theory of aided-study teaching mode

The implementation of aided-study class has changed the traditional teaching mode. It is no longer for the teacher to explain everything clearly, and then let the students do the exercises. It is to give full play to the subjectivity of students, let students try first, explore first, and then exchange learning results, and debug, correct and improve with the help of teachers and students, students and students. It can be summarized into three sentences: "research first, then teach, learn more and teach less, and teach by learning", to carry out boosting teaching.

The idea of aided-study class has been put forward in ancient my country. Confucius, an ancient Chinese educator, said that when students think positively about a certain problem, but have not fully figured it out, they will be inspired; when students have gained some thoughts on a certain problem, but it is not very clear. Another ancient Chinese educator, Mencius, famously said that although I am slow, I hope to explore it myself. He advocated that "teaching" should not be regarded as the beginning of teaching, but should be taught first and then taught. Song dynasty educator Zhu Xi also believed that learning is the student's own business, and teachers cannot replace it. He said: "Reading is to study at home. To learn is to study at home. If you don't do other people's frontline work, others can't help yourself." In modern times, educators have paid more attention to students' self-study and advocated that learning should start from problems. (Zhong Guangqun, 2014)

Western philosophers, from Plato, Comenius to Dewey and Bruner, all emphasize the student-oriented, let students learn first, learn by doing, try, explore, and discover by themselves.

It can be seen that from ancient times to the present, from the East to the West, there are many ideas and theories in the teaching aid classroom. From the scientific theory, there are mainly the following aspects.

1. Philosophical basis

The aided classroom is based on the philosophical basis of scientific dialectical materialist epistemology. The process of boosting students' learning reflects the process of "practice-knowledge-re-practice". The process of student assistance is a process that encourages students to explore independently and learn cooperatively. Independent inquiry and cooperative learning are both practical and cognitive activities, so that practice and knowledge are skillfully combined and unified. In the teaching process, letting students explore first is of practical significance to students and reflects the idea of practice first. The traditional teaching only emphasizes the teacher's teaching, but ignores the students' personal practice.

2. The basis of teaching theory

Modern pedagogical thinking is the basis of pedagogical theory in the teaching-aided classroom, which is embodied as one core, two perspectives, and three main aspects.

(1) One core

Highlight the core of "student-based learning". Education must be established on the basis of respecting and trusting students, fully believing that students' potential is huge and the space for thinking development is vast. That is, I believe that students love learning, that students are happy to explore, that students will cooperate, that students are good at reflection, and that students can create.

(2) Two perspectives

Disciplinary perspective and children's perspective. With the subject perspective, we can determine what to learn; with the children's perspective, we can determine how to learn; combining the two, we can further determine how to evaluate. Mathematics has its own regulations, and textbooks have their layout rules. Only with a subject perspective can we tap the unique resources of mathematics and develop students' mathematics competence. Of course, primary school mathematics is children's mathematics, and we have to have a children's perspective. Pay attention to how children learn mathematics, pay attention to where children learn mathematics, and pay attention to what kind of help children need us. In this way, mathematics teaching really starts from children.

(3) Three main features

Student-oriented: Give full play to the main role of students, let students observe more, think more, guess more, experiment more, explain more, verify more, and fully mobilize the initiative and enthusiasm of students in learning.

Self-study-oriented: Use the "study aid sheet" to guide students to consciously, diversify and in-depth explore new knowledge, and whether the "study aid questions" can be completed with high quality is a sign of testing the results of students' self-study.

Cooperation-oriented: attach importance to the display, communication and communication between peers, and encourage students to carry out generative cooperative learning. The so-called generative cooperative learning refers to the cooperation between students and students. It is necessary to embed doubts, rebuttals, and arguments into the cooperation of students, so that their views can collide with each other and stir each other, so as to continuously arouse the waves of innovation in order to be generated from the preset. (Zhong Guangqun, 2017)

3.The basis of psychology

Many people think this is a strange thing: if the teacher does not teach, the students will complete the "study aids" themselves. In fact, the mystery lies in the full use of the "recent development zone" theory and the constructivist theory of "learning and teaching" in the teaching aid classroom.

(1) "Zone of Nearest Development" theory

The Soviet educational psychologist Vygotsky's "recent development zone" theory provides a psychological basis for aided-study class teaching mode. Aided-study class teaching mode emphasizes that under the guidance of the "help study task

list", students first explore themselves, which is the creation of a recent development zone for students. Vygotsky's theory strongly proves that students' inquiry activities are not only necessary but also possible. Precisely because students have two levels of development (the current level of development and the potential level of development), and these two levels and mutual transformation, students' advance exploration activities can be successful.

(2) Constructivist theory of "learning and teaching"

The constructivist theory of "learning and teaching" emphasizes student-centeredness, requiring students to transform from passive recipients of external stimuli to the main body of information processing and active constructors of the meaning of knowledge; requiring teachers to transform from imparters and indoctrinators of knowledge Helper and facilitator of students' active meaning construction. This requires us to break out of the shackles of traditional classroom design and redesign our classrooms to create a classroom learning environment that includes context, collaboration, communication, and meaning construction, so that learners can rely on the help of others, such as people and people. Collaboration, communication, use of necessary information, etc., gain new cognition through meaning construction. (Zhong Guangqun, 2014)

2.2.2 Definition of the Aided-study teaching mode

Aided-study class is a kind of classroom teaching mode that helps students learn, It can be understood as both a philosophy and a method. As a concept, it aims to emphasize that learning is essentially a student's own business and is irreplaceable, and that the role of teaching is to help, facilitate, and stimulate this behavior. As a teaching method, the classroom emphasizes the "three helps" (three steps): step1, self-help, advocating research before teaching (Students learn independently through tasks assigned by teachers), under the guidance of help sheets to continuously improve students' independent learning ability; step2, mutual assistance (cooperative learning), setting appropriate task-driven situations, allowing students to fully demonstrate Through questions, supplementation, questioning, debates and other forms, the independent inquiry and group cooperation, peer exchanges and other forms of mutual aid learning can be implemented; step3, teacher assistance (the teacher helps students improve according to their learning situation), the teacher changes the traditional method of all-inclusive teaching, based on learning to teach, on the basis of the correct diagnosis of the learning situation, delete the complicated and simplify, reasonable force, the implementation of targeted teaching and learning to match the needs of students. We will also make time and effort to develop students' higher-order thinking skills and put into practice their innovative spirit and practical skills. Specifically, the order of traditional "teaching" and "learning" is reversed. The teacher will set up appropriate questions (help study task list) to let students explore first, and then let them show their learning results, discuss, question, and collaborate in the classroom, and then determine what to teach and how to teach after students'

"different ideas" have fully stirred and collided in the classroom. In this way, students are given the opportunity to explore independently, and their personalized learning style is revealed as a result of open learning time, open research content, open learning methods, and open learning resources, which allow students to fully participate. The subsequent teaching not only frees teachers from tedious lectures and trivial questions, but also allows them to develop students' initiative and creativity in the process. (Zhong Guangqun, 2013)

The " aided-study class" comes from a foreign model of flipped classroom teaching, which was proposed by Barbara Walvoord and Virginia Johnson Anderson in 1998 when they discussed how to effectively change homework. They promote self-study before class and focus on synthesis, analysis, and problem solving in class. To ensure that students have done the necessary preparation for a productive class, they advocate an assignment-based model outside the classroom: students generate work (text, questions, etc.) and receive feedback through the process of in-class activities, thus reducing the need for teachers to provide detailed written feedback on students' work. The flipped classroom approach has been used for many years in certain subjects such as history, physics, and biology. In contrast, Chinese education scholars have made many improvements and innovations after fully analyzing and studying foreign flipped classroom teaching methods, and have proposed the "aided-study class" teaching model, which differs from the flipped classroom in that students are engaged in a high-level cognitive process before and during class, and are enhanced by carefully designed learning support sheets before and during class. The "aided-study class" is a model in which students are engaged in a high-level cognitive process before and during the class, and the teacher's ability to design a learning-based curriculum is enhanced through carefully designed help sheets before the class, and students are given an opportunity to improve their initiative, practice, and reflective learning. (Sun Qian, 2016)

2.2.3 Teaching process of aided-study class teaching mode

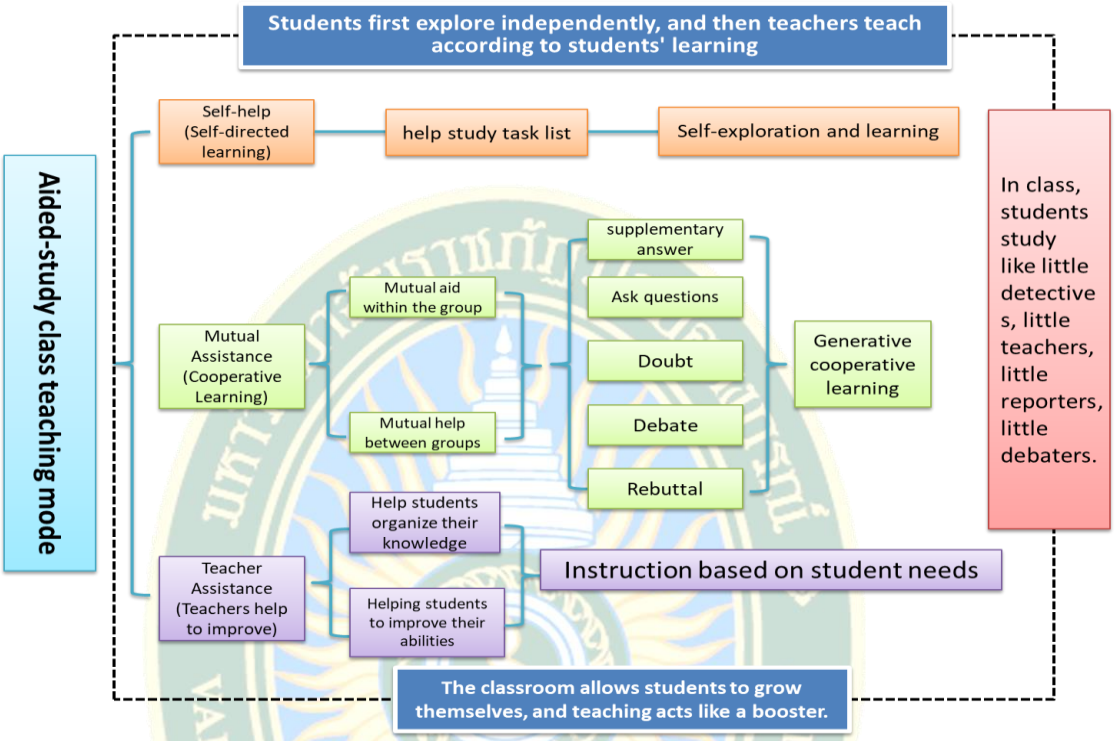


Figure 1 Aided-study class teaching mode

Source: (Zhong Guangqun, 2016) research article

The Aided-study class teaching model emphasizes the "three helps" and is divided into three steps:

