# THE EFFECT OF COOPERATIVE LEARNING USING STAD TECHNIQUE ON MATHEMATICS ACHIEVEMENT OF THE FOURTH GRADE STUDENTS IN PRIMARY SCHOOLS

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**A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS**
**FOR THE DEGREE OF MASTER OF EDUCATION**
**IN CURRICULUM AND INSTRUCTION**
**GRADUATE SCHOOL**
**VALAYA ALONGKORN RAJABHAT UNIVERSITY**
**UNDER THE ROYAL PATRONAGE PATHUM THANI**
**2022**

# ผลการเรียนรู้แบบร่วมมือโดยใช้เทคนิค STAD ที่มีต่อผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ของนักเรียนชั้นประถมศึกษาปีที่ 4 ในโรงเรียนประถมศึกษา

**Yang Pengfei**



**วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตร**

**ปริญญาครุศาสตรมหาบัณฑิต**

**สาขาวิชาหลักสูตรและการสอน**

**บัณฑิตวิทยาลัย**

**มหาวิทยาลัยราชภัฏวไลยอลงกรณ์ ในพระบรมราชูปถัมภ์ จังหวัดปทุมธานี**

**พ.ศ. 2565**

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## GRADUATE SCHOOL
## VALAYA ALONGKORN RAJABHAT UNIVERSITY
## UNDER THE ROYAL PATRONAGE PATHUM THANI

| | |
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| Degree | Master of Education |
| Field of Study | Curriculum and Instruction |

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Yang Pengfei. (2565). ผลการเรียนรู้แบบร่วมมือโดยใช้เทคนิค STAD ที่มีต่อผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ของนักเรียนชั้นประถมศึกษาปีที่ 4 ในโรงเรียนประถมศึกษา. ครุศาสตรมหาบัณฑิต สาขาวิชาหลักสูตรและการสอน. อาจารย์ที่ปรึกษา : อ.ดร.พิทักษ์ นิลนพคุณ รศ.ดร.สุวรรณา จุ้ยทอง

**บทคัดย่อ**

การวิจัยนี้เป็นการวิจัยทดลองเบื้องต้น มีวัตถุประสงค์เพื่อ 1) เปรียบเทียบผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ก่อนและหลังได้รับการจัดการเรียนรู้แบบร่วมมือโดยใช้เทคนิค STAD 2) เปรียบเทียบผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ หลังได้รับการจัดการเรียนรู้แบบร่วมมือโดยใช้เทคนิค STAD กับเกณฑ์ร้อยละ 70 ของคะแนนเต็ม กลุ่มตัวอย่างการวิจัย ได้แก่ นักเรียนชั้นประถมศึกษาปีที่ 4 จำนวน 30 คน จากโรงเรียนประถมศึกษาเซียงฮี Zhu Madian City, Henan Province ประเทศสาธารณรัฐประชาชนจีน ซึ่งได้มาจากการสุ่มแบบกลุ่ม เครื่องมือที่ใช้ในการวิจัย ได้แก่ 1) แผนการสอนที่ใช้การเรียนรู้แบบร่วมมือ 2) แบบทดสอบวัดผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ มีค่าความเชื่อมั่น 0.76 สถิติที่ใช้ในการวิเคราะห์ข้อมูล ได้แก่ ร้อยละ ค่าเฉลี่ย ค่าเบี่ยงเบนมาตรฐาน การทดสอบค่าเฉลี่ยกลุ่มตัวอย่างกลุ่มเดียววัดก่อนหลัง และการทดสอบค่าเฉลี่ยกลุ่มตัวอย่างกลุ่มเดียวเทียบกับเกณฑ์

ผลการวิจัยพบว่า 1) ผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ของนักเรียนชั้นประถมศึกษาปีที่ 4 หลังการได้รับการจัดการเรียนรู้แบบร่วมมือโดยใช้เทคนิค STAD สูงกว่าก่อนการเรียนรู้อย่างมีนัยสำคัญทางสถิติที่ 0.05 ($t_{29}$= 12.83, $p < 0.05$) 2) ผลคะแนนเฉลี่ยผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ของนักเรียนชั้นประถมศึกษาปีที่ 4 หลังได้รับการจัดการเรียนรู้แบบร่วมมือโดยใช้เทคนิค STAD สูงกว่าเกณฑ์ร้อยละ 70 ของคะแนนเต็ม อย่างมีนัยสำคัญทางสถิติที่ 0.05 ($\bar{X}$ = 86.90, S.D. = 8.55)

องค์ความรู้ที่ได้จากการวิจัยในครั้งนี้ คือ การจัดการเรียนรู้แบบร่วมมือโดยใช้เทคนิค STAD เป็นวิธีสอนที่มีประสิทธิภาพ สามารถยกระดับผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์ ของนักเรียนชั้นประถมศึกษาปีที่ 4 การจัดการเรียนรู้แบบร่วมมือโดยใช้เทคนิค STAD มี 5 ขั้นตอน ดังนี้ 1) ครูสอนในห้องเรียน 2) การจัดกลุ่ม 3) ทดสอบสมาชิกกลุ่มแต่ละคน 4) คำนวณคะแนนที่ปรับปรุงแล้วของสมาชิกแต่ละคน และ 5) การประเมินผลกลุ่มและการยอมรับ

**คำสำคัญ :** การจัดการเรียนรู้แบบร่วมมือโดยใช้เทคนิค STAD คณิตศาสตร์ระดับประถมศึกษา ผลสัมฤทธิ์ทางการเรียนคณิตศาสตร์

Yang Pengfei. (2022). The Effect of Cooperative Learning Using STAD Technique on Mathematics Achievement of the Fourth Grade Students in Primary Schools. Master of Education (Curriculum and Instruction). Advisors: Dr.Phithack Nilnopkoon, Assoc. Prof. Dr.Suwana Juithong

## ABSTRACT

The objectives of this pre-experimental research were: 1) to compare mathematics achievement of the students before and after receiving the cooperative learning using STAD technique, and 2) to compare mathematics achievement of students with the determined criterion set at 70% of the total score. The sample used in this study was 30 students in the fourth grade of Xianghe primary school in Zhu Madian City, Henan Province, Republic of China. It was derived from cluster random sampling. The research instruments were: 1) five lesson plans adopted cooperative learning using STAD technique on mathematics subject, and 2) a mathematics achievement test with the reliability of 0.76. The statistics used for data analysis were the mean, standard deviation, dependent sample t-test, and one sample t-test.

The results of the study were as follows: 1) the mathematics achievement of the fourth-grade students after receiving cooperative learning using STAD technique was higher than that before receiving such learning technique at the statistically significant level of 0.05 ($t_{29}$= 12.83, $p < 0.05$), and 2) the mathematics achievement of the fourth-grade students after receiving cooperative learning using STAD technique was higher than the determined criterion set at 70% at the 0.05 statistically significant level ($\bar{x}$ = 86.90, S.D. = 8.55).

The body of knowledge gained from this research was that the cooperative learning using STAD technique was an effective teaching method for improving mathematics achievement of the fourth-grade students. This method consisted of five steps of teaching: 1) teachers' classroom teaching, 2) a group member formation, 3) an individual member testing, 4) a calculation of individual improvement scores, and 5) group evaluation and recognition. Moreover, all these steps were included in the lesson plans. Through implementation of these lesson plans, students expressed high motivation in learning, playing positive roles in communication, driving and encouraging each other, having much opportunity to perform and participate in learning activities. Consequently, students' interest in the lesson was stimulated and the quality of teaching was also improved.

**Keywords:** Cooperative Learning Using STAD Technique, Primary School Mathematics, Mathematics Achievement

# ACKNOWLEDGEMENTS

How time flies, my postgraduate period has nearly come to an end. Looking back on my two years of study at Valaya Alongkorn Rajabhat University, I benefit a lot from it. It is beyond words to acknowledge the great assistance that I have received from my respected teachers and classmates. The whole process of writing thesis is full of difficulties and hardships, without their assistance, I would nothave finished it so well.

I would like to express my sincere thanks to my advisor Dr. Phithack Nilnopkoon and Associate ProfessorDr. Suwana Juithong for their careful proofreading and pertinent suggestions

In the process of completing my thesis, their enthusiasm for teaching research and teaching set a good example for me. Whenever I need help very much, they will help me generously. They are the most responsible teachers I have ever met in my life. How lucky I am to have such two kind and outstanding mentors.

Yang Pengfei

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# CHAPTER 1
# INTRODUCTION

## 1.1 Introduction

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, how to optimize teaching methods, promote students' cooperative learning skills and improve students' academic performance has become an urgent problem to be solved. Especially for primary school students, they feel that mathematics is boring in learning mathematics. Students can't solve problems through cooperative learning, and groups can't use group cooperative learning to find answers to problems. These problems lead to their poor performance in mathematics and are not interested in mathematics learning.

Through the analysis of the current situation of mathematics classroom teaching in grade 4 of primary school, it is found that there are the following four problems: 1. Students' mathematical language expression ability is poor; 2. Lack of hands-on activities in the classroom; 3. There is a lack of communication between teachers and students, and there is a lack of group cooperative learning activities among students; 4. The results on the report card are statistically found: the mathematics scores of the fourth grade of primary school are generally low, and the Chinese scores are generally high. ( http://www.177liuxue.cn/zt/4/3900/)

In order to solve the above four problems, the researcher considered to use the cooperative learning using STAD Technique to improve the mathematics achievement of grade four in primary school. The cooperative learning using STAD Technique is to let students rely on each other, actively discuss and explore, share and communicate. Many countries are experimenting with cooperative learning using STAD Technique, and find that the effect of cooperative learning using STAD Technique is better than traditional teaching methods in the cultivation of students' thinking ability and the lasting time of students' memory. ( Wang Tan, 2019)

Cooperative learning teaching methods can’ t only enrich classroom communication methods, but also cultivate students' communication and cooperation ability. Therefore, cooperative learning teaching methods have been widely used in classroom teaching. It makes the subject consciousness and personality socialization development of students' learning publicized, plays an irreplaceable role in cultivating students' cooperative spirit and communication ability, creates a large space for students' independent exploration and active development, and brings a new atmosphere to classroom teaching.

Decision of the State Council on the reform and development of basic education:

It attaches great importance to cooperative learning, and points out to encourage cooperative learning, promote mutual communication and common development among students, and promote the growth of teaching and learning, actively advocate thelearning methods of autonomy,cooperation and exploration.

In order to meet the needs of basic education reform and meet the new requirements of mathematics curriculum standards, this paper introduces the teaching mode of group cooperative learning in mathematics teaching in grade 4 of primary school, and discusses whether the teaching mode of group cooperative learning can improve the mathematics performance of grade 4 students in primary school.

Therefore, the researcher wants to explore how to use " cooperative learning using STAD Technique" to stimulate primary school students' interest in learning; Improve primary school students' interest in learning mathematics and academic performance. This is a problem that the researcher always care about and hope to solve in teaching. For these reasons mentioned above so the researcher is interested in studying the effect of cooperative learning using STAD technique on mathematics achievement of the fourth grade students in primary schools.

**1.2 Research Questions**

1. 2. 1 How is students' mathematics achievement before and after receiving cooperative learning using STAD Technique?

1. 2. 2 How is the students' mathematics achievement comparing with the determined criteria set at 70% of full marks?

**1.3 Research Objectives**

1. 3. 1 To compare the mathematics achievement of the students before and after learning through the cooperative learning using STAD Technique".

1. 3. 2 To compare the mathematics achievement of students after learning through cooperative learning using STAD Technique with the determined criterion set at 70% of full marks.

**1.4 Research Hypothesis**

1. 4. 1 The fourth grade primary school students' mathematics achievement after learning through cooperative learning using STAD Technique is higher than before.

1.4.2The fourth grade primary school students mathematics achievement after learning through cooperative learning using STAD Technique is higher than 70 percent.

**1.5 Delimitation of theStudy**

1.5.1 Population and sample

The population of this study is 120 students (4 classrooms) in the fourth grade of Xianghe primary school in Zhu madian City, Henan Province, China.

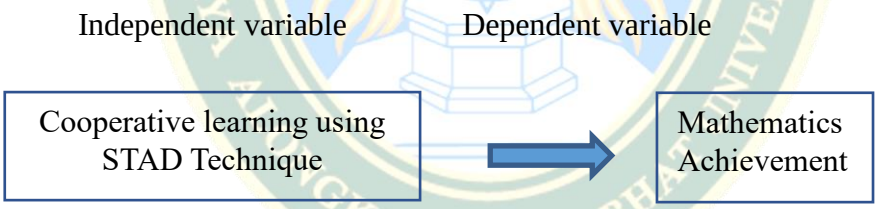
The sample of this study is 30 fourth grade primary school studentsderived from cluster random sampling.

1.5.2 Variables

Independent variable is cooperative learning using STAD Technique Dependent variable is Mathematics Achievement.

1.5.3 Time duration: October-December 2021.

**1.6 Conceptual Framework**




**1.7 Operational Definition**

1.7.1 Cooperative learning refers to the heterogeneous groups composed of 2 ~ 6 students engage in learning activities together and jointly complete the learning tasks assigned by teachers in cooperation and mutual assistance.

The cooperative learning uses the interaction between various teaching dynamic factors to promote learning, and takes the group achievement as the evaluation standard to jointly achieve the teaching objectives".

STAD ( Student' s Team Achievement Division) refers to students learning together in groups which every member is very important. Everyone has equal opportunities to contribute to the overall performance of the group, which reduces the probability of inferiority complex among members with slightly lower performance in the group. Each member should do his best to share the learning tasks, and the performance of each member will effect the overall performance. It is a way of task sharing and group integration. is the most convenient and easy to implement teaching method among the six methods of cooperative learning. Its implementation mainly

includes five processes: 1) Teachers' classroom teaching, 2) group members' formation, 3) members' personal test, 4) calculation of individual improvement points and 5) group evaluation and recognition.

1. 7. 2 Mathematics achievement refers to the examination result of the mathematics test constructed by the researcher. Students' mathematical achievements include basic mathematical knowledge and skills, mathematical consciousness ( including number sense, symbol consciousness, spatial concept, statistical concept and application consciousness), mathematical ability ( mathematical thinking ability, mathematical understanding ability, mathematical communication ability and problem-solving ability).

In the test of mathematical achievement, we can test through three aspects: knowledge test, skill test and attitude test. The test of knowledge is the test of cognitive field. The test of cognitive field includes the following aspects: memory, understanding, application, evaluation and creation. (Gasky , 1992)

**1.8 Practical Application**

1. 8. 1 This study provides a teaching and learning method for improving primary school students' mathematics achievementeffectively.

1.8.2 Teachers can use this innovation to help students learn Mathematics in class efficiently.

# CHAPTER 2
# REVIEW OF LITERATURE

This study takes 120 fourth grade students of Xianghe primary school in Zhumadian City, Henan Province as the research object, and makes a literature review on the cooperative learning using STAD technique.