Step1 is self-help, research before teaching (students learn independently through the help sheets assigned by teachers), self-help learning is a kind of open posture, students have enough time (time outside of class) to study their favorite content; second, the task is open, which can meet the individual needs of different students and lead students' pre-study to breadth and depth; third, the resources are open, they can look up relevant information on the Internet, use the learning materials around them, and complete certain tasks with parents. The fourth is the open way of learning, students can use their own personalized way of pre-study, doing, seeing and thinking, and teachers design flexible, open learning content to meet the diverse learning needs of students. In order to motivate students to "study first", you can embed such prompts in the help sheets: tell your parents about the results of your pre-study; find a problem you think is interesting and share it with your classmates tomorrow; draw a diagram, give an example, or do an experiment to prove your idea? Do you have any questions that you need help from your teacher or peers? Do you have any other solutions besides those presented in the textbook? What do you think you should remind your partner about? In this way, under the leadership of the "help

sheet" which is very flexible, students' "first research" is full of individuality and creativity, not at all like the pursuit of the so-called "standard answer" as they used to complete their homework. "Every day, there are surprising and even impressive results. In this way, students can continue to improve their independent learning ability under the leadership of the help sheet; the specific operation is to move the "first study" activities to the front of the class, with the traditional part of the homework time to replace, and develop a matching "one to explore two to learn three doubts" of The first research guidance strategy. "Exploration" refers to inquiry, usually first arrange a more challenging problem for students to think first, and then arrange to read books, operations, experiments or collect information when they can not be explored or unknown, so that students can explore learning throughout the pre-study. "The "learning" refers to self-learning, which is the action after the exploration, and it varies from person to person. "In short, the learning after students' independent inquiry is not a tasteless, dispensable learning, but some kind of learning with the desire of "inquiry" and accompanied by The learning that comes with the desire to "inquire" and with psychological expectations. "The depth of questioning reflects the depth of pre-reading and thinking. The depth of questions reflects the depth of pre-reading and thinking. Students bring their questions to the classroom, which in turn makes the subsequent learning powerful.

Step2 is mutual assistance (cooperative exchange), setting appropriate task-driven situations, allowing students to fully demonstrate the results of pre-study, through questions, supplementation, questioning, debate and other forms, so that independent inquiry and group cooperation, peer exchange and other forms of mutual learning to cooperate with each other to implement, there are questions, supplementation, questioning, debate, which makes the cooperative learning among peers become solid and efficient, and the differential resources This makes cooperative learning among peers solid and efficient, and makes full use of different resources. The process of presenting students' pre-study results is actually a process in which different ideas are exchanged and stimulated. On this basis, students should be encouraged to interact actively with each other. The specific forms are: questioning: when the other side does not understand; supplementing: when the other side is not comprehensive; questioning: when the other side has a hole in the view; debating: when the other side is ambiguous; rebutting: when the other side is wrong. When the above elements are embedded in the student-student dialogue, the classroom will show a different ecology: the teacher will retreat moderately, the podium will be given to the students, and the students will boldly express their views in front like a small teacher, while other students will evaluate, supplement and correct them. This changed the traditional classroom situation of passive listening, everyone's attention is highly concentrated, thinking in a "relaxed alert state", not only carefully distinguish the highlights and loopholes in other people's views, but also integrate their own views, and make positive responses.

Let us illustrate the process of mutual aid (cooperative learning) with an example of the class "Comparing the size of fractions".

First, the teacher presents the preview assignment 1: Compare the sizes of 3/5 and 4/9, and ask the students what comparison methods have they learned from the preview?

Afterwards, the students gave speeches, expounding their own ideas, and some students introduced two methods to everyone. One is the drawing method (displayed on a physical projector), which draws two line segments of the same length. Divide the first into 5 and take 3; then divide the second into 9 and take 4. This makes it easy to see that 4/9 is shorter than 3/5. Then he introduced another method, first find the least common multiple of 5 and 9 is 45, rewrite 3/5 to 27/45, 4/9 to 20/45, and compare 27/45 and 20/45, and conclude that 3/5 > 4/9.

The second student then came forward to express his thoughts, adding that he would compare the two scores with 1/2 and could conclude that 3/5 > 4/9.

Afterwards, other students also spoke separately, expressing their own comparison methods or supplementing or questioning the views of the first two students. Everyone had a lively discussion and exchange. (Zhong Guangqun, 2014)

There is questioning, supplementing, questioning, and debating, which makes the cooperative learning among peers solid and efficient, and the difference resources are fully utilized. Of course, there are differences in the traditional lecture-style classroom, but the differences are more between students and teachers than between students. The differences between teachers and students are single rather than rich, and rigid rather than lively. The classroom is organized for students to communicate among themselves and groups, which makes the presented ideas more original and real, and more close to students' thinking characteristics and ways, so the cooperative learning in the classroom provides a suitable environment and soil for students' innovative thinking, making the classroom atmosphere warm and lively, and students can think actively and creatively.

Step 3 is teacher assistance (the teacher helps students improve according to their learning situation), which differs from traditional teaching in that the "teaching" in the Aided-study class is based on learning. The traditional teaching method is that the teacher comes with a set teaching task and shoves the knowledge into the students in a uniform way, regardless of their cognitive differences. In the "Learning Support Classroom", teachers can accurately grasp the learning situation of students, and then implement targeted guidance and teaching according to the degree of mastery of knowledge by students through independent inquiry and cooperative learning. In this way, teachers use the power of teaching at the center of gravity and the key, in the students can not think, speak but do not know, explore but not deep, the teacher then determine what needs to speak, how to speak. The teacher then determines what to say and how to say it when the students cannot think, cannot speak, and cannot explore deeply, and frees up time and energy to work on developing students' higher-

order thinking skills, and to put into practice their creative spirit and practical skills. Therefore, the "Helping Classroom" is a student-centered teaching, a teaching based on students' needs, which can effectively improve students' thinking skills and promote the transfer and application of knowledge.

Let's take the "Comparing the Size of Fractions" class as an example to illustrate the process of teacher assistance (the teacher helps students improve according to their learning).

The teacher first praised the students for their wonderful speeches, and then guided the students to briefly summarize the main methods discussed just now.

The first student concluded that he heard three methods, the first is the drawing method, the second is "reduction of fraction to a common denominator", and the third is the comparison with 1/2.

(At this time, the teacher wrote these three methods on the blackboard, so that everyone can deepen their memory)

Then the teacher asked if you have any questions about these three methods?

Some students said that he found that the method of drawing is related to the method of "reduction of fraction to a common denominator". As long as the inverse two line segments are divided more, it is the same as the second method.

The second student does not agree with the first student's idea, he thinks that the method of drawing is based on the meaning of the fraction, and the second method is based on the basic nature of the fraction.

Then, other students also expressed their thoughts one after another. At this time, the classroom atmosphere was lively and enthusiastic, and some wonderful speeches were warmly applauded by other students.

Then, the teacher organized and summarized everyone's ideas and wrote them on the blackboard.

Then the teacher wrote a question on the blackboard and asked everyone to compare 0.6 and 0.8, and there were also several other questions, so that the students could observe the size of these groups of integers, decimals and fractions. At this time, some students have already concluded the rule. In the case of the same counting unit, if the counting unit of the number is larger, then the number is a larger number, and at the same time, the method of summarizing the comparison of fractions is to convert them first. into numbers with the same unit of count and then for easy comparison...

What the teacher wants to do is to connect the methods of comparing the size of integers, decimals and fractions on this basis, and lead the students to weave a net structure of knowledge, so that the students can see the essence of the problem through the phenomenon, and this structured treatment not only makes the students grasp the knowledge more firmly, but also has a more transferable function. This structured approach not only makes students' knowledge more solid but also more transferable. In fact, only when we know clearly where students are, what their

cognitive barriers are, and where we should lead them to, will such teaching be relevant, and only then can we say that such teaching is truly from the students' point of view. It is easy to see that teacher guidance based on students' needs can effectively enhance students' thinking character, promote the transfer and application of knowledge, and also sow the sunlight for the cultivation of students' creative consciousness to grow. (Zhong Guangqun, 2014)

2.2.4 Role of teacher and learners in "aided-study class teaching mode"

The "aided-study class teaching mode" believes that students are the inquirers, experiencers, collaborators, and demonstrators, and that the classroom should be student-centered, with the teacher setting the stage for students and students showing off on stage; the teacher tries every way to stimulate students' interest and motivation in learning, and completely gives the initiative of learning to students. The teacher will do everything possible to stimulate students' interest and motivation in learning, and completely give the initiative of learning to students, so that they can learn freely and grow happily in a relaxed and pleasant atmosphere.

The purpose of education is to liberate students and put them at the center! As the famous Chinese educator Tao Xingzhi said: "Free the minds of children so that they can think; free the hands of children so that they can do; free the mouths of children so that they can talk; free the eyes of children so that they can see; free the space of children so that they can go to nature, the great society to expand their horizons, each learn what they need, each teach what they know, each do their best; free the children's Time, give them space to digest learning, and learn something they desire, do something they want to do. The child's time must not be taken up so that the child loses the opportunity to learn about life and develops a tendency not to create."

An American educator, after a survey of more than 90,000 students, summarized 12 qualities of a good teacher: (1) a friendly attitude; (2) respect for everyone in the classroom; (3) patience; (4) a wide range of interests; (5) good manners; (6) fairness; (7) a sense of humor; (8) good character; (9) personal attention; (10) Scalability; (11) tolerance; and (12) method.

In a similar survey conducted in China, students described the teachers they disliked and the words that appeared more frequently were: impatient, emotionally unstable, too harsh, rude and unreasonable, mean, sarcastic, serious expressions, etc. Not amiable, etc.

The aided-study class believes that the role of the teacher in the classroom should be reoriented according to the purpose of education. It is important to recognize that students are the only protagonists in the classroom, the only masters of learning, and the only subjects of education. The role of the teacher should be to help, facilitate, and promote the growth of students in order to liberate them to the greatest extent possible. Liberate students' imprisoned minds, liberate students' bound personalities, enable students' rigid minds to think outside the box, and enable students' shrunken personalities to shine. In this way, our education has reached the

point where, as Suhomlinski said, "education must first meet the spiritual needs of students and enhance their spiritual power". (Suhomlinski, 1950)

Therefore, the status and role of the teacher in the "helping classroom" is an important indicator of the student's learning.

2.2.5 Synthesizing of independent variable innovation

The "aided-study class teaching mode" has the following innovations characteristics:

1. Give students enough time and space to think independently and explore actively.

Because " aided-study class " advocates learning first and then teaching. The traditional "learning first" is arranged in the classroom. We moved the activity of "learning first" before class, replaced part of the traditional homework time, and developed a matching "one exploration, two learning, three doubts" Strategy of self-study instruction. And for different learning content, the content and methods of "learning first" will be adjusted accordingly. For example, the new teaching will increase the element of inquiry, the review type will increase the sorting component, and the experience type will increase the observation and experimentation. Ingredients, practical ones will increase the ingredients of operation and production. This kind of "self-help" learning presents an open situation: first, time is open, students have enough time to study their favorite content; second, tasks are open, which can meet the individual needs of different students, and guide students' preview Leading by breadth and depth; the third is the open resources, you can search for relevant information online, and you can use the learning materials around you, and the students' basic activity experience has been effectively strengthened and activated; the fourth is the open learning method, you can adopt your own personality Pre-study is conducted in a customized way, with hands-on work, eye-moving, and thoughtful thinking. The flexible and open content of student assistance meets the diverse learning needs of students.