## 2.1 Basic information

The literature review of this study aims to explore the impact of cooperative learning using STAD technique on the mathematics performance of fourth graders in primary school. The research site is located in Xianghe primary school, Zhumadian City, Henan Province.

This chapter covers the following topics:

2.1.1 Course information

Primary school mathematics is the key starting stage of mathematics learning. The introduction of addition, subtraction, multiplication and division will have a far-reaching impact on students' further learning in the future. In teaching, our school adopts the 11th set of primary and secondary school textbooks published by the people's education press. The textbook is based on the mathematics curriculum standard for compulsory education (2011 Edition), which has been comprehensively and systematically revised and absorbed the opinions and suggestions of teachers. In the past decade or so, students and the community have paid attention to textbooks. I teach mathematics in the fourth grade of primary school, including: mixed operation of addition, subtraction, multiplication and division, understanding of rays and straight lines, understanding of parallel lines, travel problems, etc.

2.1.2 School information

The study will be conducted at Xianghe primary school in Zhumadian City, Henan Province. The primary school was established in 1965, covering an area of more than 20 acres, with 18 classes, 780 students and 36 teachers.

2.1.3 Student information

The sample of this study is 30 students from he Fourth grade students of Xianghe primary school in Zhumadian City. In this class, many children don't like the subject of mathematics. They feel that the process of learning mathematics is very boring. They feel that teachers are forcing them to instill knowledge. They have no right to take the initiative to choose. They can only be forced to accept it in the learning process. They regard learning mathematics as a burden. Therefore, I want to introduce cooperative learning using STAD technique into teaching to help students improve their learning interest and autonomous learning ability, so as to improve their mathematics performance.

**2.2 Independent variable: Cooperative learning using STAD Technique**

2.2.1 Principle, Theory of cooperative learning using STAD Technique

(1) Group dynamics theory

Kurt Lewin (1939) noted that "the theory of group dynamics is to regard the group as an organic whole of psychology, so as to study the overall level of the group or the potential driving force of social behavior".

Group refers to people who have a common purpose with each other, combine with each other in a certain way to achieve the purpose together, help each other and inspire each other, and have a common sense and emotional connection in psychology. Group cooperative learning is to divide the students into several groups, each group has more than two members, so the "group"in group cooperative learning is a small group. Group dynamics theory has five basic contents, including group cohesion, group pressure and group standard, individual motivation and group goal, leadership and group performance, and group structure. From these five aspects, we can know that the performance of the whole group is closely related to the performance of each member, and the group composed of members will gain greater motivation and achievements. Group dynamics shows that when the task of group activity is easier to solve, the activity efficiency of homogeneous grouping is higher; However, when the task is difficult, the activity efficiency of heterogeneous grouping is higher. So we will adopt the principle of "heterogeneity within group, homogeneity between groups"in group cooperative learning. Group cooperation can make students and students have a common goal, promote group cohesion, each member for the overall honor and hard thinking, struggle. The meaning of group motivation explains why each member of group cooperative learning can get the harvest, so that more students and teachers are convinced. In a certain teaching content, group cooperative learning will be more meaningful and effective than allowing students to think for themselves and teachers to teach unilaterally. (Kurt Lewin, 1939)

(2) Humanism theory

The representatives of humanism are the famous American psychologist Rogers and social psychologist Maslow, which rose in the late 1950s and early 1960s, and developed rapidly in the 1970s. Rogers ( 1960) noted that " student-centered" teaching concept. When teaching, teachers should always remember the " status" of students in the classroom. Teachers are just the guides and lecturers of knowledge. Students' learning is influenced by their own factors and the external environment, of which the selffactors are more important. Therefore, students' thinking and Practice on their own, enthusiasm and enthusiasm for learning will be better than teachers' direct "irrigation". STAD teaching mode, most of the time to the students, so that students in the mathematics classroom in the central position, fully show their own abilities and ideas. In cooperation to stimulate students' interest and curiosity in mathematics, break through the old situation that students only accept the teacher's explanation, and find the answer by themselves. At the same time, improve

the communication ability of each member, learn to better express their views and ideas. In the process of expressing their own opinions, we can find new ideas and reflect on our own shortcomings in the process of thinking. Therefore, in STAD teaching mode, teachers help to draw knowledge, and students become the master of learning and master knowledge better in the process of communication and listening.

(3) Vygotsky's theory of Social Constructivism

Vygowski (1896-1934) was an outstanding psychologist in the Soviet Union. In his short learning career, under the guidance of Marxist philosophy, he founded a famous school of social, cultural and historical studies, and was recognized as the pioneer of social constructivism and situational learning theory in today's learning theory. Vygowski spent his life studying the problem of psychological development, focusing on the occurrence and development of people's advanced psychological function. He emphasized the important role of human social culture in people's psychological development and believed that people's high-level psychological function was formed and developed in people's activities and realized with the help of language. Vygowski, A.H. leontsev and A.P. lulia formed a very influential school of cultural history - "villeru school".

1. Theory of cultural and historical development and psychological development

Vygowski analyzed the essence of psychological development from the perspective of genealogy and individual development, and put forward the theory of cultural and historical development, so as to explain the social and historical problems of human advanced psychological function.

Vygowski distinguishes two kinds of psychological functions: one is the low-level psychological function obtained by animal evolution, which is the characteristics of individual early interaction with the outside world in a direct way, such as basic perceptual processing and automatic process; The other is the advanced psychological function obtained from the historical development, that is, the psychological function mediated by the symbolic system, such as the fine processing of memory, random attention, will and so on. Advanced psychological function makes human psychology essentially different from animals. Compared with animals, human psychology is not only an increase in quantity, but also a change in structure, forming a new quality consciousness system. In the process of individual psychological development, these two functions are integrated. Advanced psychological function is restricted by the law of social and historical development. Therefore, to study children's psychological development, we must investigate the development process of children's advanced psychological function from the social environment, especially the structural changes. He also put forward the famous theory of "two tools", that is, the tool of material production and the tool of spiritual production - language symbol system. The material production tool points to the outside, causing the change of the object; The language symbol system points to the interior and affects people's psychological

structure and behavior. Due to the use of tools, human beings have a new way of adaptation, that is, they no longer adapt to nature in the direct way of the body like animals, but in the indirect way of material production. Moreover, human indirect experience, that is, social and cultural knowledge experience, condenses in human tool production, which makes the law of human psychological development no longer restricted by the law of biological evolution, but by the law of social and historical development.

Vygowski believes that psychological development refers to the process of individual psychology gradually transforming to high-level psychological function on the basis of low-level psychological function under the influence of environment and education. Higher psychological function has a series of characteristics different from lower psychological function: they are random and active; Its reaction level is characterized by generalization and abstraction, with the indirect structure mediated by symbols or words; They are the product of social, cultural and historical development; Psychological activities are personalized, and the formation of personality is an important symbol of the development of advanced psychological function. For the reasons of children's psychological development, he stressed three points: first, the development of psychological function originates from the development of social culture and history and is restricted by social laws. Secondly, from the perspective of individual development, children form various new psychological functions on the basis of low-level psychological functions by mastering the tool of high-level psychological functions - language symbol system in the process of communicating with adults. Thirdly, advanced psychological function is the result of the continuous internalization of external activities.

2. Thinking and language

Language is the core of Vygotsky's cognitive development theory. He believes that people with highly developed language skills can complete complex tasks that illiterate people cannot complete. Because when people learn a language, they are not only learning independent words, but also learning the ideas associated with these words. Language is the medium of development and the tool of thinking. Language enables people to learn from others, gain historical and other people's experience, and provide opportunities to share ideas and refine ideas.

Language is also a tool for social communication and activities. Due to social communication, culture can be shared and transmitted. Therefore, vygowski emphasizes the guidance and communication of adults to children, and also emphasizes the cooperation between children and peers through dialogue in games and classroom situations.

Language is also a tool for reflection and regulation of one's own thinking. Vygowski believes that the kind of "self talking" and seemingly aimless "grunt" is actually the beginning of an individual's internal speech. It will gradually be internalized and become the basis of complex cognitive skills, including maintaining

attention ("it seems that this is very important, I have to be more careful") Memorize new information ("repeat it several times, I can remember this phone number") and problem solving ("what should I do, first let me read the problem again"). Therefore, students should be encouraged to use vocal thinking when solving problems.

3. Recent Development Zone

With regard to the relationship between teaching and development, vygowski put forward the concept of nearest development zone. He believes that in order to achieve results, teaching must consider the existing level of children and be ahead of children's development. Therefore, when teaching, teachers must consider two development levels of children: one is the current development level of children; the other is the higher problem-solving level that can be achieved under the guidance of others, especially adults. The gap between the two is called the recent development area. The recent development zone not only provides students with the possibility of development, but also provides teachers with the reality of teaching. The interaction between teaching and learning promotes development. There are individual differences and situational differences in the nearest development area. Different individuals and different situations will have different areas of recent development.

In order to promote the development of teaching, in Vygowski's view, teachers can use teaching support, that is, to give support and guidance when children try to solve problems beyond their current knowledge level, so as to help students pass through the nearest Development Zone smoothly and finally complete their tasks independently. Scaffolding Teaching can be adopted in the following ways: dividing the contents of students' learning into many pieces that are easy to master, demonstrating the skills to be mastered to students, and providing suggestive exercises. It should be noted that the support and help provided by teachers should be appropriate. If there is too much help, students' independent thinking and operation ability can not be fully developed; if help is not enough, students may be discouraged by failure.

2.2.2 Definition of cooperative learning using STAD Technique

(1) Definition of cooperative learning

Gasky (1992) a professor at the University of Kentucky and the main representative of cooperative mastery learning theory, has made a more specific elaboration on cooperative learning. He thinks that cooperative learning is a kind of teaching form and teaching strategy in essence. Two to six students form heterogeneous groups to engage in learning activities together and complete the learning tasks assigned by teachers in cooperation and mutual assistance.

In his book "the concept and implementation of cooperative learning", Wang Tan (2002) noted that "cooperative learning is an activity that takes learning group as the basic form, systematically uses the interaction between various teaching dynamic factors to promote learning, and takes the group performance as the evaluation standard to achieve the teaching objectives together".

Even though the definition of cooperative learning is different in different countries, its characteristics and connotation coincide. Cooperative learning is to let students rely on each other, actively discuss and explore, share and communicate in a structured space environment. Many countries are experimenting with cooperative learning, and it is found that the effect of cooperative learning is slightly better than ordinary teaching methods in the cultivation of students' thinking ability, the lasting time of students' memory, and the adaptability of variant problems. The general methods of cooperative learning include: student teams achievement divisions(STAD), teams games tournaments (TGT), Jigsaw puzzle(Jigsaw), learning together (LT),Group investigation (GI),Structural approach (SA).

(2) The definition of cooperative learning using STAD technique

STAD (student's team achievement Division) is translated as the division of learning group achievements, the division of student group achievements or the sharing of group achievements. It was founded by Professor Slavin of Johns Hopkins University and his colleagues in 1978. In S-T-A-D, every member is very important, and everyone has equal opportunities to contribute to the overall performance of the group, which reduces the probability of inferiority feeling of the members with lower performance in the group. Each member should try his best to share the learning task, and the performance of each member will affect the overall performance, which is a way of task sharing and group points. STAD is one of the six teaching methods of cooperative learning, which is the most simple and easy to implement. Its implementation mainly includes five processes: Teachers' classroom teaching, group members' formation, members' personal test, personal improvement score calculation, group evaluation and recognition. (R. E. Slavin, 1978)

Teachers in their own classroom teaching link, should pay attention to the focus of classroom content on the chapters, so that students can quickly understand the main content of this lesson. Of course, teachers should have an appropriate way of explanation to make the classroom lively and interesting, rather than rigid and forceful. Simple can be summarized as accurate vivid detailed. STAD model group members should not be too many, according to the actual number of class to adapt, such as 43 people in the class, can be divided into six groups of six and one group of seven; The number of the class observed by the researchers was 48, so they were divided into eight groups of 6. Before forming a group, teachers should try their best to understand the basic situation of each student. The group should be divided according to the principle of "mutual quality within the group and homogeneity between groups". Generally speaking, each group should have both good and poor students, with gender differences; At the same time, we should not only have students who are outgoing and good at expressing themselves, but also have students who are introverted and shy and not strong in expressing themselves. We should strive to embody the miniature of the class in the composition of each group. Teachers assign tasks, each group cooperate to complete, and ensure that all members have mastered

the knowledge. During the group discussion, the teacher should step down from the platform to observe the situation of each group, and ensure that the voice of the group discussion cannot affect others too much. The individual test is no longer allowed to discuss, and each student in the class completes it independently, which can ensure that each student can concentrate on the teacher's teaching and group discussion, and effectively reduce the "free riding" phenomenon. In order to improve the score of the group as a whole, each student will also ask questions to the members of the same group where they don't understand and get answers, so as to really master knowledge points. Teachers should correct students' test papers in time, so that students can find their own problems and reflect on them. The group recognition and reward stage is based on the calculation of the improvement score of each group member and the overall performance of the group, to praise and award the group with good performance, such as pen, notebook and other prizes, can also be a certificate. (Zhou Shuhong, 2017)

2.2.3 Teaching process of cooperative learning using STAD Technique

The teaching process of cooperative learning using STAD Technique can be divided into four links and three stages:

(1) Four links

The concrete steps of STAD cooperative learning mode mainly include four links: classroom teaching group activities independent test group recognition. Based on the current situation of research, this paper combines STAD with teaching practice, adjusts it into eight links, and constructs a primary school mathematics cooperative learning model based on STAD, as shown in the figure below:

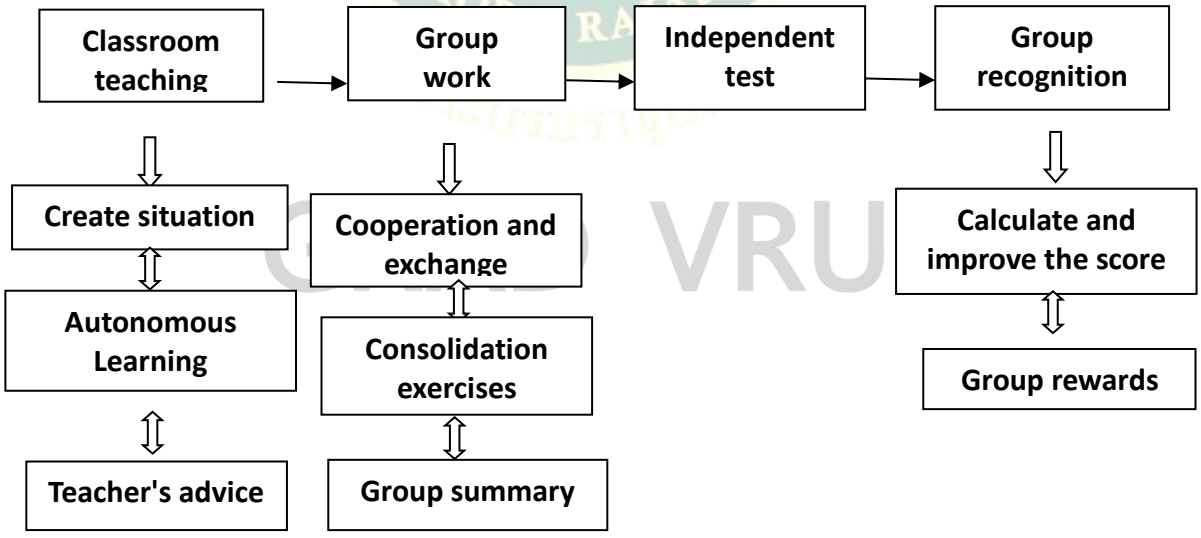



**Figure 1** Four links of STAD cooperative learning model

As shown in the figure above: Flow chart of cooperative learning mode based on STAD. (Wang Tan, 2002)

(2) Three stages

The three stages include: preparation before class, implementation in class and evaluation after class.

1. Preparation class before

In order to reduce the workload of the group leader and satisfy the psychological needs of individual members to help the class and group make contributions, the division of roles within the group should be diversified. Teachers should divide the roles within the group, assign the students to the roles suitable for their own situation as far as possible, give full play to their strengths and repair their weaknesses. First of all, the group should set up a disciplinarian, in class, if you find a companion wandering, you can remind, in the group discussion to control the overall situation, to prevent confusion, orderly. You can also set up a recorder to record the students' Thoughts on the questions, and record the people who answer the questions, so as to ensure that each student in the group has the opportunity to express themselves in the class. This not only makes every student get exercise, but also ensures fairness and justice, reducing the possibility of individual students relying on team members.

2. Classroom implementation

(A) Strengthening classroom order management

Whether in class or self-study, classroom order is very important. A good classroom atmosphere and quiet and orderly classroom will create a suitable learning environment for students. The teacher's control of the classroom is an important factor for a good class. The teacher should look around the classroom. If he finds that he has taken the opportunity to stray, he should stop and severely criticize him. After class, the teacher should talk to the students who speak loudly and disturb the order, let the students think in another position, and patiently point out the influence on other groups. Try to let students find their own shortcomings, gently encourage students to correct, then observe for a period of time, if there is progress can be appropriate praise.

(B) Emphasis on the cultivation of collective consciousness

Teachers should emphasize collective consciousness in class meetings, after class activities and class competitions, such as holding class meetings about collective at the beginning of school, using small stories to reason, so that students can gradually enhance their collective consciousness. In the group formation, the selection of the group leader should take the personality factor into account. Its function is to pay attention to the students who are lagging behind in their grades to participate in the discussion, and guide the introverted and shy students. The advantage of STAD mode is to strengthen the communication ability at the same time of learning, so as to become more excellent middle school students who are good at expressing their own

ideas. Class activities after class are also a good opportunity to cultivate students' collective consciousness. Teachers can organize students to participate in the "six Leggings race". In the race, everyone must walk in a uniform pace in order to succeed. One person running too fast or too slow will make all six people wrestle, so that students can feel and discover the importance of team.

(C) Efficient use of classroom time

After the teachers ask questions, the team leader should make reasonable arrangements for the tasks, so that each team member can play their own role. Fourthly, in the speaking stage of group representatives, teachers should make good use of their own teaching language. As far as possible to ensure that students can explain different problem-solving methods, the same or similar ideas can't be answered. Teachers can use "do other students have different methods?"“ It's a good idea to think from unknown directions. Is there any other way to think? " To improve the efficiency of the classroom and effectively avoid the time lost by similar ideas. In the group Question and answer session, members of the group can help each other instead of asking the group leader. For example, the group leader of group 8 is set to No. 1. When No. 4 asks for help from No. 1, No. 6 can also ask for help from No. 2. After No. 4 asks, No. 3 asks again. Try to ensure that the problems of team members can be solved within the time given by teachers.

3. After class evaluation

After class evaluation, it is suggested to increase group mutual evaluation. While rewarding the group with the greatest progress and the best performance, teachers can also pay attention to the students with excellent performance. Excellent performance can be reflected in many aspects, so you can choose a theme for half a month to praise. For example, this time you can praise the students who are most active in helping members in the group, and next time you can praise the students who are most progressive in the group. Because many real situations are that teachers can't observe them one by one, they can choose by voting and mutual evaluation within the group. In this way, students can be encouraged to continue to work hard, and will not feel lost because they have not been rewarded by the group. At the same time, other students are encouraged to solve the doubts of their team members; and let the students who are slightly behind have more motivation. When students are in the stage of adolescence, it is the easiest time to develop their habits and qualities. Teachers should praise and encourage them more, so that students can develop in a better direction.

2.2.4 Role of teacher and learner in cooperative learning using STAD Technique

STAD Teaching mode, most of the time, the students occupy the central position in the mathematics classroom, and fully show their own abilities and ideas to implement cooperative in specific teaching practice, teachers need to be prepared in all aspects. The first is the change of teachers' role. For teaching, teachers' role is very

important, especially for cooperative learning. Teachers need to improve their quality in all aspects, which is the premise of teaching and the basis of cooperative learning. Therefore, we can analyze the teacher, an important subject in the process of cooperative learning.

There is no doubt that the mode of cooperative learning is scientific and effective, but how to implement the cooperative teaching mode, the key lies in the guidance of teachers, students are the main body, teachers are the leaders. If teachers only learn the teaching experience of cooperative learning mode under the call of the higher authorities, rather than from the bottom of their heart to change the classroom situation, teaching will often become a mere formality and fail to achieve the desired effect. In other words, if the teacher's role is only an imitator, rather than an active participant, creator, it will often play a multiplier effect. For the teaching strategy system of cooperative learning, which is rich in content, "it may take a year for a teacher to gradually become a mechanical user of cooperative learning, and it will take at least two years to become a stable regular user of cooperative learning. Such a long process, if there is no enthusiasm for teachers to take the initiative to create, will soon make the implementation of cooperative learning halfway, thus reduced to a form. In fact, such a situation is not uncommon in the cooperative learning classroom since the implementation of the new curriculum. For example, when the students are in the state of cooperative learning, some teachers tour between groups aimlessly, like a bystander. In addition, when the students are enthusiastic and energetic, in order to complete the teaching progress, the teacher interrupts the students' cooperative discussion, and the cooperative learning time is less than 3 minutes. Obviously, cooperation is not over, and students are still in the process of active exploration. Such cooperative learning can't form students' good habit of autonomous learning, on the contrary, it will frustrate students' enthusiasm for learning, and break the atmosphere of autonomous and cooperative learning that students have just realized. Such cooperation is a form of cooperation without any value. The main reason for these problems is that some teachers are not clear about the concept of cooperative learning, or do not make a deep discussion, just feel that others have, if not, they will be backward, blindly introduce cooperative learning into the classroom, and have little theoretical understanding of the background and application scope of cooperative learning. As a result, no matter whether the classroom time is needed or not, they move in all at once. They always feel that they use the form of cooperative learning anyway. As for the effect, they don't care. They simplify and vulgarize cooperative learning, which leads to a large number of ineffective cooperation in the classroom. A large part of these phenomena are caused by the improper role of teachers. Teachers' traditional teaching concept has not been liberated. To say, cooperation is also cooperative learning covered by traditional teaching concept.

Glas (1988) noted that "control theory tells us that teachers can't force any students to do what they don't want to do. It's always difficult to force students to

learn. Only by creating conditions to meet the needs of students for their sense of belonging and influence, can they feel that learning is meaningful, willing to learn and learn better. "

That is to say: only willing to learn, can we learn well. Similarly, the smooth and effective implementation of cooperative learning in the classroom is inseparable from teachers' active participation in the classroom reform and effective correction of classroom problems in the process of reform, rather than just passive imitation. Without the creative application of the teaching mode, teachers can easily become "teaching materials" instead of "teaching students". It is difficult to avoid closed, mechanical, stereotyped and stylized teaching. It is difficult to avoid teachers' monologue. It is impossible to take into account the unique life performance of students and the very personalized problems raised by students, Students' rich spiritual life, independent communication and personality display in the classroom will be greatly limited. As a teacher, we should take the initiative to find and solve problems, and create suitable teaching methods according to our own teaching practice.

In addition to having a correct understanding of the connotation of cooperative learning, teachers also need to reconstruct their roles in the classroom. When individual students do not participate in communication seriously, do things unrelated to cooperative learning, or individual groups do not communicate seriously, teachers will guide them in time, and then make clear requirements to ensure that the cooperative learning of the group is carried out smoothly, and pay more attention to the group in the next cooperation activities; When the students are not clear about the task of the group, the teacher should patiently explain the content and operation procedure of the task to the students repeatedly; When the group discussion deviates from the theme or the discussion is blocked, the teacher should guide and inspire the students in time, open up the students' thinking, and make the discussion of the problem continue to deepen; When the group completes the task ahead of time, the teacher should check whether they have completed the task correctly. If they have really completed the task, they should organize them to carry out some spare activities, such as helping other groups to complete the task. It is the teacher's continuous guidance in the classroom that makes the students' sense of cooperation and effectiveness more and more obvious. In fact, the success of cooperative learning is inseparable from teachers' guidance and participation. When students carry out cooperative learning, teachers are not more relaxed, but take on greater management and control responsibilities. In the process of students' group cooperative learning, teachers should adopt a friendly and suggestive attitude and behavior. They should not only interfere with the process and results of students' thinking, but also can't stand idly by the difficulties and questions of students. If there is no effective organization of teachers, no teachers' guidance and promotion according to the situation, it is difficult for students to grasp the problem at a higher level due to their

own level. Such cooperation is bound to be disordered and inefficient. Therefore, in group cooperative learning, teachers should not be the hegemonist or the bystander, but should actively participate in group cooperative learning, become the motivator of learning process and the regulator of classroom structure, so as to achieve the teaching effect of student interaction, teacher-student interaction and harmonious development.

2.2.5 Synthesizing of independent variable innovation

Based on the theory of cooperative learning of STAD, the cooperative learning theory is combined with the classroom practice of basic education in China, which provides a feasible model for the specific practice of the method of cooperative learning of STAD. The teaching steps are as follows:

1. Guide students to improve their understanding of cooperation

(1) Teachers should tell students: in today's society, personal needs must be connected with others. The social environment is that you have me and I have you. We all live together. Therefore, we should emphasize the importance of cooperation in order to improve students' understanding of the current mathematics cooperation group. Realize that our group cooperative learning is not in the form, nor just to improve the mathematics achievement, but also to consider the activities carried out for the students' diversified ability, especially the communication ability and the ability to assist in the cultivation. The most needed talents in the 21st century: innovation practitioners; Cross domain synthesizer; The high EQ co author, EQ includes how to cooperate with people, including a kind of self-consciousness, including a kind of management of oneself, also includes the ability of unity and cooperation with others and social communication; Efficient communicators, a person with good communication ability, can spread a very difficult information to others. One person has poor communication ability, and he cannot communicate information. Therefore, others may despise him and think he has no ideas. So communication ability is very need to learn; Love workers; Active; The optimistic. It can be seen that students who need to study carefully in the 21st century need more innovative and practical talents; It needs the expertise of each department, but it needs the interdisciplinary synthesizer; People with high IQ are needed, but more people with high Eq. The model of mathematics cooperative group learning is conducive to the cultivation of this kind of talents.

(2) Encourage students to perform well in group cooperative learning with the wisdom of celebrities. Some American scholars have studied that: reading things are transformed by 10%, listening to things into 20%, seeing things transforming 30%, combining seeing and listening can transform 50%, and discussing with others can transform 70%. If you experience them yourself, 80% can be converted into yourself. However, if you can teach others what you know, you can learn from others, It can be converted into 90 percent of it. In this way, we can eliminate some students' misconceptions, think it is their own loss or waste time to give others a lecture, so that they realize that teaching is double learning.

(3) Fully mobilize the students who have been admitted to the group to participate in cooperative learning. The group establishment has given the students more opportunities to help them to establish their self-confidence in learning. The group's bundled evaluation makes them realize their importance and urge them to show their good performance as a group to win glory.

2. Give effective cooperation method guidance

(1) Ask students to be civilized listeners and learn to listen. When speaking in the group, students should listen carefully to and think about whether the speaker is reasonable. If there is any doubt or different opinions, it is impolite to wait for the students to make a speech after they have finished. It is impolite to interrupt others' speech at will.

(2) Help students learn to speak to serve people rationally. In the process of group cooperation, we should pay attention to explain the reasons for the conclusion, but not just what the result is, learn to explain the problems with the concepts, properties, laws, theorems, mathematical thought methods and so on, pay attention to the explanation of the problem solving process, and try to tell the source of the solution method as far as possible.

(3) Remind students to speak more polite words, be humble and respectful. For example, in the process of group cooperative learning, more use of the Group partners: "sorry, excuse me, I don't think so. The reasons are as follows, thank you and other words", to observe and learn the advantages of others. The group and the group should also appreciate each other and compete fairly.

2.2.6 Lesson plan writing

Through the presentation and analysis of the three class observation cases of new teaching, exercise class and review class, we can know that teachers have different time setting and link arrangement in different classes. Based on the five basic processes of the STAD cooperative learning model, the paper gives more detailed implementation suggestions for the three classes of new teaching, exercise class and review class.

The new teaching links are: situation introduction, asking questions, intra group communication, inter group communication, intra group, personal testing, calculation of team member improvement score, group improvement score and group reward.