2. Create an atmosphere of cooperation and mutual benefit for the classroom, allowing students to cooperate, communicate and demonstrate.

Aided-study classroom provides students with the opportunity to fully demonstrate. Groups first, then the whole class, so that every student has the opportunity to speak, and also makes the subsequent inter-group communication deeper and more intense; first "poor" students, then eugenics, to ensure that everyone can be on the original basis Appropriate development in the above; there are groups and individuals, according to the characteristics of the content and the degree of difficulty, choose a matching communication method.

The process of students showing their preview results is actually a process in which dissimilar ideas are exchanged and excited. On this basis, we encourage students to interact with each other. The specific format is to ask questions when the other party does not understand clearly, supplement when the other party does not

speak comprehensively, question when the other party's point of view has loopholes, debate when the other party is ambiguous, and refute when the other party's view is wrong. When the above elements are involved in the exchange, the classroom will present a different kind of ecology: the teacher retreats moderately, the podium is given to the students, the students boldly express their opinions in the front like a small teacher, and other children evaluate and supplement, Correction, the students on and off the stage focused on the problem and conducted intense exchanges and debates. Such cooperative learning provides a suitable environment and soil for students' innovative thinking, so that the classroom is full of generation and creativity.

3. According to the situation of students' self-study and cooperative learning, teachers provide students with the help they urgently need, so that the cognition presents a "network structure" and pays attention to the cultivation of students' sense of innovation.

The difference from traditional teaching is that the "teaching" in the aided classroom is based on learning to teach. The traditional teaching method is that the teacher comes with the set teaching tasks, regardless of the differences in students' cognition, and uses a unified way to give knowledge to the students. In the “aided-study class”, teachers have to accurately grasp the situation of students' autonomous and cooperative learning, and then implement targeted guidance and instruction according to the degree of achievement of students' autonomous inquiry and cooperative learning. In this way, the teacher puts the power of teaching on the focus and the key points. When the students are unable to think, say, or explore, the teacher will then determine what to say and how to say. At the same time, it can also free up more time to lead students to develop advanced thinking skills.

Aided-study classroom is conducive to the cultivation of students' sense of innovation, because it finds a certain balance between what to teach and how to teach. It redesigns the role of learners: students explore the mystery of knowledge like a detective; explain their understanding to everyone like a teacher; learn to ask questions about unclear questions like a reporter; dare to make differences like a debater Compete with each other's opinions. It has also done a good job in optimizing the dynamic system of students: assisting motivation, allowing students to learn happily and eagerly; assisting methods, allowing students to learn and live learning; assisting behaviors, allowing students to learn well and diligently. The classroom not only has confident display and communication, curious questions and supplements, but also fierce debate and questioning. (Zhong Guangqun, 2014)

2.3 Dependent variable: mathematics achievement

2.3.1 Principle, Theory of mathematics achievement

The famous mathematician Polya pointed out through his research: "After graduating from secondary school, students who study mathematics or engage in

mathematics education account for 1%, those who use mathematics account for 29%, and those who basically do not use or rarely use mathematics account for 70%." For this reason, he believes that the meaning of mathematics education is to cultivate students' habits of thinking, a cultural cultivation. Yoneyama Kunizo, a famous Japanese mathematics educator, also pointed out: The mathematical knowledge learned in school, if there is little opportunity to use after graduation, a year or two later, they will soon forget. However, no matter what kind of work they do, only the spirit of mathematics, the way of thinking, the research method, the reasoning method, and the point of view of problems, etc., which are deeply engraved in their hearts, are always in effect and will benefit them throughout their lives. Therefore, in the teaching of mathematics, in addition to attaching importance to the teaching of mathematical concepts, laws, formulas, properties and other explicit mathematical knowledge, more importance should be attached to the cultivation of mathematical competence such as mathematical thinking methods and mathematical thinking methods, so that students have a mind that can think mathematically and have an ability to use mathematical methods to solve problems. Good mathematical competence will lay a solid foundation for a person's sustainable development. (Zhong Guangqun, 2013)

2.3.2 Mathematical achievement

In this research, mathematics achievement is reflected in students' test scores, as well as their ability in mathematics.

UNESCO’s requirements for primary school students in terms of numbers and mathematics are: students can have number concepts and calculation skills, understand that numbers can represent size, can sort and calculate, and can be classified into different types, such as natural numbers, Integers, rational numbers, etc; able to calculate different types of calculations skillfully, and judge whether the calculation results are reasonable. Addition, subtraction, multiplication, and division are the focus of this stage of learning. In addition, students can understand geometric figures and use numerical operations to solve problems encountered in different situations. Students can also express their understanding of the problem to others, conduct data analysis, data presentation, and explain the reasons for problem solving.

In China, in 2014, the Ministry of Education issued the policy document "Opinions on Comprehensively Deepening Curriculum Reform and Implementing the Fundamental Tasks of Lide-Cultivating People". The term "core competence" was mentioned six times. Regarding mathematics, it was proposed to focus on training students Mathematical ability.

As shown in Appendix H, this table is the views of domestic and foreign education experts on mathematical ability. From this table, we can see that Chinese educators believe that mathematical ability should include the following three aspects:

1. The humanities of mathematics: refers to the persistent interest and curiosity in mathematics, the pursuit of the beauty of mathematics, and the ability to

communicate in mathematics. The focus is: motivation, aesthetics, and expression. Specifically: students are willing to learn mathematics; often construct math problems in their minds; know that they will encounter difficulties in the process of mathematics learning, but do not escape mathematics difficulties; know how to appreciate the truth and beauty of mathematics structure; know how to be concise, meticulous, and even answers Unique value with uniform rules; like reading mathematics, and able to communicate and write in mathematics language.

2. Mathematics consciousness: including calculation ability, space concept, symbol consciousness, and problem-solving strategies. The focus is: learning, basics, and methods. Specifically: students will explain life from the perspective of mathematics, and deconstruct mathematics from the mathematics itself; have their own good interpretation and deconstruction methods; be able to use the essence of mathematics to expand the boundaries of intelligence.

3. Mathematical thoughts: covering three mathematical thoughts: abstraction, reasoning, and modeling. The focus is: knowledge, rationality, and wisdom. Specifically, on the basis of willingness to learn, under the guidance of mathematical thinking, students will improve their thinking quality, improve their effectiveness in studying mathematics, and become students who can learn mathematics. That is to say, more complex mathematical problems can be transformed into familiar mathematical knowledge through reasonable reasoning; more complex life situations can be abstracted into mathematical problems, and then mathematical models can be used to solve them. (Chen Liuyi, & Liu Xiaoping, 2016)

2.3.3 The importance of Mathematics Achievement

Students' mathematical achievement consists of basic mathematical knowledge and skills, mathematical consciousness (including number sense, symbolic consciousness, spatial concept, statistical concept and application consciousness, etc.), mathematical ability (mathematical thinking ability, mathematical understanding ability, mathematical communication ability, problem solving ability) and mathematical values. Teaching should pay attention to the formation of students' basic mathematical competence, so that students have the ability of lifelong learning. The development of students' abilities, especially the ability to find, study and solve problems, as well as the ability to collect. The ability to communicate, process and use information can lay a broad foundation for their future development in society. Mr. Ye Shengtao once emphasized: "The ultimate goal of education is that students can learn and encourage themselves, and after they leave school and take up jobs, they can always learn and encourage themselves and be active and productive people for their whole life." Therefore, in classroom teaching, we should formulate learning objectives that focus on the overall development of mathematical competence, design learning tasks that carry the goal of mathematical competence development, organize a comprehensive participation, sharpen the thinking process, guide students to carry out more project-based mathematical practice activities, let students experience the

process of thinking about mathematical knowledge "from beginning to end", and organize In addition, we also organize thematic mathematical activities such as mathematics festivals, so that students can experience the charm of mathematics and improve their mathematical competence in a comprehensive manner. In the implementation of learning assessment, we should try to carry out "developmental" assessment to effectively promote the development of students' mathematical competence from multiple perspectives.

2.3.4 The development of Mathematics Achievement

Aided-study class teaching mode is a study focusing on the teaching practice under the scientific teaching theory, aiming to change the current classroom structure of primary school mathematics classroom, which takes knowledge as the logical order, to a classroom teaching that takes students' learning as the logical structure. By giving priority to the learning path, the teaching is truly based on students' first attempts, and the teaching contents and teaching methods are designed to match students' learning situations, and teachers use the focus on the key and difficult points of students' learning, so as to realize a beautiful transformation of the primary school mathematics classroom to a student-oriented one, and build a new method of mathematics teaching that is both theoretical and practical. In particular, we strive to further transform teachers' educational concepts through research, and effectively realize the three major changes of "taking students as the main body of learning, focusing on learning method research as a breakthrough, and making teaching method follow learning method", so as to improve the quality of primary school mathematics classroom and let students obtain mathematical achievements. (Sun Qian, 2016)

2.3.6 Measurement and evaluation of Mathematics Achievement

"Aided-study class teaching mode" uses a combination of various forms to evaluate students' learning, including test scores, classroom observation, homework analysis, and experimental activities, etc. When presenting the evaluation results, we use a combination of qualitative and quantitative methods, with qualitative descriptions being the main focus and qualitative descriptions being in the form of comments, paying more attention to what students have mastered, what progress they have made, and what abilities they have. The qualitative descriptions are mainly in the form of comments, focusing more on what students have mastered, what progress they have made, and what abilities they have. The quantitative assessment takes the form of a grading system, including tests and exams.

2.4 Principles and Theories of Cooperative Learning

Cooperative learning is a creative and effective teaching theory and strategy that emerged in the United States in the early 1970s and made substantial progress from the mid-1970s to the mid-1980s. Because of its remarkable effect in improving the social psychological atmosphere in the classroom, improving the academic

performance of students in a large area, and promoting students to form good non-cognitive qualities, it quickly attracted the attention of all countries in the world, and became the mainstream teaching theory and strategy in contemporary times. It has been hailed as "the most important and successful teaching reform in the past ten years". Since the late 1980s and early 1990s, research and experiments on cooperative learning have also appeared in my country, and have achieved good results. (Chen Qi, & Liu Rude, 2007)

2.4.1 Goal Structure Theory

The goal structure theory is proposed by Deutsch (M. Deutsch, 1949) on the basis of Lewin's theory of group dynamics. In the process of goal, the interaction between individuals is also different. Deutsch divides these approaches into three types: mutually reinforcing approaches, mutually antagonistic approaches, and mutually independent approaches. These different modes of action have different effects on the individual's psychological process and behavior.

Deutsch (1949) believes that there are three main types of goal structures: cooperative, competitive, and individual.

1. Cooperation goals refers to the fact that members of the group have a common goal, and only when all members achieve the goal can the individual achieve the goal and achieve success. If one person in the group fails to achieve the goal, the others also fail to achieve their own. Under such conditions, group members must form positive mutual promotion relationships, and act in a way that is beneficial to their own success and to the success of their peers.