New teaching is an important part of learning new knowledge for students. It is necessary to strengthen interest in this link. Teachers should focus on students' exploration of new knowledge and explanation of new concepts, and emphasis on key and difficult points of teaching, because these are also easy to be wrong. Therefore, the new teaching links have been refined. As shown in the figure below:

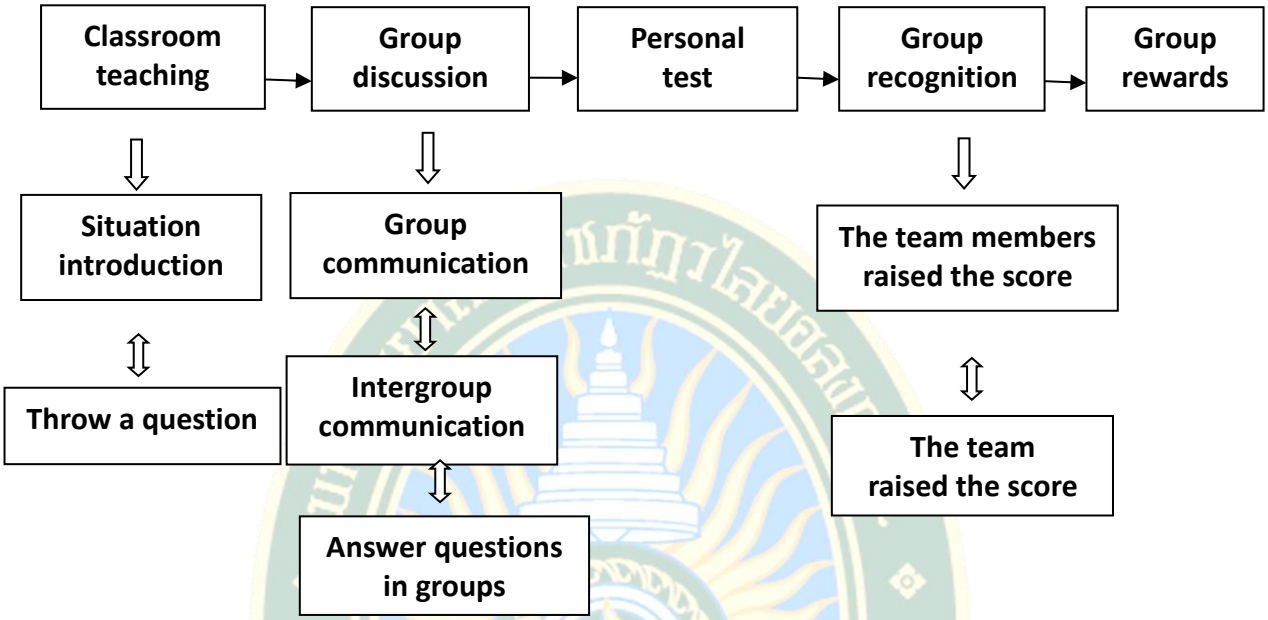



**Figure 2** suggestions for the improvement of new teaching link under STAD cooperative learning mode (Wu Qiong, 2013)

The teaching links of exercise class are: review of knowledge points, explanation of examples, giving out problems, intra group communication, inter group communication, personal testing, improving scores of team members, improving scores of groups, and group rewards.

Exercise class is an important part to check whether the knowledge points are completely mastered and to prompt the students to answer the questions step by step. In this part, students can be given more time to discuss, so that students can explore more ideas to solve problems in this process. The selection and explanation of examples by teachers are also very important. Therefore, the exercise class is refined. As shown in the figure below:

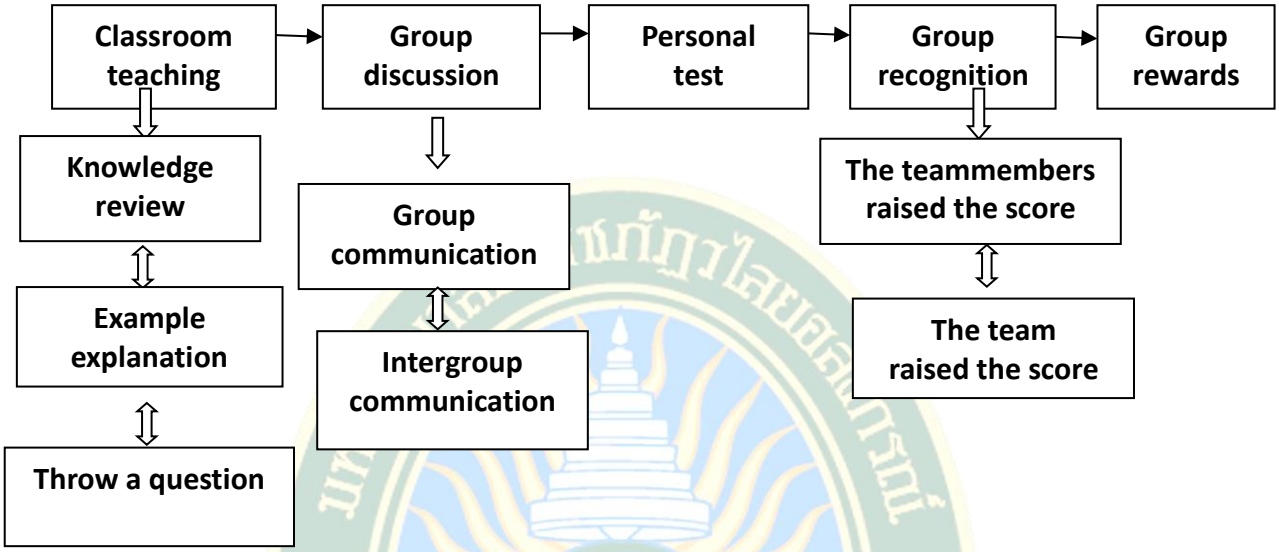



**Figure 3** suggestions for the improvement of exercise class link under STAD cooperative learning mode (Jiang Hui, 2008)

The teaching links of recitation are: review of knowledge points, assignment of tasks, intra group communication, inter group communication, individual detection, improvement of group members' scores, improvement of group scores, and group rewards.

Recitation is the summary of knowledge, correct and teach students where there are problems. The teacher arranges the task, lets the student summarize first. And according to the students' usual homework review situation, will be more mistakes, easy to ignore the important knowledge points forgotten review summary. So the review section is refined. As shown in the figure below:

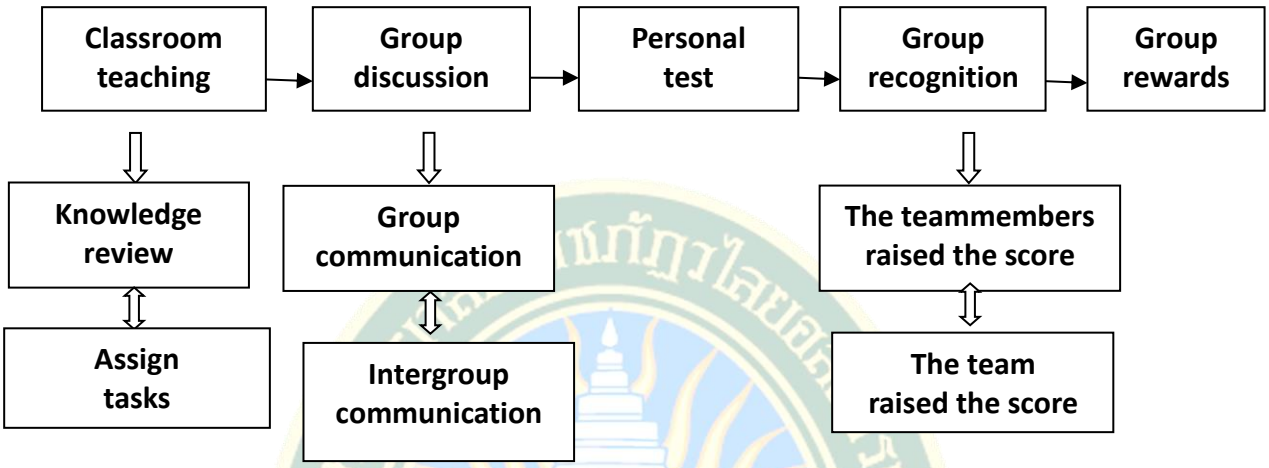



**Figure 4** suggestions for the improvement of recitation link under STAD cooperative learning mode (Zhang Wenyu, 2011)

The new teaching is a new class, which will talk about some new knowledge points;

Practice classes are usually classes that do some exercises or test papers according to the knowledge points after learning some knowledge points;

Review class is a class in which knowledge points have been learned and contacted, and knowledge review is carried out later in order to meet the examination.

The above three different courses are interrelated, because the new teaching needs to be practiced in the classroom. After the new teaching, the content of the first teaching needs to be reviewed and reviewed before the Fourth teaching. The practice class is based on the new teaching. After the teaching, do exercises to deepen the mastery of knowledge points in the new curriculum. And every new course also needs to complete the mastery of the previous course as the fundamental principle. If the previous knowledge can't be understood, the new course will be difficult to carry out.



**2.3 Dependent variable: Mathematics Achievement**

2.3.1 Principle, Theory of Mathematics Achievement

1. Incentive theory

Incentive theory is the theory of how to mobilize people's enthusiasm. It holds that work efficiency and labor efficiency are directly related to employees' work attitude, which depends on the satisfaction of needs and incentive factors.

Incentive theory refers to the process of maximizing employees' commitment to the organization and work through specific methods and management system. Incentive theory is a summary of the principles and methods of how to meet people's

various needs and mobilize people's enthusiasm. The purpose of motivation is to stimulate people's correct behavior motivation, mobilize people's enthusiasm and creativity, so as to give full play to people's intellectual effect and make the greatest achievements. Incentive theory is the theory of how to mobilize people's enthusiasm. It holds that work efficiency and labor efficiency are directly related to employees' work attitude, which depends on the satisfaction of needs and incentive factors. For example, Maslow, an American psychologist, divides people's various needs into five levels: physiological needs, security needs, social needs, respect needs and self realization needs, and believes that people pursue satisfaction according to the level of needs. Therefore, setting goals according to the needs of managers can play an incentive role. In addition, Herzberg, a two factor theorist, divides the factors that affect work attitude into two categories: health care factors and incentive factors. Health care factors include organizational policy, management technology, colleague relationship, salary, working environment, etc. the improvement of these factors can eliminate employees' dissatisfaction. Incentive factors are suitable for personal psychological growth and can mobilize enthusiasm, but only maintain the original efficiency. (Zhang Yan, 2011)

Since the 1920s and 1930s, many foreign management scientists, psychologists and sociologists have put forward many incentive theories based on the practice of modern management. These theories can be divided into behaviorism motivation theory, cognitive motivation theory and comprehensive motivation theory. Motivation theory is the category of management psychology. The early research of motivation theory is the research of "need", which answers the questions of what is the basis, or according to what can motivate employees' work enthusiasm, including Maslow's hierarchy of needs theory, Herzberg's two factor theory, and McLellan's achievement need theory. Maslow's hierarchy of needs theory, which is the most representative, puts forward that human needs have hierarchy, and develop from the lowest needs to the highest needs step by step. According to their importance, needs are: physiological needs, security needs, belonging and love needs, respect needs and self realization needs. When the needs of a certain level are met, the need will stop its incentive function. The process school of motivation theory holds that there is a process to achieve the goals of an organization by meeting people's needs, that is, it needs to influence people's needs by setting certain goals, so as to stimulate people's actions, including Fromm's expectation theory, Locke and Hughes's goal setting theory, Porter and Lawler's comprehensive incentive model, Adams's equity theory, and the theory of motivation Skinner's theory of reinforcement, and so on.

2. Hierarchy of needs theory

Abraham Harold Maslow (1943) noted that "Hierarchy of needs theory", He divides the complex needs of human beings into five levels: physiological needs, security needs, friendship and belonging needs, respect needs and self-realization needs. In 1954, Maslow developed the human needs into seven levels from the low to

the high level in the book "motivation and personality": the physiological needs, the safety needs, the needs of friendship and belonging, the needs of respect, the need for knowledge, the need for beauty and the need of self realization.

Maslow believes that only when the low-level needs are partially satisfied can the high-level needs become an important determinant of behavior. The seven needs rise in order. After the needs of the next level are basically satisfied, the pursuit of the needs of the next level becomes the driving force of behavior. However, the gradual rise of the level of needs does not follow the rule of "all" or "None", that is, one needs to be 100% satisfied before another needs to appear. In fact, under normal circumstances, most people in the society have their basic needs partially met.

Maslow divides the seven basic needs into high and low levels. Among them, physiological needs, security needs and social needs belong to low-level needs. These needs can be met through external conditions, such as meeting physiological needs with the help of wage income and meeting security needs with the help of legal system. The needs of respect and self realization are high-level needs, which are satisfied from the inside, and a person's needs for respect and self realization will never be fully satisfied. The high-level needs are more valuable than the low-level needs, and the structure of human needs is dynamic and developing. Therefore, it has a more stable and lasting force to mobilize the enthusiasm of production by meeting the senior needs of employees.

This is the motivation theory put forward by psychologist Maslow. According to this theory, human needs can be divided into five levels

(1) Physiological needs - the necessary physical needs for human survival.

(2) Safety needs - to protect the body and mind from harm.

(3) The needs of belonging and love -- including feelings, belonging, being accepted, friendship and other needs.

(4) The need of respect includes internal respect, such as self-esteem, autonomy, sense of achievement, and external respect, such as status, identity, and being valued.

(5) The need of self realization includes the need of personal growth, exerting personal potential and realizing personal ideal.

3.Objective management theory

Management by objectives is to set goals according to people's needs, combine organizational goals with personal needs as much as possible, so as to stimulate motivation, guide people's behavior, and complete the overall organizational goals.

The theory of management by objectives is a goal incentive scheme put forward by Peter Drucker, a modern management master, according to the theory of goal setting.

It is based on the goal setting theory in the goal theory. Management by objectives emphasizes the participation of organizations and groups to specify specific, feasible and objectively measurable goals. It is a set of management system based on Taylor's theory of scientific management and behavioral science management.

Management by objectives regards people as "social people" and believes that people do not just survive for bread. Besides material conditions, there are also social and psychological factors that affect people's enthusiasm for production. Work efficiency mainly depends on the morale of employees, which in turn depends on family and social life, as well as the relationship between people in enterprises.

From the assumption of "social man", MBO requires managers to take trust management measures to their subordinates

(1) Managers should not only pay attention to the completion of production tasks, but should focus on caring for people and understanding their needs.

(2) Managers should not only pay attention to planning, organization, command and control, but also pay more attention to the relationship between employees, and cultivate and form the sense of belonging and integrity of employees.

(3) When implementing the reward system, we should advocate that the collective reward system is more important than the individual reward system, and positively guide the employees to achieve the goal and strive for the collective honor through competition.

(4) Managers should fully trust their subordinates, often listen to their opinions, implement "participation management", and let them participate in the research and lectures of work objectives and realization methods to varying degrees, so as to improve their awareness of the overall objectives and strengthen their sense of responsibility, so as to implement "self-control" and "self-management". The task of managers is to give full play to their work potential, and explore the wisdom and creativity existing in them

4. Bloom's taxonomy of educational objectives

Bloom's classification of educational objectives is a classification method of education. Educational objectives can be divided into three areas: cognitive field, emotional field and motor skill field.

Classification of educational objectives:

4.1 Cognitive domain

4.1.1Knowledge

It means knowing and remembering. This level involves the identification of specific knowledge or abstract knowledge, and recalls this concept or phenomenon in a form very close to the concept and phenomenon that students first encountered.

Tips: recall, memory, recognition, list, definition, statement, presentation

4.1.2 Comprehension

It refers to the understanding of things, but it does not require a deep understanding, but preliminary and may be superficial. It includes "transformation", interpretation, inference, etc.