2. Competing goal means that the goals between individuals are antagonistic. In a group, it is possible for an individual to achieve his or her own goal and succeed only when others cannot. If others are successful, the likelihood of an individual being successful is diminished. In this case, the relationship between peers is confrontational and negative. Each individual acts in only one way that is beneficial to him, but unhelpful or even harmful to others in order to increase his own likelihood of success.

3. Individualized goal means that whether the individual achieves the goal has nothing to do with whether other peers achieve the goal, and the individual pays attention to the completion of his own tasks and the extent of his own progress. Thus, individuals seek a self-beneficial outcome without caring whether other individuals achieve their own goals. The connections formed between individuals are independent of each other and do not interfere with each other.

On the basis of his own experimental research, Deutsch pointed out that the cooperative goal structure makes the communication between members of the group more frequent. Acceptance, thus making them more motivated in the process of completing tasks and increasing their achievement levels more quickly. In these respects, it outperforms competing and individualized target structures.

Thus, Deutsch's cooperative goal structure sets up a situation in which group

members can achieve their respective goals only when the group is successful. Therefore, in order to achieve their own goals, group members must help each other to achieve the group's success. That is, this way of rewarding on the basis of group performance creates positive interpersonal relationships, and it enables group members to give positive social reinforcement, such as praise and encouragement, to their peers' efforts. This is not available in the classroom with a traditional competitive goal structure.

In addition, the change of students' social status in cooperative learning is also one of the motivations of students' learning. American educational psychologist Slavin found that students with low status in traditionally taught classes gained their social status due to the achievements of cooperative groups. That is to say, because of the academic success of cooperative group members, the social status of students with low achievement levels changes. At the same time, American social psychologist H.C. Kelman also found that for students with better grades, this change in social status also helped other students in the learning process, making them the "leadership" of the group. Make them more proud and more confident, so they can put more effort into their own learning and help their peers succeed.

At the same time, in the process of cooperative learning research, many researchers found that there are two main problems in the traditional competitive teaching method. First, the competitive reward structure offers few chances of success, with only a few winning and the majority losing. Only those students with very high grades will be successful and have the opportunity to be rewarded. And for middle- and low-achieving students, success is nearly impossible. As a result, they lose confidence in learning and no longer have the enthusiasm for learning. Second, the peer relationships formed by the competitive reward system also interfere with students' academic efforts. Because the success of a few students reduces the chances of success for most students, peers are often mutually exclusive or even hostile to each other, and sometimes even blame the "teacher's darling" with high grades, interfering with his continued efforts. As for individualized teaching, the formation of positive peer relationships is completely ignored.

It is clear that the cooperative goal structure creates positive peer relationships among students, and this positive peer relationship has a positive and far-reaching impact on students' learning.

2.4.2 Development theory

The goal structure theory of cooperative learning is from the perspective of motivation, emphasizing the influence of cooperative goals on the incentives of students to engage in academic tasks, while the development theory focuses on the effect of cooperative learning on the completion of tasks from a cognitive point of view (in reaching the group. whether each group member improved their cognitive level during the course of the goal).

Development theory is mainly Piaget's point of view. Its most basic

assumption is that, during appropriate tasks, children's interactions improve their mastery and understanding of key concepts. The former Soviet scholar Vygotsky defined the zone of proximal development as the difference between a child's actual developmental level of independent problem-solving and the potential developmental level of problem-solving under the guidance of adults or with more capable peers. distance. In other words, he believes that in addition to adult guidance, children can also improve their existing cognitive levels by completing tasks and discussing problems with their peers. Therefore, he believes that cooperative activities are superior to individual activities and can accelerate the development of children's cognitive level.

Likewise, other Piaget researchers have emphasized the importance of this idea, arguing that knowledge can be acquired more rapidly through the interaction of children. Their work on conservation supports this idea. These findings suggest that when conserved and unconserved children of the same age complete tasks that require conserved concepts together, the unconserved children rapidly develop their own conserved concepts. Some studies have also found that when two children who have no concept of conservation have different views, they will also form a consensus in mutual discussions to obtain the concept of conservation.

In addition, one of the researchers explored the cognitive impact of children's different roles as facilitators and mentors in groups. The tutors improved their cognitive development level through the explanation and help of their peers. When tutors conduct tutoring, they need to reorganize the materials and extract the most important materials to explain, which further consolidates the knowledge they have learned and benefits them in learning.

On the basis of these findings, many in the Piaget school advocated for collaborative activities in schools. They point out that students' interactions in learning tasks will lead to improved cognitive levels. Students can ultimately reach an understanding of knowledge by discussing learning content, resolving cognitive conflicts, and clarifying insufficient reasoning.

From the goal structure theory and development theory of cooperative learning, we can see that the cooperative learning method is a superior teaching method both from the perspective of motivation and from the perspective of cognition.

2.5 Related research

This part includes 6 Chinese and foreign literatures related to "aided-study class teaching mode".

1. Zhong Guangqun (2013), the research topic is "Aided the classroom, empowering teaching to grow". Using case studies, interviews, classroom observations and literature analysis, the researchers took students from a primary

school in Nanjing as a sample. The study found that "aided-study class teaching mode" has a good effect in primary school mathematics teaching, and students are interested in and enthusiastic about the classroom. Very high, the assisted classroom model is suitable for most courses and teachers can make good use of it, this method gives students the opportunity to increase the initiative, practice and reflection of learning and improve their mathematics performance.

2. Jiang Yunfeng (2017) The research topic is "Research on Peer Cooperative Learning Based on "Student Aid" Classroom". The researcher uses case studies, interviews, classroom observations and literature analysis methods to take the eighth grade students of a middle school as a sample. The research found that, Facing the deficiencies of traditional teaching, the "Aided-study class teaching mode" constructed with the student-oriented concept has the effect of activating students' learning motivation. In English teaching, "aided-study class teaching mode" has a very good role in promoting peer cooperative learning and "interaction" in the learning process, and can make students' English learning enter a virtuous cycle.

3. Gong Ping (2008) the research title was "A Brief Discussion on How to Grasp the Degree of Problem Setting in the "Student Aid Classroom"", the researcher used case studies, classroom observation and literature analysis methods, taking the seventh grade of a middle school as a sample, and found that , the student-aiding class focuses on starting students' thinking with "question" as the main axis, promoting students' development with "thinking" as the main attack, encouraging teachers to skillfully set key and difficult questions, and gradually stimulate students' initiative and creativity in learning. Passive acceptance is transformed into active development. In order to achieve the desired effect, teachers must grasp the angle, difficulty, span, gradient, breadth, density and other issues of problem setting in classroom teaching, help students to effectively inspire thinking, and make students' thinking activities gradually Move from knowledge to the unknown to resolve doubts and solve problems.

4. Xu Rongrong (2017), the research topic is "Creating a Student-Assisted Classroom and Improving Students' Ability", the researcher used case studies, classroom observation and literature analysis methods, taking a third-grade primary school student as a sample, and found that the student-aiding classroom It is an effective teaching method to improve students' autonomous learning ability. In Chinese teaching, teachers should stand in the perspective of positive pragmatics and implement the realization method of auxiliary classroom. Specific strategies include: focusing on practical application to help improve speech ability; optimizing teaching links to help form learning methods; grasping stylistic characteristics and helping to form learning ability.

5. Sun Qian (2016), the research topic is the transformation of the role of teachers in the "assistant classroom", the researcher uses case studies, classroom observation and literature analysis methods, taking the second grade students of a

primary school as a sample, the research found that the assistance classroom The charm of it is that it gives students a real learning position. Of course, from a traditional classroom to a student-aided classroom, the transformation of the teacher's role is by no means an overnight event. The students have "a wonderful minute on the stage", and the teacher needs to "work hard for a few years off the stage". Not only good at "teaching", but also good at "learning", in order to better grasp the learning situation, improve classroom efficiency, and achieve "efficient" mathematics ecological classroom.

6. Wang Yusong (2015), the research topic is "Student-aiding Classroom," to give full play to the student's standard, to explore and practice the reform of "Study-aided Classroom" of Ganyu Experimental Primary School in Lianyungang City, the researcher adopts case study, classroom observation and literature analysis methods , taking the fifth grade students of a primary school as a sample, the study found that in the student-aiding classroom, the role and behavior of teachers have undergone fundamental changes. Under the guidance of the teaching proposition of "student-oriented, student-assisted integration", teachers believe in students, liberate students, rely on students, and focus on students.

CHAPTER 3
RESEARCH METHODOLOGY

This chapter describes the research design and methodology which are used in the conduction of the study. Since this study aims to compare mathematics achievement of the students before and after receiving the aided-study class teaching method. The description of population and samples, experimental design, research instruments, data collection, and data analysis are brought to be presented.

3.1 Population and sample

3.1.1 The population in this study was 230 Grade 4 students of in Bayi Road, Chuanhui District, Zhoukou City, Henan Province, China, Semester 2 Academic Year 2021.

3.1.2 The sample for this study was 30 Grade 4 students of primary schools in Bayi Road, Zhoukou City, Henan Province, Semester 2 Academic Year 2021, selected through cluster random sampling method.

3.2 Experimental design

O_1	X	O_2

O1 was measurement of the aided-study class teaching mode before an experiment

X was aided-study class teaching mode

O2 was measurement of mathematics achievement after an experiment

3.3 Research instruments

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

Instruments for experiment

1) Instructional innovation: Aided-study class teaching mode

2) Lesson plan: A total of 5 lesson plans with 10 hours of primary math instruction were implemented.

Instruments for collecting data

1) A test of mathematics

The evaluation form of test had a total of 40 items (Multiple choice tests with 4 alternatives), and the Index of Item Objective Congruence (IOC) of each item was 1, higher than 0.5, the result of analyzing the IOC index showed that all test items were appropriate and could be used in the test.

The reliability value of the achievement test was 0.71, higher than 0.7, difficulty (p) between 0.2-0.8 and discriminability (r) > 0.2.

The process of constructing an achievement test is as follows.

Step 1: Studied the construction of the achievement test and related documents. Consideration was focus on the purposes, types, and contents of the test evaluation form. The construction of the test involves item analysis to clarify the item differentiation and item difficulty of the test, as well as the discriminability and reliability of the test.

Step 2: The course content and learning objectives were analyzed, and the evaluation and analysis table of the course objectives and content was constructed. The test items included four types of cognitive domains. 1) Knowledge, 2) Comprehension, 3) Application, 4) Analysis.

Step 3: Constructed an achievement test about the " aided-study class teaching model ". The test consists of 40 multiple-choice questions, each with 2-4 alternative answers and one correct answer.

Step 4 :The draft test was presented to thesis advisors for their advice on the appropriateness, precision, accuracy, ambiguity and wording of the test. After that the draft test was revised according to the thesis advisors' suggestions. The test and the test evaluation form were offered to the three experts for the content reliability check and suggestions such as the type of questions, accuracy of the test and wording. The quality of the test was considered from Index of Item Objective Congruence (IOC) obtained from the achievement test evaluation form.