Tips: description, identification, description, explanation, difference, restatement, induction, comparison

4.1.3Application

It refers to the application of the concepts, rules and principles learned. It requires learning to correctly apply abstract concepts to appropriate situations without explaining the problem-solving model. The application mentioned here is a preliminary direct application, not a comprehensive, analytical and comprehensive application of knowledge.

Tips: application, demonstration, operation, practice, classification, examples and solutions

4.1.4 Analysis

It refers to the decomposition of materials into its constituent elements, so as to make the relationship between concepts clearer, the organizational structure of materials clearer, and clarify the basic theory and basic principles in detail.

Tips: analysis, inspection, experiment, organization, comparison, comparison, discrimination, difference

4.1.5 Synthesis

It is based on analysis to comprehensively process the decomposed elements and re combine them into a whole as required, so as to comprehensively and creatively solve problems. It involves activities such as characteristic expression, formulating reasonable plans and implementable steps, and launching some laws according to basic materials. It emphasizes characteristics and initiative, which is a high-level requirement.

Tips: composition, establishment, design, development, planning, support and systematization

4.1.6 Evaluation

This is the highest level of educational objectives in the field of cognition. The requirement of this level is not to judge by intuitive feelings or observed phenomena, but to make a persuasive judgment on the value of the essence of things rationally and deeply. It integrates internal and external data and information to make inferences in line with objective facts.

Tips: evaluation, estimation, comment, identification, identification, defense, proof, prediction, prediction, support

The cognitive domain was revised by Anderson and Krathwohl together with a group of cognitive psychologists and educators in 2001. The revised version includes: Rember, Understand, Apply, Analyze, Evaluate and Create.

4.2 Affective domain

The teaching goal of affective domain, led by Krathwohl Dr, was put forward in 1964, which is divided into five levels:

4.2.1 Accept

4.2.2 Reaction

4.2.3 Form values

4.2.4 Organizational value system

4.2.5 Personalization of value system

4.3 Psychomotor domain

Bloom was only aware of the existence of the field of motor skills when he created the educational goal, and did not formulate the specific goal level. In 1972, Simpson EJ proposed that the teaching objectives in the field of motor skills can be divided into seven levels:

4.3.1 Perception

4.3.2 Set

4.3.3 Guided response

4.3.4 Mechanical action

4.3.5 Complex explicit reaction

4.3.6 Adapt

4.3.7 Innovation

2.3.2 Definition of Mathematics Achievement

Mathematics achievement, broadly speaking, It is the test result of mathematical logic ability. Narrowly speaking, it refers to mathematics learning achievement, that is, the score of examination. Achievement is a result, which represents the past and is the general evaluation of the past mathematics learning activities.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 literacy, 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.

2.3.3 The importance of Mathematics Achievement

Mathematics is a subject that studies the concepts of quantity, structure, change and spatial model. Through the use of abstraction and logical reasoning, it can be understood as a necessary way for human logic training.

Mathematics, as the expression of human thinking, reflects people's aggressive will, careful reasoning and the pursuit of perfect state. Its basic elements are: logic

and intuition, analysis and reasoning, generality and individuality. Although different traditional schools can emphasize different aspects, it is the interaction of these opposing forces and their combined efforts that constitute the vitality, usability and lofty value of mathematical science. (Rogers , 1960)

2.3.4 Components of Mathematics Achievement

In the test of mathematical achievement, we can test through three aspects: knowledge test, skill test and attitude test. The test of knowledge is the test of cognitive field. The test of cognitive field includes the following aspects: memory, understanding, application, evaluation and creation.(Gasky , 1992)

In this research, Mathematics score is composed of three parts: final examination paper score ( 70% ), usual test score ( 20% ), class performance score (10%). (Wang Jun, 2019)

2.3.5 Development/construct the Mathematics Achievement

STAD is a model of cooperative learning, which mainly includes five processes: Teachers' classroom teaching, group members' formation, members' personal test, personal improvement score calculation, group evaluation and recognition.

Group activities

The specific process of group activities is that the team members jointly complete two learning sheets issued by the teachers. In the group learning process, the teacher must clarify the rules of group activities to the students. The group activities require the group members to learn two learning sheets, one knowledge sheet and one homework list issued by the teachers. The distribution of knowledge sheet is to facilitate the group members to have knowledge-based in the exchange and discussion, give full play to their own initiative and help the students with difficulties to complete the answers to the questions. Students can explore and solve a specific problem through two learning lists, or carry out practical operation on a specific operation. In the process, we should pay attention to several points: the team members should ensure that all members of the group have mastered the knowledge points; The principle of the end of group activities is that all the group students have met the requirements of the activities; When the group members encounter problems, they should give priority to asking questions and solving them. If they encounter problems that cannot be solved by the group members, they can report to the teacher; Group discussions should be kept as low as possible to avoid affecting the activities of other groups. The whole group activity can reflect the independent ability of the group members, whether the team members can complete the task list learning without the need of teachers, but also reflect the students' cooperation ability. How the team members can help other members of the group to master the corresponding knowledge through reasonable communication. The most important thing about the whole activity is how the team members can help all members of the group achieve

the goal of the activity through their best efforts. In group activities, teachers should try to participate in them and guide them well.

Group test

After the group's activities are over, the teacher will take a test on each student in the class. In the test, teachers can test the students' knowledge points by a test paper or exercise question. Unlike group activities, in this process, the team members will no longer cooperate. Teachers must make this clear to students, and ensure that the team members can make all members of the group understand knowledge to a certain extent through efforts, and can cope with the next test. Students acquire knowledge through new teaching and group activities, and reflect the degree of knowledge mastery in the test.Teachers should give students enough time to complete the test papers independently, so as to ensure that the test paper can fully reflect the students' knowledge and understanding of the problems. After the test, the test paper can be reviewed by teachers or exchanged by different groups. Because the answer to the test paper is unique, it is difficult to read, and the examination will not take too much time. The final evaluation of success is based on the group. Therefore, this link will remind students to help each other as much as possible and actively participate in the mutual education activities (Jiang Hui, 2008).

Group evaluation

In the final evaluation, that is, the group approval.In this link, teachers can choose a variety of evaluation methods, such as calculating the total score of the group, the average score of the group, the variance of the group, etc. In the guided group cooperative learning model, teachers calculate the difference between each member of the group and the previous test scores, then add the group's improvement scores to get the total score of the group, and divide the number of groups to get the average score of a group, so as to serve as the group's performance. This way of score evaluation can stimulate students to improve their own level and improve the closer relationship between the group members. Teachers can encourage groups by means of item award and certificate issuing. The difference between scores before and after the calculation test does not bring too much work to the evaluation link, but it can reflect the changes of students and groups in the learning process, so as to constantly urge the performance of students and groups in the learning process, encourage students to help the peers of the same group fully grasp the materials issued by the teachers, and achieve the success of the group.

2.3.6 Measurement and evaluation of Mathematics Achievement

The evaluation is based on classroom performance, homework and final closed book examination.In the final closed book examination, the examination content should be set from multiple perspectives, including single choice questions, multiple choice questions, question and answer questions and judgment questions(Zhang Wenyu, 2011).

The detection and evaluation of learning outcomes is a very important part of the implementation strategy of cooperative learning, especially for mathematics. Only by testing can helpstudents grasp the degree of knowledge. How to improve the quality of testing and analysis? Testing can be divided into three types: normal testing, unit testing and phase testing. Usually, the test is a small test after a lesson or several lessons. The unit test is a unit test after each lesson. The stage test is a comprehensive test of several related content and review. The specific method is: for the students' questions, you can test in the group, find out the mistakes, and then focus on the practice in turn. The types of questions in their test papers basically include filling in the blanks, judgment, calculation, application questions and so on, and some exploratory things also appear in their test papers. There are also some students who are difficult to solve the problem, but after all, they have chosen the problem for a long time, and they will discuss how to solve it. In my own papers, in order to avoid the students' idea of coping, I put the papers of the whole class together and let the team leader choose them. The condition of selection is: choose the papers you think are valuable. If you can't choose them, you can't choose them. You should tell the reason why you don't choose them. Students have a wide range of questions, which can avoid the omission of knowledge, and can be targeted at the places they have not mastered. The process of questions is a positive reflection and comprehensive process of knowledge, which can't only deepen the understanding of knowledge, but also cultivate students' various abilities and good habits. As for the evaluation, an important part of cooperative learning, teachers should do this: first of all, they should change the standard of evaluating individuals into the collective evaluation group, which is composed of two parts: the group leader's evaluation and the whole class's evaluation. That is to say, around the group's tutoring learning situation, each group leader will vote and score, and then the whole class's students will vote and score, each of which accounts for 50%, Then the ranking of each group will be announced. In this way, the sense of participation and competition among team leaders, groups and people is greatly enhanced; Then, guide each group leader and tell them that you have gained a lot while teaching others. The evaluation method has changed from summative evaluation to process evaluation and summative evaluation.

In general, the group will be evaluated once in two weeks and the final evaluation will be conducted after the end of one semester. One evaluation is divided into three grades: excellent, good and general. Which group gets the most excellent is awarded to excellent group. This evaluation method focuses on the performance of learning life, so that each group can summarize experience and lessons in time, It is very beneficial to improve the group learning plan in time and improve the quality of group learning steadily. Fourthly, the evaluation indexes include: classroom performance, active state of participation in learning, progress star, whether group cooperation is harmonious, and learning achievement. The excellent performance in class refers to the group put forward the valuable problems, and has found the most

solving methods. It can use many methods to display and exchange, and the debate is reasonable and orderly. The excellent performance in the classroom is to promote the development of students' comprehensive mathematics ability; The positive state of participating in learning refers to the completion of homework, whether to ask questions actively and communicate actively in class. This is an evaluation of students' emotional attitude towards learning mathematics; The progressive Nova refers to the progress range of the students who are learning difficulties in the group, so as to make the group help to achieve the implementation; Whether group cooperation is harmonious is to promote the unity between students; Academic achievement refers to the examination results of each semester and the end of the term. The first four of the five items accounted for 80% of the total, with only 20% of the results, which also reflected the basic requirements of process evaluation. Finally, the change of evaluation is the leading, from teacher evaluation to Teacher-Student evaluation. When teachers reflect on teaching, they should make a detailed and focused record of the students' excellent performance in class, positive status of participation in learning, progress stars and group cooperation. They can make a comprehensive assessment every week, accounting for 30% of the evaluation. While students are recorded by the small group leader (mainly during the class), and once every two weeks, accounting for 70% of the evaluation, This is not only to give each group a learning results, but also to let each group in the process of mutual evaluation to learn from each other, improve together.

Teachers should bring the incentive evaluation into the classroom teaching process, adhere to the group evaluation in the classroom, encourage students' enthusiasm for competition, and cultivate students' competitiveness. Both process evaluation and stage evaluation are carried out in groups. In the evaluation, first praise the excellent group, and then have a private talk with the group leaders who have poor performance to point out their shortcomings and the direction of their efforts, so as to give full play to the incentive function of evaluation. This kind of group oriented evaluation can guide students to learn to reflect and summarize, improve their own cooperative learning, and experience the happiness of cooperative learning through evaluation. In addition, cooperative learning emphasizes complementarity and dynamics, and competition among groups. Timely and diversified evaluation can stimulate students' sense of cooperation and competition, so that students can compare with themselves while evaluating others, learn from others' advantages, and benefit both sides of evaluation(Zhang Yan, 2011).

**2.4 Related research**

Related researches cover following topics:

1. Researcher name: Xie Chunling (2017)

2. Research title: Research on the application of STAD cooperative learning model in junior high school mathematics teaching -- Taking Nanchong No.10 middle school as an example

3. Sample group: Nanchong No.10 middle school

4. Research methodology: Case study, interview, classroom observation and literature analysis

5. Research finding: STAD cooperative learning mode has a good effect in junior high school mathematics teaching. Many students need a short time to adapt to the teaching method, which is very different from the traditional teaching method. Students have strong interest and high enthusiasm in class.

Conclusion on knowledge from the related research:

STAD cooperative learning mode is suitable for most of the courses, and teachers use it more frequently. On the one hand, teachers use STAD mode to give most of the classroom time to students themselves, which increases students' communication, promotes the development of thinking and improves students' performance.

1. Researcher name:Xing Wei (2011)

2. Research title:Research on Mathematics Teaching in junior middle school based on STAD -- Taking Smiddle school in Yantai as an example

3. Sample group: S middle school in Yantai

4. Research methodology: Literature research, questionnaire survey, student interviews

5. Research finding: The research shows that the use of STAD cooperative learning in junior high school mathematics classroom can improve students' academic performance, mathematics learning habits and peer acceptance in varying degrees. Through the analysis of the original data, especially for the relatively poor students, the improvement of mathematics learning interest and peer acceptance is more obvious.

Conclusion on knowledge from the related research :

In this paper, the author studies the specific process of implementing the cooperative learning model based on STAD in junior high school mathematics classroom, and shows the practice process in the form of teaching cases. After the practice, the students were interviewed to study the students' qualitative feedback on the model. And through the comparative research method, the paper compares and analyzes the differences of students' academic performance, interest in mathematics learning and peer acceptance before and after the implementation, studies the students' quantitative feedback on the model, and further verifies the effectiveness of the cooperative learning model based on STAD.

1. Researcher name:Gu yuecheng (2015)

2. Research title:Research on the Application of Guided Model Group Cooperative Learning in Primary School Mathematics Teaching —Taking the Jiangsu Education Press Mathematics Grade 5 as an Example

3. Sample group: Jiangsu Education Press Mathematics Grade 5

4.Research methodology: Experimental research method, Literature research, questionnaire survey

5. Research finding: Through the experimental research, it is found that guided group cooperative learning can improve the students' communication ability, make the students' ability to solve problems get great progress, carry out cooperative exploration under the guidance of teachers, and fully mobilize the students' interest in learning mathematics.

Conclusion on knowledge from the related research :

Group cooperative learning is worthy of promotion and application. But before we use it widely, there is still a lot of work to do, and the problems in the research still need to be solved. But I believe that with the development of society and the continuous improvement of education level, the research on group cooperative learning will be more in-depth and the application of group cooperative learning will be more extensive in the future.