Step 5 :Analyzed the IOC index of the test items .The formula used to calculate the IOC index is:

$$IOC = \frac{\sum R}{N}$$

Where IOC means Index of Item Objective Consistency

ΣR means Summation of experts' opinion marks

N means A number of experts

The evaluation form of test had a total of 40 items, and the Index of Item Objective Congruence (IOC) of each item in the test was higher than 0.5, the result of analyzing the IOC index showed that all test items were appropriate and could be used in the test.

Step 6 :Revised the test according to the experts' comments and suggestions.

Step 7 :Measured the item difficulty (p)and item discriminability (r) including reliability by trying out the test to 30 students who had learned this content.

Step 8: Analyzed each item of the test to find out the item difficulty and item discriminability including reliability. Item difficulty (p) should range from 0.20-0.80 and item discriminability (r) should be more than 0.20. The reliability of the test was computed using the formula of Kuder and Richardson formulas 20 and should be more than 0.7(Kuder; & Richardson. 1939 pp. 681-687).

3.4 Data collection

The procedures of data collection were as follows:

1.The sample was given the pretest for measuring Mathematics Achievement with constructed instrument.

2.The samples was taught by using aided-study class teaching mode.

3.After finishing the instruction, the samples received the posttest by using the same instrument which was used in the pretest.

3.5 Data analysis

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

1) Compare Mathematics Achievement before and after receiving Aided-study class teaching mode by using t-test for dependent sample.

2) Compare the mathematics achievement of after grader 4 students using Aided-study class teaching mode, with a set criterion of 70 percent of the full marks.

CHAPTER 4
RESULTS

This chapter describes the research result. Since this study aims to the Effect of Aided-study class teaching mode on Mathematics Achievement of Grade 4 Students in Primary Schools.

The research objectives of this study is to compare mathematics achievement of the students before and after receiving Aided-study class teaching mode. Mathematics achievement of Grade 4 students after receiving Aided-study class teaching mode is higher than before, with a set criterion of 70 %.

Statistical symbols	**Description**
$\bar{X}$	The average
S.D.	The standard deviation of the difference scores
t	The test statistic (denoted t) for the paired T test
p	The p-value corresponding to the given test statistic t with degrees of freedom df

Table 1 Section 1 Result of comparing mathematics achievement of the students before and after receiving Aided-study class teaching mode by using t-test for dependent sample.

Group	**N**	$\bar{X}$	**S.D.**	**df**	**t**	**P**
Before using "aided-study class teaching mode"	30	30.03	4.97	29	9.63	.00
After using "aided-study class teaching mode"	30	35.43	2.62			

* means statistical significant difference at 0.05 level

As shown in Table, students had mathematics achievement after learning through aided-study class teaching mode (post-test) greater than before learning (pre-test) at .05 statistically significant level ($t = 9.63$, $p < 0.05$).

On average, Posttest scores were 5.4 points higher than Pretest scores (95%).

Thus, it was concluded that, mathematics achievement of grade 4 students after receiving aided-study class teaching mode is higher than before.

Table 2 Section 1 Result of comparing mathematics achievement of the students before and after receiving Aided-study class teaching mode by using t-test for one sample.

Group	**N**	**Full score**	**Criteria score**	$\bar{X}$	**S.D.**	**t**	**p**
Experimental group	30	40	28	35.43	2.62	15.52	.00

* means statistical significant difference at 0.05 level

Based on the results, we can state the following:

The average score for the mathematics achievement of grade 4 students after using aided-study class teaching mode was 35.43 from a full marks of 40 and the standard deviation was 2.62 which was statistically higher than the criterion of 70% at the .05 level of statistical significance.

Thus, it was concluded that, the mathematics achievement of the Grade 4 students who received aided-study class teaching mode was higher than 70%.

CHAPTER 5
DISCUSSION

This research aimed to: 1) Compare the mathematics achievement of grader 4 students before and after using "aided-study class teaching mode", and 2) Compare the mathematics achievement of grader 4 students after using "aided-study class teaching mode", with a set criterion of 70 percent of the full marks. The samples used in this study was 30 grade 4 students from Primary School in Bayi Road, Zhoukou City, Henan Province.

5.1 Research conclusion

Through comparative analysis of grade 4 students using Aided-study class teaching mode pre-test and post-test, after the intervention of Aided-study class teaching mode.

1) Mathematics achievement of grade 4 students after using Aided-study class teaching mode" was higher than before at a statistically significant level of 0.05.

2) The mathematics achievement of grade 4 students after using Aided-study class teaching mode were higher than the standard of 70 percent at the 0.05 statistical significance level ($\bar{X}$= 35.43 S.D. =2.62). Therefore, this teaching method was feasible in primary school mathematics teaching, which helped to improve students' learning effect and mathematics achievement. The experimental results verified the research hypothesis.

5.2 Research discussion

5.2.1) Mathematics achievement of grade 4 students after using Aided-study class teaching mode was higher than before at a statistically significant level of 0.05. This is because Aided-study class teaching mode is a kind of classroom teaching mode that helps students learn, it can be understood as both a philosophy and a method of teaching. As a concept, it aims to emphasize that learning is essentially a student's own business and is irreplaceable, and that the role of teaching is to help, facilitate, and stimulate this behavior. This teaching method emphasizes the three steps: Step 1: Self-help, advocating research before teaching. Students learn independently through tasks assigned by teachers, which increate students' independent learning ability, In line with the theory of the "zone of proximal development" by the Soviet educational psychologist Lev Vygotsky, the student-aid classroom emphasizes that students will explore themselves first under the guidance of the "help study task list", which is the creation of the zone of proximal development for the students. Lev Vygotsky (1934) believed that students' inquiry

activities are not only necessary but also possible. It is precisely because the students have two development levels (the existing development level and the potential development level), and these two levels and mutual transformation, the students' first exploration activities can be successful. Step 2: Mutual assistance which is cooperative learning, setting appropriate task-driven situations, allowing students to fully demonstrate through questions, supplementation, questioning, debating and other forms, the independent inquiry and group cooperation, peer exchanges and other forms of mutual aid learning can be implemented. Through these learning activities, students gained more knowledge, acquired earning independent and problem-solving skills，in line with constructivism theory, "aided-study class" emphasizes student-centered, requiring students to transform from passive recipients of external stimuli to subjects of information processing and active constructors of knowledge meaning; teachers are required to be knowledge imparters, instillers The student becomes the helper and facilitator of the students' active meaning construction. This requires teachers to redesign our classrooms to create a classroom learning environment that includes context, collaboration, communication and meaning construction, so that learners can rely on the help of others, such as interpersonal collaboration, communication, use of necessary information, etc., and gain new cognition through meaning construction. Step 3: Teacher assistance which helps students improve according to their learning situation), the teacher changes the traditional method of all-inclusive teaching, based on learning to teach, on the basis of the correct diagnosis of the learning situation, delete the complicated and simplify, reasonable force, the implementation of targeted teaching and learning to match the needs of students. We will also make time and effort to develop students' higher-order thinking skills and put into practice their innovative spirit and practical skills. Specifically, the order of traditional "teaching" and "learning" is reversed. The teacher will set up appropriate questions (help study task list) to let students explore first, and then let them show their learning results, discuss, question, and collaborate in the classroom, and then determine what to teach and how to teach after students' "different ideas" have fully stirred and collided in the classroom. (Zhong Guangqun, 2014)

5.2.2) The mathematics achievement of grade 4 students after using Aided-study class teaching mode were higher than the standard of 70% at the 0.05 statistical significance level.

This is because the teacher has made a lot of efforts in the development of the "help study task list", the ingenious design allows the students to have full space for learning, and the students are very interested in learning mathematics and can study at their own pace, There is also confidence in the interactive learning activities in the classroom, and this research makes full use of the "zone of proximal development" theory and the constructivist "learning and teaching" theory, by redesigning our classrooms to create situations that include situational, collaborative, The classroom learning environment that includes communication and meaning construction allows

learners to obtain cognition through meaning construction with the help of others, such as interpersonal collaboration, communication, and use of necessary information. (Zhong Guangqun, 2013)

At the same time, through the Aided-study class teaching mode, students are happy to learn, they can learn, they can learn, their learning methods are optimized, their learning ability is improved, and their math scores are improved.

5.3 Recommendation

5.3.1 Recommendations for applying the research results

5.3 1.1 Teachers should learn and understand each step of Aided-study class teaching mode well. Before class, teachers need to do a lot of preparatory work to mine teaching resources, analyze the teaching content through the steps of curriculum standard study, textbook analysis, etc., determine the key and difficult teaching points, and design a "help study task list" around the key and difficult content. In the classroom, teachers communicate and interact with students based on the students' preview of the "help study task list", so that teachers can achieve the curriculum objectives.

5.3.1.2 Teachers should understand the process of learning management. First, they should understand the three steps of Aided-study class teaching mode, and fully understand the roles played by teachers and students in "aided-study class teaching mode", with students as the center, allowing students to experience the joy of cooperation, the joy of success, and the beauty of learning mathematics.

5.3.2 Recommendation for further research

5.3.2.1 Future research may focus on extracurricular activities, such as the development of "help study task list".

5.3.2.2 The future study of Aided-study Class may not only apply to science, but also social subjects such as Chinese, English, history, and humanities.

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APPENDICES

APPENDIX A

LESSON PLAN

LESSON PLAN 1

Course / Subject: Primary school mathematics
Instructional Topic: Preliminary understanding of decimals
Class Level: Grade 4
Time for Instructional: 90 minutes
Instructor's name: Zhang Ancheng

1. Objectives

1.1 Learn to recognize decimals.

1.2 Read and write decimals.

1.3 Explain the actual meaning of decimals.

2. Content

Recognize decimals

3.Instructional Strategies (aided-study class teaching method)

3.1 Step1 (35 minutes)

1. The teacher shows the preview homework and asks questions. Through the preview, you learned how to distinguish and read decimals? (Teacher organization, students are free communication, students speak and write their own ideas, students express their opinions and explain what others say, During the student's answer, the teacher will make a summary and guidance based on the student's answer.) (20 minutes)

2. The price of some commodities is displayed on the screen (Wisdom Blackboard, PowerPoint). Two people at the same table look at the screen and take turns acting as salespersons, explaining the price of each commodity and the amount of money required to the same table. (15 minute)

3.2 Step 2: Cooperative learning (40 minutes)

1. The desk mate talk to each other about the decimals they encounter in their lives and their actual meanings. (5 minutes)

2.Talk about the understanding of decimals in the group. (5 minutes)

3. Classroom testing (15 minutes)

(Page 91 of the textbook)

4. Team cooperation: (15 minutes)

(1) The members of each group will speak in the order of the most wrong questions, and analyze each wrong question one by one;

(2) Other members of the group combine their own understanding to help, supplement and remind;

(3) When you encounter the same wrong question, you only need to focus on the discussion when it first appears.

3.3 Step 3: Teachers help to improve (15 minutes)

1. Interaction between teachers and students to deepen understanding (the teacher asks the students to recommend which test question is good and explain the

reason for the recommendation, and guide the students to think). (10 minutes)

2. Teacher summary (5 minutes)

4. Media and Learning Resources

Chalk, Wisdom Blackboard, PowerPoint.