1. Researcher name: Wu meilan (2016)

2. Research title: Experimental research on cooperative learning of Mathematics for technical school students

3. Sample group: technical school students

4. Research methodology: iterature research, questionnaire survey, student interviews

5. Research finding: The students in group cooperative learning have higher learning enthusiasm than those in independent learning and competitive learning, and have stronger awareness of participating in learning

Conclusion on knowledge from the related research:

STAD, TGT, block splicing method, common learning mode and other common modes can be used in technical school cooperative learning, but as mathematics cooperative learning, STAD mode should be the preferred mode. It plays a very important role in publicizing students' personality, cultivating teachers' self-improvement ability, cultivating students' spirit of independent innovation, cooperation and communication, and improving students' academic performance,

1. Researcher name:Yang Wen (2018)

2. Research title:The practice of the teaching mode of primary school mathematics group cooperative learning

3. Sample group: Primary school

4. Research methodology :Case study, interview, classroom observation and literature analysis

5. Research finding: Cooperative learning improves students' comprehensive ability

Conclusion on knowledge from the related research :

Mathematics group cooperative learning as a new teaching method actively advocated in the current curriculum reform. It can' t only fully mobilize students' learning enthusiasm, but also achieve remarkable results in cultivating students' cooperative ability and interpersonal communication ability. Generally speaking, cooperative learning has achieved better teaching effect.

# 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: 1) Compare Mathematics Achievement before and after learning through cooperative learning using STAD Technique.

Compare Mathematics Achievement after learning through cooperative learning using STAD Technique with the determined criterion set at 70 % of full marks

The description of population and sample, 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 120 students ( 4 classrooms) in the Fourth grade of Xianghe primary school in Zhumadian City, Henan Province, China.

3.1.2 The sample of this study was 30 students (1 classroom) of Fourth grade of Xianghe primary school which was selected by using cluster random sampling method.

## 3.2 Experimental Design

This study used one group pretest-posttest design shown in the below figure.

| | | |
|---|---|---|
| O1 | X | O2 |

O1 was measurement of the mathematics achievement before an experiment
X was cooperative learning using STAD technique
O2 was measurement of the mathematics achievement after an experiment

## 3.3 Research Instruments

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

3.3.1 Instruments for research experiment

(1) Instructional innovation: Cooperative Learning Using STAD Technique

(2) Lesson plan: A total of five lessons with ten hours of elementary math instruction were assigned.

3.3.2 Instruments for collecting data

A mathematics achievement test

3.3.3The construction of mathematics achievement test

Constructing the achievement test was proceeded as follows.

Step 1: Studying the construction of the achievement test and the relevant documents. Consideration was focus on purposes, types, and contents of the test. The construction of the test involving item analysis in order to clarify the item discrimination and item difficulty of the test, as well as the validity and reliability of the test. low, 1943)

Step 2: Analyzing the curriculum contents and the learning objectives by constructing the analysis table of curriculum regarding the coverage of objectives and content of the curriculum. The test items consisted of four types of cognitive domain: 1) knowledge, 2) comprehension, 3) application, and 4) analysis.

Step 3: Constructing the achievement test on "Mathematical problems in life". The test consists of 20 option questions. Each question itemhas four options, and each option has a 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 validity 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: Analyzing the IOC index of the test items. The formula used to calculate the IOC index is:



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

Where

IOC means Index of Item Objective Congruence

ΣR means Summation of experts' opinion marks

N means A number of experts

If the Index of Item Objective Congruence (IOC) of each item of the test is higher than 0.5, that means it can be used in the test. The quality of the Mathematics achievement test in terms of content validity was 1, IOC>0.67. The result of analyzing the IOC index showed that all test items were appropriate and could be used in the test.

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

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

Step 8: Analyzing each item of the test to find out the item difficulty (p) and item discriminability (r) 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 ).The reliability of Mathematics achievement test was 0.76.

**3.4 Data collection**

The procedures of data collection were as follows:

1. The sample was given the pretest to measure Mathematics Achievement with constructed instrument.

2. The sample was taught by using cooperative learning using STAD Technique.

3. After finishing the instruction, the sample 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.

Compare Mathematics Achievement before and after learning through cooperative learning using STAD Technique by using t-test for dependent samples.

Compare Mathematics Achievement after learning through cooperative learning using STAD Technique with the determined criterion set at 70 % of full marks by using t-test for one sample.

# CHAPTER 4
# RESEARCH RESULTS

This chapter describes the research result. Since this study aims to 1) Compare mathematics achievement of the students before and after learning through the cooperative learning using STAD Technique. 2) Compare mathematics achievement of students with the determined criterion set at 70 % of full marks.

Table 1 Statistical symbols

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

**Table 2** Section 1 Result of comparing mathematics achievement before and after learning through cooperative learning using STAD technique by using t-test for dependent samples.

| Group | N | $\bar{X}$ | S.D. | t | p |
|---|---|---|---|---|---|
| Experimental group | 30 | 9.27 | 8.55147 | 12.830 | 0.000 |

P means statistically significant difference at 0.05 level

From the results of paired samples test, we can say that:

Students have mathematics achievement score after receiving cooperative learning using STAD Technique (post-test) greater than before receivingcooperative learning using STAD Technique (pre-test) at .05 statistically significant level ($t_{29}$= 12.83, $p < 0.05$).

On average, Posttest scores were 9.27 points higher than Pretest scores (95% CI [13.71, 20.09]).

**Table 3** Section 2 Result of comparing mathematics achievement with the determined criterion set at 70 percent of full marks by using t-test for one sample.

| Group | N | Full score | Criteria score | $\bar{X}$ | S.D. | t | p |
|---|---|---|---|---|---|---|---|
| Experimental group | 30 | 100 | 70 | 86.9 | 8.55147 | 10.824 | 0.000 |

P means statistically significant difference at 0.05 level

Since $p < 0.05$, we reject the null hypothesis (H0) and conclude thatthe mean Mathematics achievement of the sample is significantly different than the average Mathematics achievement of the overall student population.

Based on the results, we can state the following:

The Mathematics Achievement of the Fourth Grade Students in Primary Schools after learning through the cooperative learning using STAD Technique was 86.9 from a possible full marks of 100 and the standard deviation was 8.55 which was statistically higher than the criterion of 70% at the .05 level of statistical significance.

# CHAPTER 5
# DISCUSSION

This research aims to: 1. compare mathematics achievement of the students before and after receiving the cooperative learning using STAD Technique and 2. compare mathematics achievement of students with the determined criterion set at 70 % of full marks.

The sample was 30 Fourth grade primary school students.

The experimental design of this study was one group pretest-posttest design shown in the below figure:

| O1 X O2 |
|---|

O1 was measurement of the mathematics achievement before an experiment.

X was cooperative learning using STAD Technique.

O2 was measurement of the mathematics achievement after an experiment.

The research instrument was a mathematics achievement test.

Data collection were managed as follows: 1.The sample was given the pretest for measuring Mathematics Achievement with constructed instrument. 2.The sample was taught by cooperative learning using STAD Technique. 3.After finishing the instruction, the sample received the posttest by using the same instrument which was used in the pretest.

Data analysis were proceeded as follows: 1) to compare Mathematics Achievement before and after cooperative learning using STAD Technique by using t-test for dependent samples. 2) to compare Mathematics Achievement with the determined criterion set at 70 % by using t-test for one sample.



## 5.1 Research conclusion

Through comparative analysis of Forth grade students learning through cooperative learning using STAD Technique between pre-test and post-test, according to the current situation of mathematics learning at the same level, after the intervention of cooperative learning using STAD Technique, students' mathematics achievement significantly improved and statistically higher than the 70% standard,at the 0.05 level. 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.

In addition, the cooperative learning using STAD Technique, significantly improved students' performance in class, self-learning habits, and activeness in finding and solving problems.

**5.2 Research discussion**

The following points based on the research results were discussed:

Students' mathematics achievement score after learning through cooperative learning using STAD Technique was greater than before learning through cooperative learning using STAD Technique at .05 statistically significant level ($t_{29}$= 12.83, $p < 0.05$).

The two successful results implied that, the cooperative learning using STAD Technique consisted of effective steps of teaching: 1) Stimulate students' interest in learning new courses. 2) Cooperation and exchange within the group. 3) Teams share results. 4) Teacher evaluation and scoring.

In the first step, teachers can introduce new courses through scenario simulation, which can stimulate students' interest in learning new courses. As the saying goes: interest is the best teacher. Stimulating students' interest in learning can improve their enthusiasm and higher learning efficiency.

In the second step, the cooperation and communication within the group can make students benefit from the communication. Through the cooperation and communication, they can explore the answers to the questions and have a deeper memory.

In the third step, the group will show the results of the group and experience the fun of learning by sharing the results. While the group shares the results, it is also a time for the groups to learn and compare with each other.

In the fourth step, the teacher evaluates the results of each group, scores the results of each group, lets each group know their shortcomings, and praises the group that has done well, which can encourage students to study more seriously.

Through the cooperative learning method based on the use of STAD technology, students feel that the process of learning mathematics is not boring. Students gradually change the current situation of taking learning as learning, occupy the dominant position in the classroom, and change from passive learning to active discussion and learning. (Wu Qiong, 2013)

The teacher set up the concept of serving the students. Teaching content and form also serve students. In a series of teaching activities, teachers first stimulate students' interest in learning. (Zhang Wenyu, 2011) in the cooperative learning method using stad, the classroom is student-centered, abandoning the teacher centered teaching mode in the traditional teaching mode, and teachers guide students to conduct cooperative learning and communication in groups in the classroom. Each group obtains the results of the group through cooperation and communication. After

sharing the results, the group gets the evaluation of the teacher, so as to know the problems of the group and obtain knowledge by correcting the problems. (Wu Qiong, 2013)

**5.3 Recommendation**

The following are some recommendations based on the research results:

5.3.1 The traditional concept of education is deeply rooted, so many teachers and students have not been exposed to the "cooperative learning using STAD Technique ". Therefore, it is necessary to implement the"cooperative learning using STAD Technique" on a large scale, improve students' group cooperation ability and their autonomous learning ability, and let students accept the "auxiliary learning classroom"student-centered teaching mode.

5.3.2 Although the teaching method of "cooperative learning using STAD Technique "is simple in implementation, many teachers have problems in grouping and can' t actively guide in the process of group communication, so the teaching results are not obvious. This requires our teachers to have experience and patience in the implementation of the teaching method of "cooperative learning using STAD Technique . Only with the joint efforts of teachers and students can we see the obvious effect.

Through this study, we can conclude that the cooperative learning using STAD Technique has a good effect in primary school mathematics teaching. Many students need a short time to adapt to the teaching method, which is very different from the traditional teaching method. Students have strong interest and high enthusiasm in class. Its essence is to transform students' passive acceptance of knowledge into active communication, and give full play to students' dominant position in the learning process. Moreover, the fourth grade students of primary school are full of interest in mathematics learning, and their mathematics scores have also improved significantly.

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# APPENDICES

# APPENDIX A

# LESSON PLAN

There are three research instruments in this study, the lesson plans, the performance evaluation form.

**LESSON PLAN 1**

Course / Subject : Mathematics for the Fourth year of primary school
Instructional Topic : Solving practical problems of two-step calculation
Class Level : Grade four of primary school
Time for Instruction :Two hours
Instructor's name :Yang Pengfei

**1. Objectives**

1.1 Students can explain the relationship between quantities with line segment diagramand describe the calculation related to "times". (Knowledge)

1.2 Students can combine the learned knowledge and apply to solve practical problems in real life situations. (Skills and Attitude)

**2. Content**

Master the calculation problem of combining multiplication with addition and subtraction.The multiple relationship between quantity and quantity is understood through the line segment diagram, and the two-step calculation method of multiplication and addition is used to calculate the results.

**3. Instructional Strategies (teaching methods)**

**3.1 Create life situations and introduce new courses.**

Create the following life scenes: at the weekend, when Mr. Guo was shopping for his children's clothes in the mall, he found different

The price of clothes is different. Take the picture as an example:


Pants: 28 yuan

Coat: the price is three times that of trousers

On this basis, guide the students: what relevant mathematical problems can

you put forward after you understand this information

Question? Or what do you want to know? Students are required to think independently and communicate with their desk mates.

According to the student report, the teacher writes on the blackboard:

1. What's the price of a coat?

2. How much does it cost to buy a suit of clothes?

3. How much is a coat more expensive than trousers?

3.2Cooperate to explore new knowledge and exchange calculation methods.

Scenario creation: mathematics is closely related to our life. If you think about it, you can find that many things in life can be solved with mathematical knowledge. When solving specific problems, we usually use a variety of methods. "Painting mathematics"is a commonly used method. Do you want to know what "painting mathematics"is?

Teachers and students cooperate to discuss the method of "drawing mathematics":

As we can see above, if the price of a pair of trousers is 28 yuan, we can use a line as shown in the figure : _____ , Students can draw the length in their mind according to their own experience. The premise of this question is that we don't know the price of the coat, so you can try how to use lines to express the price of the coat.

Teachers and students work together to complete the line segment diagram:

pants: _____

Coat: _____

1. "How much is a coat?"

Students have to solve the calculation of the value of a coat

Students try to finish by themselves at the bottom, and then write the results on the blackboard: 28 * 3 = 84 (yuan)

Next, please cooperate in groups. The team leader will assign the remaining questions to the team members. The team members need to use the method of "drawing mathematics"to express the problem-solving ideas and problem-solving process. If the team members have difficulties, other team members can help them.

2. "How much is a suit of clothes?"

Inspiration: we must find out what is "a suit of clothes"? Is a suit a coat? Or a pair of pants, or two together? Finally, we'll find out how much it costs to buy a suit of clothes.

Students can communicate with each other

Method 1: 28 * 3 = 84 (yuan)... The price of the coat

84 + 28 = 112 (yuan)... The price of a suit of clothes

The comprehensive formula is: 28 * 3 + 28

Method 2: 3 + 1 = 4... 4 28 is the sum of the value of clothes and trousers

28 * 4 = 112 (yuan)... The meaning of the above formula is the total value of a suit of clothes

The comprehensive formula is: 28 * (3 + 1)

3. How much is a coat more expensive than a pair of trousers?

Students draw line segments by themselves to illustrate the problem.

Let the students communicate freely in the group, explain the meaning of the line segment they have drawn, and what is their thinking?

Method 1: 28 * 3 = 84 (yuan)... The price of the coat

84-28 = 56 (yuan)... Pants are cheaper than clothes

The comprehensive formula is: 28 * 3-28

Method 2: 3-1 = 2... Two 28 yuan is the value of coat more than pants

28 * 2 = 56 (yuan)... Less money for pants than coat

The comprehensive formula is: 28 * (3-1)

4. Summary and comparison: summarize the similarities and differences of questions 2 and 3.

3.3 Organize practice, consolidate and deepen.

1. "Think and do"complete questions 1 and 2

Requirements: understand what is shown on the picture presented by the teacher, find out what is asked, and then try to answer it by yourself. After that, you can communicate with the group members.

2. "Think and do"complete question 3

Requirement: find out what the question is, and then try to fill in the form

All team members work together to complete the form

3. Turn the textbook to "think and do"and complete questions 4 and 6 independently.

3.4A summary of the whole class.

This class is coming to an end. Students, you can think about what you learned today?