5. Measurement and Evaluation

5.1 Classroom testing. (The step 2 of classroom teaching is carried out.)

5.2 Homework. (Page 92 and 93 of the textbook.)

5.3 Teachers ask questions. (Self-directed learning is carried out in the step 2 of classroom teaching.)

LESSON PLAN 2

Course / Subject: Primary school mathematics
Instructional Topic: Comparison of fraction
Class Level: Grade 4
Time for Instructional: 90 minutes
Instructor's name: Zhang Ancheng

1. Objectives

1.1 Demonstrate how to compare fractions with different denominators.

1.2 Analyze and explain the calculation methods of using different methods to solve different denominator fractions.

2. Content

Comparison of fraction.

3. Instructional Strategies (aided-study class teaching method)

3.1 Step1 (35 minutes)

1. The teacher shows homework one ((Wisdom Blackboard, PowerPoint)): compare the size of 3/5 and 4/9. Through the preview, what comparison methods have you learned? (Teacher organization, students speak freely, fully express their views, explain the speech of others, when students answer, the teacher will summarize, guide and write on the blackboard based on the students' answers.) (15 minutes)

2. Presenting "Preview 2: Do you have any other comparison methods? More than others!" How did the students solve this question? Please communicate in the group first. The group communicates their different methods and prepares to speak in the class. (20 minute)

3.2 Step 2: Cooperative learning (40 minutes)

1. According to the teacher's two questions on power point (Present the problem with PowerPoint on the wisdom blackboard), the group cooperates to discuss and answer how to use the knowledge learned flexibly? (25 minutes)

2. Classroom testing (15 minutes)

(Page 88 and 89 of the textbook)

3.3 Step 3: Teachers help to improve (15 minutes)

1. Interaction between teachers and students to deepen understanding (the teacher asks the students to recommend which test question is good and explain the reason for the recommendation, and guide the students to think). (10 minutes)

2. Teacher summary (5 minutes)

4. Media and Learning Resources

Chalk, Wisdom Blackboard, PowerPoint

5. Measurement and Evaluation

5.1 Classroom testing. (The step 2 of classroom teaching is carried out.)

5.2 Homework. (Page 90 and 91 of the textbook)

5.3 Teachers ask questions. (Carry out in step 1 and step 3)

LESSON PLAN 3

Course / Subject: Primary school mathematics
Instructional Topic: Law of operation
Class Level: Grade 4
Time for Instructional: 90 minutes
Instructor's name: Zhang Ancheng

1. Objectives

1.1 Demonstrate the discovery process of the commutative law of addition and the associative law, and explain the value and significance of the commutative law of addition and the associative law;

1.2 Demonstrate how to use mathematical thinking methods to solve problems encountered in life;

2. Content

Commutative law of addition and associative law of addition.

3. Instructional Strategies (aided-study class teaching method)

3.1 Step1 (30 minutes)

Through yesterday's preview, did you find any secrets hidden in the addition? The group communicated and spoke about what is the commutative law of addition? How did you prove it? (Teacher organization, students are free communication, students speak and write their own ideas, students express their opinions and explain what others say, During the student's answer, the teacher will make a summary and guidance based on the student's answer.) (30 minutes)

3.2 Step 2: Discuss the associative law of addition (20 minutes)

What is the associative law of addition? Will you prove it? Can it be proved by the method we have just learned? (Group communication, debate, cooperative learning, and then show separately) (20 minutes)

3.3 Step 3: Consolidation exercises (20 minutes)

1. The teacher presents the first question: What operation law does each of the following equations use? (5 minutes)

2. The teacher presents the second question: Can you fill in the appropriate numbers or letters in the □? (5 minutes)

3. The commutative law of addition and the law of combination of addition are very useful. Through preview, what use do you find both of them? (10 minutes)

3.4 Step 4: Ability development (20 minutes)

1. In 1787, in the classroom of a rural primary school in Germany, the mathematics teacher asked a question: 1+2+3+4+5+……+98+99+100=? As soon as the teacher finished talking about the question, little Gauss handed in the correct answer he had written. At the same time, his answer method was praised by the teacher. Do you also use your brain to solve this problem like little Gauss with the

knowledge you learned today? (The teacher uses PowerPoint to show the problem on the wisdom blackboard, and guides the students to think and show their ideas) (15 minutes)

2. Teacher summary (5 minutes).

4. Media and Learning Resources

Chalk, Wisdom Blackboard, PowerPoint.

5. Measurement and Evaluation

5.1 Homework. (Page 19 and 20 of the textbook)

5.2 Teachers ask questions (Carry out in step 1 and step 4.)

LESSON PLAN 4

Course / Subject: Primary school mathematics
Instructional Topic: Average number
Class Level: Grade 4
Time for Instructional: 90 minutes
Instructor's name: Zhang Ancheng

1. Objectives

1.1 Explain the meaning of the average, show a simple method of averaging, and be able to answer flexibly according to the specific situation.

1.2 Demonstrate the process of solving simple life problems with ordinary knowledge, and have a preliminary experience of the mathematical thinking of "moving more and making up for less".

1.3 Demonstrate the application case of the average value in life, and experience the fun of learning mathematics to solve practical problems.

2. Content

Recognition and calculation of average.

3. Instructional Strategies (aided-study class teaching method)

3.1 Step1 (30 minutes)

Before class, students have watched the video and completed the "Average" aided-study sheet.

Teacher's question:

(1) Through the preview, do you know how many shots are made on average each time?

(2) Through the preview, do you know how many pieces are collected per person on average?

(Teacher organization, students can speak freely, students say and write down their own thoughts, and come on stage to demonstrate to everyone the method of "shifting the more and filling the less"? Students can express their opinions and explain what others have said. During the answering process, the teacher will summarize and guide the students according to their answers.)

3.2 Step 2: Discuss the associative law of addition (20 minutes)

Three questions will be displayed on the screen (Wisdom Blackboard, PowerPoint). In last night's "aided-study sheet", the students still had the following puzzles. Who can help solve them?

① It is not very useful to shift more and supplement less.

②Some classmates are not good at shifting more and less, can you help him?

③Is it easy to move more and add less or is it easy to calculate?

(1) Team cooperation, discussion and exchange (30 minutes)

① Each group member speaks in the order in which the wrong

questions appear, and analyzes each wrong question one by one;

②Other members of the group will give help, supplements and reminders based on their own understanding;

③When you encounter the same error problem, there is no need to repeat the discussion.

(2) The teacher showed the second question (Wisdom Blackboard, PowerPoint): The boy's team and the girl's team of Class 4 (2) had a wonderful shuttlecock game. Think about it and do the math: Which team has the better results? Have you figured it out? Please vote. If you think the boy's team is better, please choose one, and if you think the girl's team is better, please choose two. After you have chosen, please bring your ideas to the group.

On one occasion, the boys team lost a game and was very unconvinced. They invited an excellent squad leader. With the strong joining of the squad leader, the boys team won this time. Some students think it is unfair, why? Everyone discusses and speaks (10 minutes)

(3) Classroom testing (20 minutes)

(Page 22 and 23 of the textbook.)

3.3 Step 3: Teachers help to improve (15 minutes)

1. Teacher-student interaction to deepen understanding (the teacher asks the students to talk about the average number they see in their daily life, and lists a case to help students think about how to use the knowledge they have learned to solve problems in life). (10 minutes)

2. Teacher summary (5 minutes)

4. Media and Learning Resources

Chalk, Wisdom Blackboard, PowerPoint.

5. Measurement and Evaluation

5.1 Classroom testing. (The step 2 of classroom teaching is carried out.)

5.2 Homework. (Page 19 and 20 of the textbook)

5.3 Teachers ask questions. (Carry out in step 1 and step 4.)

LESSON PLAN 5

Course / Subject: Primary school mathematics
Instructional Topic: Parallelogram
Class Level: Grade 4
Time for Instructional: 90 minutes
Instructor's name: Zhang Ancheng

1. Objectives

1.1 Explain the formula for calculating the area of a parallelogram, and use the formula to correctly calculate the area of a parallelogram.

1.2 Through operation, observation, and comparison, students' spatial concepts are cultivated, and students' ability to use transformational thinking methods to solve problems and logical thinking skills are cultivated.

1.3 Demonstrate the application of parallelogram area in daily life.

2. Content

Recognize parallelograms and calculate the area of parallelograms.

3.Instructional Strategies (aided-study class teaching method)

3.1 Step1 (35 minutes)

Before class, students have watched the video and completed the "Area of Parallelogram" aided-study sheet.

1. The teacher shows the preparation work and asks questions. Did you gain anything from the preview? Share your thoughts with everyone (teacher organization, students can speak freely, students can speak and write down their own ideas, students can express their opinions or comment on what others have said. In the process of students' responses, the teacher will Summarize and guide according to the students' answers.) (20 minutes)

2. Show the grid on the screen (Wisdom Blackboard, PowerPoint), let the students fill in the form on page 87 of the textbook based on the grid, and share what they found after completing the form. (15 minutes)

3.2 Step 2: Cooperative learning (40 minutes)

1. Please cut the parallelogram you prepared along the height you made, and put it together. Discuss what kind of graphics we have learned before the cut shapes can be assembled? (5 minutes)

2. When changing the position of the figure, how to do it according to a certain rule? (5 minutes)

3. Classroom testing (15 minutes)

(Page 89 of the textbook)

4. Teamwork: (15 minutes)

(1) The group members discussed the area of the rectangle transformed from the parallelogram compared with the area of the original parallelogram. Is there any change? Why?

(2) Show your findings, and other members of the group will give help, supplements and reminders based on their own understanding;

(3) Discuss and show the relationship between the length of this rectangle and the base of the parallelogram? What is the relationship between the width of this rectangle and the height of the parallelogram?

3.3 Step 3: Consolidation exercises (20 minutes)

1. Teacher-student interaction to deepen understanding (The teacher guides students to think about how to find the area of this rectangle and explain the reason and explain the reason). (10 minutes)

2. The teacher summarizes and verifies the area formula (5 minutes)

4. Media and Learning Resources

Chalk, Wisdom Blackboard, PowerPoint.

5. Measurement and Evaluation

5.1 Classroom testing. (The step 2 of classroom teaching is carried out.)

5.2 Homework. (Page 90 of the textbook)

5.3 Teachers ask questions. (Carry out in step 1 and step 3.)

APPENDIX B

TEST PAPER

Test paper

1.4.5 Compared with 4.500, which of the following statements is correct ().

A. The size is the same, and the counting unit is the same.

B. The size is equal, but the counting unit is different.

C. Different sizes and different counting units.

2. 4 points 6 points + 7 yuan 4 points = ( ).

A. 7 yuan, 8 jiao and 6 minutes

B. 12 yuan

C. 7.50 yuan

3. Rewrite 2 meters 3 centimeters as the decimal point using meters as the unit ( ) meters.

A. 2.3

B. 2.03

C. 2.003

4. Calculate the decimal subtraction, accidentally increase the subtraction by 3.2, and the subtracted number does not change, then he calculated the difference ( ).

A. Increase 3.2

B. Reduce 3.2

C. Unchanged

5. The number equal to 140.60 is ( ).

A.140.6

B.14.6

C.14.06

6. In the following numbers, the 0 at the end can be removed and the size remains unchanged is ( ).

A.4.700

B.200.00

C.150.00

7. The "6" in 7.8.6 means 6 ( ).

A. One-hundredth

B. One-tenth

C.0.01

8. Mom spent 5.8 yuan on fruits and 2.6 yuan on vegetables. Fish spent 5.2 yuan more than the sum of fruits and vegetables. How much did it cost to buy fish?

A.8.4 yuan

B.5.2 yuan

C.13.6

9. Using 7 as the denominator, there are ( ) fractions larger than $\frac{3}{7}$ and smaller than $\frac{6}{7}$.

A. 2
B. 1
C. 3

10. A pencil uses $\frac{4}{9}$ of it, and the rest is more than it is used ( ).

A. $\frac{5}{9}$
B. $\frac{1}{9}$
C. $\frac{4}{9}$

11. The following scores are arranged in ascending order ( ).

A. $\frac{4}{10} < \frac{9}{10} < 1$
B. $\frac{9}{10} < \frac{4}{10} < 1$
C. $1 < \frac{4}{10} < \frac{9}{10}$

12. The two addends are $\frac{2}{7}$ and $\frac{3}{7}$ respectively. What is their sum?

A. $\frac{5}{14}$
B. $\frac{5}{7}$
C. $\frac{4}{7}$

13. How many more seven $\frac{1}{9}$ are than three $\frac{1}{9}$?

A. 6
B. $\frac{4}{9}$
C. $\frac{4}{7}$

14. The length of the rectangle is $\frac{9}{10}$ meters, and the width is $\frac{1}{10}$ meters shorter than the length. How many meters is the width of the rectangle?

A. 8
B. $\frac{8}{9}$
C. $\frac{8}{10}$

15. The number of girls in the first class of the second grade accounted for $\frac{5}{9}$ of the class. What percentage of the class did boys account for?

A. half

B.$\frac{4}{9}$

C.$\frac{5}{9}$

16. There are 120 saplings, of which 12 points are given to the third grade, and the remaining 12 points are given to the second grade. How many saplings are divided into the second and third grades?

A.60 30

B.60 60

C.30 30

17.3108+6269=9377, the wrong checking method is ( ).

A.9377+3108＝6269

B.9377-3108＝6269

C.6269+3108＝9377

18. A number is 300 less than 727. This number is ( ).

A.427

B.373

C.1027

19. 105+890+95=(105+95)+890 What calculation method is used?

A. Commutative law of addition

B. Associative law of addition

C. Commutative law of addition and associative law

20. The formula that is not equal to the result of 199+203 is ( ).

A.199+200+3

B.200+1+203

C.200-1+200+3

21. The fruit shop originally had 1,400 kilograms of fruit, and then 480 kilograms were imported and 320 kilograms were sold. How many kilograms of fruit does the fruit shop now have? The correct column formula is ( ).

A.1400+480-320-1400

B.1400+480-320

C.480-320

22.56+72+28=56+70+2+28 uses ( ).

A. Commutative law of addition

B. Associative law of addition

C. Associative law of multiplication

23.101×125=( ).

A.100×125+1

B.125×100+1

C.100×125+1×125

24. Xiong cheng Department Store sold 269 refrigerators, 67 refrigerators, 331 refrigerators and 233 refrigerators in the first and fourth quarters. How many refrigerators are sold in Xiong cheng Mall in the whole year? Use the associative law of addition to formulate the formula, the correct one is ( ).

A.269+331+67+233

B. 269+67+331+233

C. 269+233+331+67

25. Old Liu cut down trees, 50 trees were cut on the first day, and 110 trees were cut on the second and third days. How many trees are cut every day on average? ( )

A. (50+110) ÷ 2

B. (50 +110 +110) ÷ 3

C. (50 +110) ÷ 3

26. At 0 o'clock, 6 o'clock, 12 o'clock, and 18 o'clock in a day, the water level measured by the hydrological monitoring station is 8 meters, 12 meters, 7 meters, and 10 meters respectively. Please calculate the average water level for this day. ( )

A. (8 +12+ 7+ 10) ÷ 4

B. (8 +12+ 7+ 10) ÷ (0+ 6+ 12+ 18)

C. (8 +12+ 7+ 10) ÷ 1

27. A company produced 420,000 boxes of beverages in the first half of the year, with an average monthly production of ( ) million boxes.

A. 42÷12

B. 42÷2

C. 42÷6

28. Lili's average score in mathematics and English is 95 points, of which English is 91 points, and mathematics is ( ) points.

A. 90

B. 95

C. 99

29. The master and the apprentice cooperated to produce a batch of parts in 3 days, 234 pieces on the first day, 287 pieces on the second day, and 293 pieces on the third day. Each person produced ( ) pieces on average.

A. (234+287+293) ÷ 2

B. (234+287+293) ÷3

C. (234+287+293)÷2÷3

30. In the third grade, 4 classes donated books. Class 1 and Class 2 donated a total of 23 books, Class 3 donated 15 books, and Class 4 donated 22 books. On average, each class donated books ( ) books.

A. 20
B. 15
C. 5

31. In the diving competition, ten judges will score, and it is stipulated that the final score is the average score after removing the 1 highest score and 1 lowest score. The average score of the scores scored by the 10 judges for the athletes A and B is 9.75 And 9.76, where the average scores of the highest and lowest scores are 9.83 and 9.84, then the final score is ( ).

A. Grade A is high
B. B's score is high
C. The scores of A and B are equally high

32. A garment factory produced 4,800 sets of garments in the first half of the year and 700 sets of garments per month in the second half of the year. How many sets of garments were made per month on average during the year? ( ).

A. 400
B. 483
C. 750

33. The rectangle made by nailing the wooden slats is turned into a parallelogram by hand. What happens to its height ( ).

A. No change
B. Bigger than before
C. Smaller than before

34. The base of the parallelogram is enlarged 6 times, the height remains unchanged, and its area ( ).

A. No change
B. Expanded by 6 times
C. 3 times smaller

35. The rectangle made by nailing the wooden slats is pulled apart with a hand to make it a parallelogram. What happens to its area ( ).

A. No change
B. Smaller than before
C. Bigger than before

36. Parallelograms can be drawn ( ) height on the same base.

A. Countless
B. 1
C. 5

37. Cut the parallelogram and connect them to form a rectangle. What happens to the area and perimeter ( ).

①Bigger ②No change ③Small ④Incomparable

A. ①②

B. ②③

C. ②①

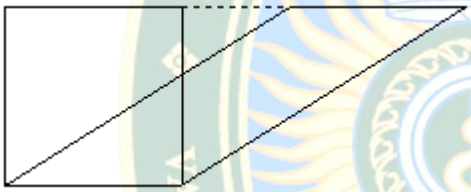
38. The area of a piece of parallelogram land is 560 square meters, its base is 28 meters, and its height is ( ) decimeters.

A. 2

B. 20

C. 200

39. The area of the rectangle and parallelogram below ( ).



A. Equal

B. Not equal

C. uncertain

40. The base of the parallelogram is enlarged 6 times, the height is reduced 3 times, and its area ( ).

A. No change

B. Expanded by 6 times

C. Expand 2 times

APPENDIX C

HELP STUDY TASK LIST

Preliminary understanding of decimals

1. Recognize decimals

Preview content

Example 1 and related content on pages 91-92 of the textbook, exercises 20, questions 1-4.

Aided-study test

1. Give it a try, believe I can do it

Xiaohong went to the stationery store to buy a diary. The price was 2.50 yuan. Do you know how many yuan and how many cents?

2. Think about it, believe I can find out

(1) A stationery box is 19.80 yuan, a ruler is 0.5 yuan, and a pen is 5.50 yuan.

19.80 reads:

0.5 reads:

5.50 reads:

Think: How to read decimals?

2. write the decimals

0.54 writes:

53.26 writes:

Think: how to write decimals?

2. Simple addition and subtraction of decimals

Preview content

Example questions and related content on pages 96 and 97 of the textbook, practice 21 questions 1 and 2.

Aided-study test

1. Think about it, believe I can.

The contents of self-study textbooks 96-97, think about it, what are the similarities and differences between the addition and subtraction of decimals and the addition and subtraction of integers?

2. Believe I can do it.

7.3+3.48 = 15+4.27 = 1.76-0.85 =

3. Do you have any questions about addition and subtraction of decimals? What do you think needs to be brought to the attention of your peers?

APPENDIX D

THE EVALUATION FORM OF TEST

Test Item	Expert 1			Expert 2			Expert 3			IOC	Result
	+1	0	-1	+1	0	-1	+1	0	-1		
1	√			√			√			(1+1+1)/3=1	Quality
2	√			√			√			(1+1+1)/3=1	Quality
3	√			√			√			(1+1+1)/3=1	Quality
4	√			√			√			(1+1+1)/3=1	Quality
5	√			√			√			(1+1+1)/3=1	Quality
6	√			√			√			(1+1+1)/3=1	Quality
7	√			√			√			(1+1+1)/3=1	Quality
8	√			√			√			(1+1+1)/3=1	Quality
9	√			√			√			(1+1+1)/3=1	Quality
10	√			√			√			(1+1+1)/3=1	Quality
11	√			√			√			(1+1+1)/3=1	Quality
12	√			√			√			(1+1+1)/3=1	Quality
13	√			√			√			(1+1+1)/3=1	Quality
14	√			√			√			(1+1+1)/3=1	Quality
15	√			√			√			(1+1+1)/3=1	Quality
16	√			√			√			(1+1+1)/3=1	Quality
17	√			√			√			(1+1+1)/3=1	Quality
18	√			√			√			(1+1+1)/3=1	Quality
19	√			√			√			(1+1+1)/3=1	Quality
20	√			√			√			(1+1+1)/3=1	Quality
21	√			√			√			(1+1+1)/3=1	Quality
22	√			√			√			(1+1+1)/3=1	Quality
23	√			√			√			(1+1+1)/3=1	Quality
24	√			√			√			(1+1+1)/3=1	Quality
25	√			√			√			(1+1+1)/3=1	Quality

26	√				√		√			(1+1+1)/3=1	Quality
27	√			√			√			(1+1+1)/3=1	Quality
28	√			√			√			(1+1+1)/3=1	Quality
29	√			√			√			(1+1+1)/3=1	Quality
30	√			√			√			(1+1+1)/3=1	Quality
31	√			√			√			(1+1+1)/3=1	Quality
32	√			√			√			(1+1+1)/3=1	Quality
33	√			√			√			(1+1+1)/3=1	Quality
34	√			√			√			(1+1+1)/3=1	Quality
35	√			√			√			(1+1+1)/3=1	Quality
36	√			√			√			(1+1+1)/3=1	Quality
37	√			√			√			(1+1+1)/3=1	Quality
38	√			√			√			(1+1+1)/3=1	Quality
39	√			√			√			(1+1+1)/3=1	Quality
40	√			√			√			(1+1+1)/3=1	Quality