4. Media and Learning Resources

Blackboard, chalk, computer, multimedia, projector,

PowerPoint of Solve the practical problem of two-step calculation,

and intelligent classroom.

5. Measurement and Evaluation

By scoring each other among groups, the teacher scores the performance of each group through observations and gets the comprehensive score of each group.

**LESSON PLAN 2**

Course / Subject : Mathematics for the Fourth year of primary school
Instructional Topic : Learning of ray, line and line segment
Class Level : Grade four of primary school
Time for Instruction : Two hours
Instructor's name : Yang Pengfei

**1. Objectives**

1.1 Students can explain the concepts of ray, straight line and line segment, and describe the similarities and differences of line segment, straight line and ray. (Knowledge)

1.2 Students can combine the learned knowledge and apply to solve practical problems in real life situations. (Skills and Attitude)

**2. Content**

Learn the concepts of ray, straight line and line segment, and understand what are ray, straight line and line segment? What are the similarities and differences between them.

**3. Instructional Strategies (teaching methods)**

3.1Create life situations, vividly demonstrate and introduce new courses.

Create the following life scenes: The teacher will carry the infrared flashlight on, the light projected to the classroom wall. Ask the students questions and inspire them to think: you can see a bright spot on the wall, so you can use your imagination. If the light bulb in my hand is also a dot, what can I do between the two points? Line segment? So what are line segments?

Continue to ask: through your own observation, what are the characteristics of line segments? Can you draw a 5 cm line?

Vivid demonstration: the teacher will hand the flashlight up, you can see the light directly into the sky.

Ask the students: students, just now we can see a light spot on the wall, can we still see it now?

Students may reply that there is no end in sight, no limit.

Conclusion: This is the ray that we often talk about(The teacher writes on the blackboard: Ray),

Please join me in enjoying the beautiful scenery.

(play the magnificent scene of large colored lights shooting from the ground to the sky)

Question: you have just enjoyed the beautiful scenery. Can you try to draw the beautiful lines? You can draw a picture by yourself.

Students draw rays and teachers inspect.

Achievement display: most of you have finished painting. Who thinks you are good at painting and would like to share with you?

Students communicate with each other, then evaluate each other and summarize the characteristics of ray (The teacher writes on the blackboard: endpoint, infinite length)

Scenario assumption: you just showed your ray, and you will find that one end of the ray is infinite. So, do you wonder what will happen if you extend the other end of the ray?

Demo: using multimedia to talk about the extension of one end of the original ray endpoint, we will find that if the two ends of a line segment are extended unlimited, then we can see the birth of a straight line. Next, let's summarize the characteristics of the straight line.

(the teacher writes on the blackboard: there are no end points at both ends, and the length is infinite)

3.2 Cooperate to explore new knowledge and exchange similarities and differences of rays, lines and line segments.

Group discussion and comparison of the relationship between the three

Question: just now we have known three objects together, one is line segment, one is ray, and another is ray , one is a straight line. Are you curious about the difference between them?

Encourage students to discuss in groups and communicate in the whole class. The team leader will hand in the form after completing the form, and rank according to the order. If all the forms are correctly filled in, the team will be given different degrees of bonus points.

Let the students exchange the results of the discussion and complete the following table according to the students' answers:

| name | Similarities | difference | |
|---|---|---|---|
| line segment | perfectly straight | Two endpoints | Finite length |
| ray | perfectly straight | One endpoint | Infinity |
| straight line | perfectly straight | There are no endpoints | Infinity |

3.3 Organize practice, consolidate and deepen.

1. Turn the textbook to "think and do"question 1 and finish the exercise.

2. Expand and extend.

Ask the students: now I'll give you a point. How many straight lines do you think pass through this point? You can try to see who finally draws more straight lines.

Students finish the straight line by themselves, and stop when students raise their hands.

Conclusion: we all work hard and draw a lot of lines, so we can see each other. Who draws more lines?

(we can understand that if we draw through this point, we can draw as many straight lines as we want, and it is endless.)

Now I'll give you two points. How many straight lines can you draw?

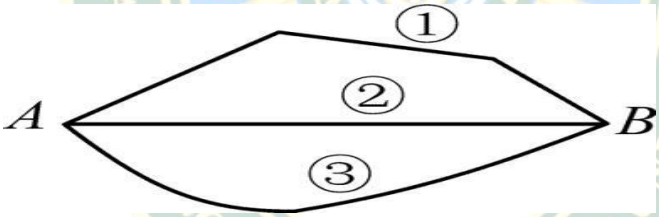
The answer is a straight line.

Summary of this section: we can see that if we give you a little, you can draw countless straight lines; But if I give you two points, you can only draw a straight line. This is a classic law, which is often used in daily life.

Multimedia demonstration: wall building of workers, determination of finish line in track and field competition, etc.

3. Teaching "think about it".

Question: (showing the picture) there are two points A and B. There are three lines between them. Which one is the shortest?




Conclusion: we can see that the line segment is the shortest between two points. Therefore, the connection between A and B

The size of the line is the distance between the two points.

3.4 A summary of the whole class.

Review: students, our class is coming to an end, so what did you gain today? Can you share your knowledge with the students around you?



**4. Media and Learning Resources**

Blackboard, chalk, computer, multimedia, projector,
PowerPointofLearning of ray, line and line segment
and intelligent classroom

**5. Measurement and Evaluation**

By scoring each other among groups, the teacher scores the performance of each group through observations and gets the comprehensive score of each group.

**LESSON PLAN 3**

Course / Subject : Mathematics for the Fourth year of primary school
Instructional Topic :Recognize parallel lines
Class Level : Grade four of primary school
Time for Instruction : Two hours
Instructor's name : Yang Pengfei

**1. Objectives**

1.1 Students can explain the definition of parallel lines and describe several positional relationships between two lines in the same plane. (knowledge)

1.2Students can combine the learned knowledge and apply to solve practical problems in real life situations. (Skills and Attitude)

**2. Content**

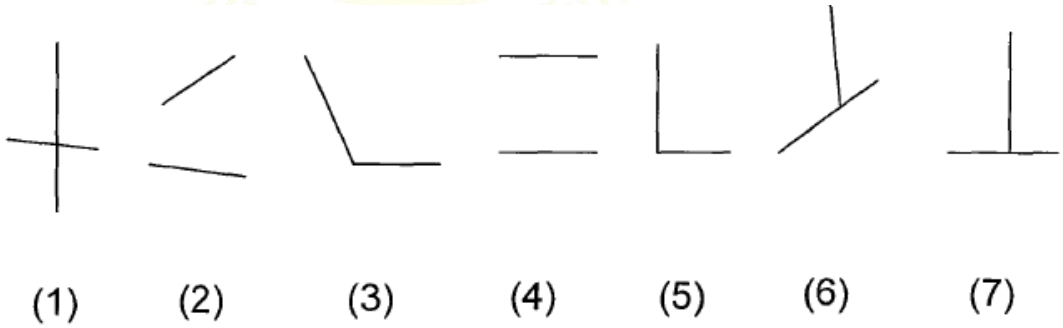
Master the definition of parallel lines, and discuss several positional relationships of two lines in the same plane through group communication.

**3. Instructional Strategies (teaching methods)**

3.1 Exciting games and introduce new courses.

Scenario setting: students, you can see what you have in your hand. Are there two sticks? You should give full play to your imagination, because it is not only a stick, but also a part of a straight line. What is the relationship between the two straight lines in position?

Team members can first clarify the division of labor of each member, and then cooperate to draw the graphics while placing the graphics. Then the teacher presents the final result. Preset the following conditions:




3.2Cooperate to explore new knowledge and communicate classification methods in groups.

Group cooperation goals, learn to understand parallel relationships and classify them at the same time

Situation: students, we have put forward so many permutation relationships together. Then, can you find out which of the following relationships are one?

Next, work in groups. Each group sends a recorder to record the classification

results and talk about why.

We can assume that the following students are most likely to sum up the score

The first is a more intuitive graphic classification, which classifies (1), (6) and (7) into one category, because these two small rods form multiple angles; (2) and (4) are classified into one category because the two small rods are not in contact at all; Put (3) (5) and (3) into one category, because two small rods form an angle together.

Secondly, the classification is based on whether the sticks are dependent or not. In this classification mode, (1), (3), (5), (6) and (7) are of one kind: (2) and (4) are of one kind.

Another requirement mentioned in the scenario hypothesis is to imagine the stick as a straight line. As a straight line, it has obvious characteristics, that is, it can be extended indefinitely. Based on the above principles, we can consider reducing (1), (2), (3), (5), (6) and (7) to one category, mainly considering the stick after the rod is extended, it finally intersects at one point; And (4) is a separate category, it will never have an intersection.

Students can communicate in private and share their own ideas.

Then guide the students to think: we said that we should let everyone imagine the stick as two straight lines. Then you can look at the graphics on the blackboard. If they are straight lines, what are the characteristics of straight lines?

Then ask the students: suppose we extend the straight lines on the blackboard infinitely, what will we find? The auxiliary is to extend the graphics on site to help students observe.

On this basis, ask the students again: do you sum up your classification according to what you see with your eyes? Can you think about it? Slowly guide it to the standard classification method, one is parallel and the other is intersection.

Then, summarize the previous stage: similar to the two straight lines in (1), (2), (3), (5), (6) and (7) on the blackboard, they vividly become intersecting straight lines, and what we say in written language is intersecting straight lines. For the relationship between the two lines in (4), we call it disjoint. (writing on the blackboard: disjoint), written language, we become "parallel to each other" (writing on the blackboard: disjoint two straight lines are parallel to each other), and they can become one parallel line to the other.

Finally, ask the students: look at these figures on the blackboard. Who is whose parallel line? (mark the graphics with letters on the blackboard).

First, the teacher can choose one or two students to confirm, and then let the students confirm each other.

3.3 Contact life and find examples.

Show the students the four pictures they have prepared: one is the playground runway; Second, staff; Third, high voltage wire rack; Fourth, swing.

Scenario hypothesis: students, use your eyesight to find out the lines you think are parallel or intersecting from these pictures as much as possible.

The practice mode is to let students think independently for about half a minute, and then everyone summarizes. When we summarize together, we must affirm the students with good performance and pay attention to guidance at the same time.

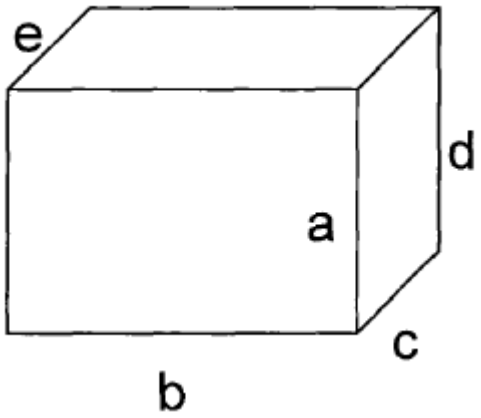
Examples are as follows: when students point out which parallel lines are on the staff, teachers can timely guide: students, can you accurately point out which lines are parallel in the staff? Then let the students play freely.

In the process of students' answer, we should timely guide and ask whether there are only two parallel lines in a group, and then illustrate with practical examples that it can be two, three or even more.

Finally, a question is added: can a straight line be called a parallel straight line? The answer is No.

On the basis of the above, we make a summary of this summary: your answer is very correct. When it comes to parallel lines, we should think that there are at least two straight lines before we can call them parallel lines. Otherwise, who is parallel to them?

The teacher shows a rectangular frame organization chart, and guides the students to look at their own stationery box, etc




Scenario hypothesis: just now I have known what is parallel line and intersecting line with you, and you have performed very well. You can find and point out many parallel lines around you. Now, I want to increase the difficulty. Look at the cuboid at hand. Please think about what kind of positional relationship a and b are? What about a and d? What about a and e?

At this time, students may have different views: some students may feel that they are intersecting, some students may feel that they are parallel, and some students feel that they have neither intersecting nor parallel. They can't explain the basis for their judgment.

Scenario hypothesis: through your discussion, we will find a strange place, that is, it seems that the two do not intersect or parallel. What is the reason? Next, students, take your group as a unit, observe the cuboid model in their hands, discuss

with each other, and find out the reason.

After a period of time, gradually make students realize that a and E are not on the same plane, then they have neither intersection nor parallel relationship.

Based on the above analysis, we summarize this section: we should note that at the beginning of the course, we realized that those straight lines are in the same plane, so they have either parallel or intersecting relations, that is, we can draw a conclusion because they are "in the same plane". This sentence can be specially marked with colored chalk. If you are interested, you can borrow the textbooks of junior middle school to learn about the nonintersecting and nonparallel straight lines.

3.4 Organize practice, consolidate and deepen.

1. Please turn the textbook to "think and do"to find question 1: which straight lines are parallel to each other.

Students answer together and teachers and students comment together.

2. Please turn the textbook to "think and do"to find question 2. Let the students do it by themselves and evaluate the results.

3. Please turn the textbook to "think and do"to find question 3. Students study in groups and then discuss with the whole class.

3.5 A summary of the whole class.

Summarize with the students: students, today's class should be very full, so let's review our specific learning content.

Question: students, what is parallel? You can review the textbook again. If you have any questions, you can put them forward and discuss them together.

**4. Media and Learning Resources**

Blackboard, chalk, computer, multimedia, projector,
PowerPoint of Recognize parallel lines,
and intelligent classroom.

**5. Measurement and Evaluation**

By scoring each other among groups, the teacher scores the performance of each group through observations and gets the comprehensive score of each group.

**LESSON PLAN 4**

Course / Subject : Mathematics for the Fourth year of primary school
Instructional Topic :Solve problems with multiples
Class Level : Grade four of primary school
Time for Instruction : Two hours
Instructor's name : Yang Pengfei

**1. Objectives**

1.1Students can use the line segment diagram to understand the relationship between quantities, learn to apply mathematical knowledge, combine mathematical knowledge with real life, and further understand the calculation related to "times".(Knowledge)

1.2 Students can combine the learned knowledge and apply to solve practical problems in real life situations. (Skills and Attitude)

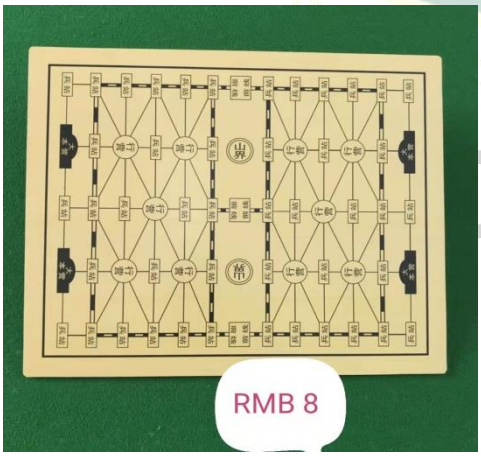
**2. Content**

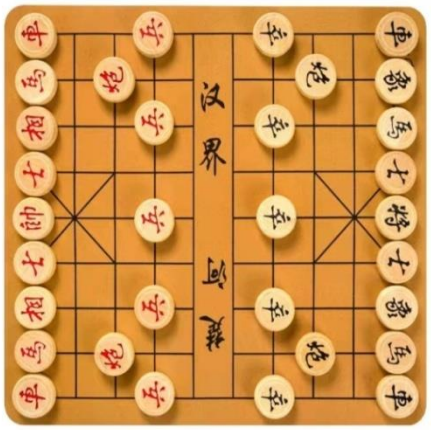
Master the use of line segment diagram to understand the relationship between quantities, learn to apply mathematical knowledge, combine mathematical knowledge with real life, and further understand the calculation related to "times".