APPENDIX E

THE EVALUATION FORM OF THE LESSON PLANS

No	Item	Opinion of appropriateness level				
		5	4	3	2	1
1	Learning objectives were covered the learning behaviors in terms of knowledge, skills, and attitude	√				
2	Learning objectives were congruent with contents	√				
3	Learning objectives were congruent with teaching methods	√				
4	Contents were congruent with teaching methods	√				
5	Contents were appropriate in terms of modernized	√				
6	Contents were appropriate in terms of difficulty	√				
7	Teaching methods were congruent with the definition of terms	√				
8	Teaching methods provide hand-on activities	√				
9	Teaching methods provide the opportunity for students to construct their own knowledge	√				
10	Teaching methods provide both individual and group activities	√				
11	Teaching activities employ technologies for supporting students' learning	√				
12	Teaching methods provide an opportunity for self-study, discussion and presentation	√				
13	Learning materials were appropriate with contents and learning activities	√				
14	Learning outcomes can be applied to the real-life situations	√				
15	The evaluation methods were congruent with learning objectives	√				

APPENDIX F

TEST PROJECT RELIABILITY WITH KUDER AND RICHARDSON FORMULA 20

ID	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10	Item11	Item12	Item13	Item14	Item15	Item16	Item17	Item18	Item19	Item20	Item21	Item22	Item23	Item24	Item25	Item26	Item27	Item28	Item29	Item30	Item31	Item32	Item33	Item34	Item35	Item36	Item37	Item38	Item39	Item40	Total
1	1	1	1	1	0	1	1	1	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0	1	1	0	1	0	1	1	0	1	0	1	0	0	1	28
2	1	1	0	1	0	1	1	0	1	0	1	0	1	0	1	0	0	1	1	0	1	0	1	0	0	1	0	0	1	1	0	1	0	1	0	1	0	1	1	0	21
3	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	33
4	0	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	34
5	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	33
6	1	0	1	1	0	1	0	0	1	1	1	1	1	0	1	0	0	0	1	0	1	0	1	0	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	0	20
7	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	35
8	1	0	1	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	32
9	0	1	1	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	32
10	1	1	0	1	0	1	0	1	0	1	1	1	0	1	1	1	1	0	1	0	1	1	1	1	0	1	1	0	1	1	1	1	0	1	0	0	1	1	0	1	27
11	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	33
12	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	36
13	0	1	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	32
14	1	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	33
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	0	0	1	1	35
16	0	1	1	1	0	0	1	1	0	1	1	1	0	1	0	1	0	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	28
17	0	1	1	0	1	0	1	0	1	0	0	1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	0	0	0	1	0	1	0	0	1	18
18	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	33
19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	0	1	1	0	1	1	1	0	1	0	1	1	0	1	1	0	1	32
20	1	1	0	1	0	1	1	0	1	0	1	0	0	0	1	0	1	1	1	1	0	0	1	1	0	1	1	0	1	0	1	0	1	0	1	0	1	1	0	1	23
21	0	0	1	1	1	0	1	1	0	1	1	1	1	1	0	1	0	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	0	28
22	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	1	1	33
23	1	1	1	1	0	1	0	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0	32
24	1	0	0	1	1	0	1	0	1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	0	0	1	0	0	1	0	0	1	0	1	0	1	0	18
25	0	1	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	31
26	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	0	1	0	1	1	1	1	1	0	1	1	1	33
27	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	0	1	1	0	1	1	1	0	1	1	1	1	0	1	1	1	1	32
28	1	0	1	0	0	1	0	1	1	0	1	1	0	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	30
29	1	1	0	1	1	1	1	0	1	1	0	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	32
30	0	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	0	1	1	1	1	1	33
Total	22	21	21	24	21	23	24	22	23	23	24	22	24	24	23	20	22	24	24	22	24	22	24	21	22	21	22	23	23	24	22	24	22	25	22	19	22	23	22	21	
p	0.73	0.70	0.70	0.80	0.70	0.77	0.80	0.73	0.77	0.77	0.80	0.73	0.80	0.80	0.77	0.67	0.73	0.80	0.80	0.73	0.80	0.73	0.80	0.70	0.73	0.70	0.73	0.77	0.77	0.80	0.73	0.80	0.73	0.83	0.73	0.63	0.73	0.77	0.73	0.70	
q	0.27	0.30	0.30	0.20	0.30	0.23	0.20	0.27	0.23	0.23	0.20	0.27	0.20	0.20	0.23	0.33	0.27	0.20	0.20	0.27	0.20	0.27	0.20	0.30	0.27	0.30	0.27	0.23	0.23	0.20	0.27	0.20	0.27	0.17	0.27	0.37	0.27	0.23	0.27	0.30	
pq	0.20	0.21	0.21	0.16	0.21	0.18	0.16	0.20	0.18	0.18	0.16	0.20	0.16	0.16	0.18	0.22	0.20	0.16	0.16	0.20	0.16	0.20	0.16	0.21	0.20	0.21	0.20	0.18	0.18	0.16	0.20	0.16	0.20	0.14	0.20	0.23	0.20	0.18	0.20	0.21	7.41

k	40
∑pq	7.41
var	23.866
ρ	0.7086

APPENDIX G

ITEM DIFFICULTY (P) AND ITEM DISCRIMINABILITY (R) OF TEST PAPER EVALUATION FORM

Item difficulty (p) and item discriminability (r) of test paper evaluation form

Item (full score)	Total scores of High score group	Total scores of low score group	$P_H = \frac{\sum H}{\sum T_H}$	$P_L = \frac{\sum L}{\sum T_L}$	Difficulty $P = \frac{P_H + P_L}{2}$	Discrimination $r = P_H + P_L$
Item 1 (1 score)	22	8	0.73	0	0.37	0.73
Item 2 (1 score)	21	9	0.70	0	0.35	0.70
Item 3 (1 score)	21	9	0.70	0	0.35	0.70
Item 4 (1 score)	24	6	0.80	0	0.40	0.80
Item 5 (1 score)	21	9	0.70	0	0.35	0.70
Item 6 (1 score)	23	7	0.77	0	0.38	0.77
Item 7 (1 score)	24	6	0.80	0	0.40	0.80
Item 8 (1 score)	22	8	0.73	0	0.37	0.73
Item 9 (1 score)	23	7	0.77	0	0.38	0.77
Item 10 (1 score)	23	7	0.77	0	0.38	0.77
Item 11 (1 score)	24	6	0.80	0	0.40	0.80
Item 12 (1 score)	22	8	0.73	0	0.37	0.73
Item 13 (1 score)	24	6	0.80	0	0.40	0.80
Item 14 (1 score)	24	6	0.80	0	0.40	0.80
Item 15 (1 score)	23	7	0.77	0	0.38	0.77
Item 16 (1 score)	20	10	0.67	0	0.33	0.67
Item 17 (1 score)	22	8	0.73	0	0.37	0.73
Item 18 (1 score)	24	6	0.80	0	0.40	0.80
Item 19 (1 score)	24	6	0.80	0	0.40	0.80
Item 20 (1 score)	22	8	0.73	0	0.37	0.73
Item 21 (1 score)	24	6	0.80	0	0.40	0.80
Item 22 (1 score)	22	8	0.73	0	0.37	0.73
Item 23 (1 score)	24	6	0.80	0	0.40	0.80
Item 24 (1 score)	21	9	0.70	0	0.35	0.70
Item 25 (1 score)	22	8	0.73	0	0.37	0.73
Item 26 (1 score)	21	9	0.70	0	0.35	0.70
Item 27 (1 score)	22	8	0.73	0	0.37	0.73
Item 28 (1 score)	23	7	0.77	0	0.38	0.77
Item 29 (1 score)	23	7	0.77	0	0.38	0.77
Item 30 (1 score)	24	6	0.80	0	0.40	0.80
Item 31 (1 score)	22	8	0.73	0	0.37	0.73
Item 32 (1 score)	24	6	0.80	0	0.40	0.80
Item 33 (1 score)	22	8	0.73	0	0.37	0.73
Item 34 (1 score)	25	5	0.83	0	0.42	0.83
Item 35 (1 score)	22	8	0.73	0	0.37	0.73
Item 36 (1 score)	19	11	0.63	0	0.32	0.63
Item 37 (1 score)	22	8	0.73	0	0.37	0.73
Item 38 (1 score)	23	7	0.77	0	0.38	0.77
Item 39 (1 score)	22	8	0.73	0	0.37	0.73
Item 40 (1 score)	21	9	0.70	0	0.35	0.70
					0.8>P>0.2	r>0.2

APPENDIX H

TABLE OF VIEWS OF DOMESTIC AND FOREIGN EDUCATION EXPERTS ON MATHEMATICAL ABILITY

Time	Representative	Basic Knowledge
1959	Crowther	observation, hypothesis, experiment, verification, quantitative thinking.
1974	J.R.Zacharias	arithmetic, real number, measurement, graph, rate of change, statistics.
1977	Western Australia Department of Education	Ability to count tables, calculation skills and the habit of making reasonable estimates of space.
1982	Cockcroft	numerical and mathematical skills, the ability to understand graphs, curves, percentages, etc.
1986	American Association of Mathematics Teachers	The value of mathematics, confidence in mathematics skills, and the ability to solve math problems.
1992	Cai Shanghe	Knowledge skills, logical thinking, application of mathematics and materialist dialectics.
1997	"MA" research group	Innate physiological characteristics, stable attributes under the influence of acquired mathematics education.
1997	Mathematics Competence Education Strategy Development Seminar.	Basic mathematics concepts and skills, mathematics thinking and strategies, general thinking skills and well-founded appreciation situations, including the intention to use mathematics in situations.
2002	Wang Zixing	Innate physiological basis, acquired relatively stable state.
2005	Zheng Qiang	Mathematics culture, the value of the times or a new level reached by himself.
2012	PISA	Use mathematical reasoning to describe, explain and predict phenomena.
2015	He Xiaoya	Computing, reasoning, consciousness, thinking methods, emotions, attitudes and values.
2015	Kang Shigang, Song Naiqing	Experience, perception and reflection are a comprehensive feature.

APPENDIX I

SECTION 1 RESULT OF COMPARING MATHEMATICS ACHIEVEMENT OF THE STUDENTS BEFORE AND AFTER RECEIVING AIDED-STUDY CLASS TEACHING MODE BY USING T-TEST (PAIRED SAMPLES TEST) FOR DEPENDENT SAMPLE.

Section 1 Result of comparing mathematics achievement of the students before and after receiving aided-study class teaching mode by using t-test (Paired samples test) for dependent sample.

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	posttest	35.4333	30	2.62197	.47870
	Pretest	30.0333	30	4.97915	.90906

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	posttest & Pretest	30	.852	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	posttest - Pretest	5.40000	3.06931	.56038	4.25390	6.54610	9.636	29	.000

APPENDIX J

SECTION 2 RESULT OF COMPARING MATHEMATICS ACHIEVEMENT OF STUDENTS WITH THE DETERMINED CRITERIA SET AT 70 % BY USING T-TEST FOR ONE SAMPLE.

Section 2 Result of comparing mathematics achievement of students with the determined criteria set at 70 % by using t-test for one sample.

T-Test

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
posttest	30	35.4333	2.62197	.47870

One-Sample Test

Test Value = 28

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
posttest	15.528	29	.000	7.43333	6.4543	8.4124

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