**3. Instructional Strategies (teaching methods)**

**3.1 Create life situations and introduce new courses.**

When Xiao Ming buys goods in the store, he finds that the prices of different goods are different. Take the picture as an example:



Military chess: 8 yuan

Chess: the price is four times that of military chess

On this basis, guide students to find out relevant mathematical problems, and require students to think independently or communicate with their deskmates.

According to the student report, the teacher writes on the blackboard:

1. What is the price of a set of chess?

2. How much does it cost to buy a set of chess and a set of military chess?

3. How much is a set of chess more expensive than a set of military chess?

3.2 Cooperate to explore new knowledge and exchange calculation methods.

Scenario creation: mathematics is closely related to our life. You can use your brain. Can you find that many things in life can be solved with mathematical knowledge? When solving problems, we usually use a variety of methods. "Painting mathematics"is a more commonly used one. Do you want to know what "painting mathematics"is?

Students, teachers and students cooperate to discuss the method of "drawing mathematics":

As we can see above, if the price of a set of military chess is 8 yuan, we can use a line as shown in the figure: _____, You can draw the length in your mind according to your own experience. The premise of this problem is that we don't know the price of chess, so you can try how to use lines to represent the price of chess.

Teachers and students work together to complete the line segment diagram:

military chess:_____

chess:_____

1. "How much is a set of chess?"

Students have to solve the calculation of the value of a set of chess

Students try to finish by themselves, and then write the results on the blackboard: 8 × 4 = 32 (yuan)

Next, please cooperate in groups. The team leader will assign the remaining questions to the team members, who need to use the method of "drawing mathematics"to express the problem-solving ideas and process. If you encounter a difficult team member, other team members can help you with the coaching.

2. "How much does it cost to buy a set of chess and a set of military chess?"

Inspiration: we must find out what items to buy.

Students can communicate with each other

Method 1: 8 × 4 = 32 (yuan)... The price of chess

32 + 8 = 40 (yuan)... The price of buying a set of chess and a set of military chess

The comprehensive formula is: 8 × 4 **+** 8

Method 2: 4 + 1 = 5... Five eights are the value sum of a set of chess and a set of military chess

eight × 5 = 40 (yuan)... The meaning of the above formula is the total value of a set of chess and a set of military chess

The comprehensive formula is: 8 × ( 4 + 1 )

3. How much is a set of chess more expensive than a set of military chess?

Students draw line segments by themselves to illustrate the problem.

Let the students communicate freely in the group, explain the meaning of the line segment they have drawn, and what is their thinking?

Method 1: 8 × 4 = 32 (yuan)... The price of a set of chess

32-8 = 24 (yuan)... A set of military chess is cheaper than a set of chess

The comprehensive formula is: 8 × 4-8

Method 2: 4-1 = 3... Three 8 yuan is the value of chess more than military chess

eight × 3 = 24 (yuan)..... the amount of money for a set of military chess is less than that for a set of chess

The comprehensive formula is: 8 × ( 4 - 1 )

4. Summary and comparison: summarize the similarities and differences of questions 2 and 3.

**3.3Organize practice, consolidate and deepen.**

1. "Think and do"complete question 2

Requirements: find out what is shown in the picture in the exercise and what is asked, and then try to answer it by yourself. After that, you can communicate with the group members.

2. "Think and do"complete question 3

Requirement: find out what the question is, and then try to fill in the form

All team members work together to complete the form

3. "Think and do"complete questions 4 and 6 independently.

**3.4 A summary of the whole class.**

Students talk about the harvest of this class.

**4. Media and Learning Resources**

Blackboard, chalk, computer, multimedia, projector,

PowerPoint of Solve problems with multiples,

and intelligent classroom.

**5. Measurement and Evaluation**

By scoring each other among groups, the teacher scores the performance of each group through observations and gets the comprehensive score of each group.

**LESSON PLAN 5**

Course / Subject : Mathematics for the Fourth year of primary school
Instructional Topic :Learning distance, speed and time
Class Level : Grade four of primary school
Time for Instruction : Two hours
Instructor's name : Yang Pengfei

**1. Objectives**

1.1 Students can explain the definition of speed and explain the relationship between speed, time and distance. (knowledge)

1.2 Students can combine the learned knowledge and apply to solve practical problems in real life situations. (Skills and Attitude)

**2. Content**

The concept of speed and the relationship among speed, time and distance

**3. Instructional Strategies (teaching methods)**

3.1 Create life situations and introduce new courses.

Create the following life scenes: Students, today, the teacher took you to a racing scene. Two cars are having an intense cross-country race. Guess which car will win? Just now, some students guessed that the blue car won, some guessed that the red car won, and others guessed that the two cars arrived at the same time. What was the result? Let's have a look (play the courseware). Who won in the end? (blue car) why did the blue car win? During the race, the average speed of the blue car was faster, so it won the final victory.

What is speed? What is the relationship between speed, time and distance? In this class, we will study the itinerary. (writing on the blackboard while talking)

3.2 Cooperate to explore new knowledge and exchange the relationship between speed, time and distance.

Teacher: OK, please open page 81 of the textbook and learn all the contents of this page by yourself. Consider the following two questions independently:

1.What is speed? How else can speed be expressed?

2. By completing example 3, can you find any relationship between speed, time and distance?

Then exchange your views and cooperate loudly in the group to complete the learning record card. Please take out the learning record card. Is there anything you don't understand?

The express train runs 160 kilometers per hour and Kobayashi walks 60 meters per minute; Ordinary trains travel 106 kilometers per hour.

Relationship between speed, time and distance:

After 10 minutes:

1. Which group is willing to report the meaning and writing of speed?

2. Interaction between students, let the students who listen to the report ask their own questions.

3. Which group will report on the relationship between speed, time and distance?

3.3 Summarize knowledge points

OK, through the students' learning, reporting and mutual questioning, we know what speed is and the simple way to write speed. (combined with courseware summary):

1. The distance traveled by an object per minute, per second, per hour and other units of time is called its speed.

2. A simple way to write speed can be divided into two parts by a slash. On the left is the distance and on the right is the time unit. In this way, the speed of an object is concise and clear.

In addition, we also know the relationship between speed, time and distance:

3. The basic relationship between speed, time and distance is: speed × Time = distance.

Do you have any questions?

3.4 Organize practice, consolidate and deepen.

1. Evaluate students' simple writing method of speed.

(1) Show me textbook P81 question 5 (plus two).

(2) The courseware reveals the answers and let the students correct them by themselves. And use gestures to show their right and wrong. And make a simple evaluation

(3) Combine topic resources to communicate the relationship between mathematics and other disciplines.

Teacher: first question, by writing these speeds, who do you think is the fastest? Why?

Second question, do you think the speed of sound is fast or the speed of light is fast? How do you know?

2. Apply mathematical models.

(1) The courseware shows question 6 and adaptation on page 81 of the textbook.

(2) Let's talk about the problem-solving process. Then ask: what is the relationship between these three questions and what laws have you found?

3. Problem solving:

(1) Show me textbook question 8.

(2) Students do questions, let the students who finish first go to the podium to do them, then correct them, and say the idea of problem-solving.

4. Thinking question: the distance from Guangzhou to Nanning is about 1000 kilometers. It took a long-distance bus three hours to travel 300 kilometers from Guangzhou. At this speed, how long does it take for the long-distance bus to reach Nanning?

3.5 Reflective evaluation**:**

Students have many ways to solve problems, and they also have their own different opinions. So what do you think is the biggest gain of this class?

**4. Media and Learning Resources**

Blackboard, chalk, computer, multimedia, projector,
PowerPoint of Learning distance, speed and time,
and intelligent classroom.

**5. Measurement and Evaluation**

By scoring each other among groups, the teacher scores the performance of each group through observations and gets the comprehensive score of each group.

# APPENDIX B
# TEST PAPER

**Mathematics test questions for Fourth grade of primary school students**
**Test questions writer: Yang Pengfei**
**Time: 60 minutes**
**Total test score: 100 points**

Directions: Choose the correct answer for each of the following item. choice question. (5 points will be obtained after choosing the correct answer for each question, and no point will be obtained if choosing the wrong answer)

1. We know that the line segment is straight, so how many endpoints does the line segment have? ( )

A : 0 B : 1 C : 2 D : 3

2. How many endpoints does the ray have? ( )

A : 0 B : 1 C : 2 D : 3

3. If we extend the line segment infinitely in two directions, what line will be formed? ( )

A: Straight line B: Ray C: Curve D: Parallel line

4. If we extend the line segment infinitely in one direction, what line will be formed? ( )

A: Ray B: Straight line C: Curve D: Parallel line

5. The price of a box of pencils is 10 yuan, and the price of a box of colored pencils is twice that of a box of pencils. How much is a box of colored pencils? ( )

A: 12 yuan B: 20 yuan C: 200 yuan D: 5 yuan

6. A pencil is 2 yuan and the price of a pen is 5 times that of a pencil. How much is a pen? ( )

A. 7 yuan B. 10 yuan C. 6 yuan D. 5 yuan

7. The price of a water cup is 5 yuan, and the price of a schoolbag is 6 times that of a water cup. How much does it cost to buy a water cup and a schoolbag? ( )

A: 25 yuan B: 35 yuan C: 45 yuan D: 55 yuan

8. The price of a coke is 5 yuan. The price of a hamburger is three times that of a coke. How much is a hamburger more expensive than a coke? ( )

A: 2 yuan B: 10 yuan C: 15 yuanD: 5 yuan

9. We know that a straight line cannot form a group of parallel lines, so at least several straight lines can form a group of parallel lines? ( )

A : 0 B : 2 C : 3 D : 4

10. How many lines can a group of parallel lines be at most? ( )

A: Countless B: 2 C: 3 D: 4

11. If two straight lines do not coincide in the same plane, how many positional relationships do they have? ( )

A : 1 B : 2 C : 3 D : 4

12. Xiao Ling's walking speed is 60 meters per minute. How many meters did Xiao Ling walk after 10 minutes? ( )

A : 70 B : 60 C : 600 D : 6000

13. The school is 5 kilometers away from the park. If we drive at a speed of 50 kilometers per hour, how many hours will it take us to get to the park from the school? ( )

A : 1 B : 0.1 C : 10 D : 0.01

14. The distance from Beijing to Bangkok is 3200 kilometers. If the flight speed of the plane is 800 kilometers per hour, how many hours does it take to fly from Beijing to Bangkok? ( )

A : 8 B : 4 C : 6 D : 5

15. If the speed of the train is 80 kilometers per hour and the speed of the plane is 10 times that of the train, how many kilometers can the plane fly for 2 hours? ( )

A : 1600 B : 1800 C : 800 D : 160

16. If the speed of the plane is 800 kilometers per hour and the speed of the plane is 10 times that of the train, how many kilometers can the train travel in 2 hours? ( )

A : 1600 B : 1800 C : 800 D : 160

17. If the speed of the plane is 800 kilometers per hour and the speed of the plane is 10 times that of the train, how many kilometers can the train travel in 2 hours? ( )

A : 1600 B : 1800 C : 800 D : 160

18. What is the positional relationship between a straight line and two other parallel lines in the same plane? ( )

A: Both parallel B: both intersect

C: both parallel or both intersect D: unable to judge

19. If two straight lines do not coincide in the same plane, what kind of positional relationship do they have? ( )

A: Parallel B: intersection

C: parallel or intersection D: unable to judge

20. If we draw a 1 cm line segment to represent an item of 5 yuan, how long do we need to draw a line segment to represent an item of 15 yuan? ( )

A: 2cm B: 5cm C: 3cm D: 4cm

# APPENDIX C
# THE EVALUATION FORM OF THE LESSON PLANS

**The evaluation form of the lesson plans**

**Thesis title: The Effect of Cooperative Learning Using STAD Technique on Mathematics Achievement of the Fourth Grade Students in Primary Schools.**

**Direction for evaluator/expert**

In your opinion, please evaluate the drafts of lesson plans in terms of appropriateness according to the definition of terms.

**Definition of terms /Operational definition**

Lesson plan 1:Solving practical problems of two-step calculation

Lesson plan 2:Learning of ray, straight line and line segment

Lesson plan 3:Recognize parallel lines

Lesson plan 4:Solve problems with multiples

Lesson plan 5:Learning distance, speed and time

Operational definition of Cooperative Learning Using STAD Technique:The teaching process ofCooperative Learning Using STAD Techniqueis mainly to assign the learning contents or problems to students, let them communicate, discuss, help and coordinate with each other in the process of task completion, and jointly solve problems and complete tasks in an encouraging atmosphere .It is not only a way of learning, but also exists as a teaching thought and teaching method. As a teaching method, the classroom emphasizes the " four helps) "four steps:(

Step 1 .Stimulate students' interest in learning new courses

Step 2 .Cooperation and exchange within the group

Step 3 .Teams share results

Step 4 .Teacher evaluation and scoring



The evaluation criteria of appropriateness of lesson plans are five-point rating scales which are shown below;

| Scoring | The appropriateness level |
|---|---|
| 5 | Very high level |
| 4 | High level |
| 3 | Moderate level |
| 2 | Low level |
| 1 | Very low level |

| 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 | √ | | | | |

Other suggestions

.....

(Wei Hanyu) Name of Expe

**The evaluation form of the lesson plans**

**Thesis title: The Effect of Cooperative Learning Using STAD Technique on Mathematics Achievement of the Fourth Grade Students in Primary Schools.**

**Direction for evaluator/expert**

In your opinion, please evaluate the drafts of lesson plansin terms of appropriateness according to the definition of terms.

**Definition of terms /Operational definition**

Lesson plan 1:Solving practical problems of two-step calculation

Lesson plan 2:Learning of ray, straight line and line segment

Lesson plan 3:Recognize parallel lines

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Lesson plan 5:Learning distance, speed and time

Operational definition ofCooperative Learning Using STAD Technique:The teaching process ofCooperative Learning Using STAD Techniqueis mainly to assign the learning contents or problems to students, let them communicate, discuss, help and coordinate with each other in the process of task completion, and jointly solve problems and complete tasks in an encouraging atmosphere .It is not only a way of learning, but also exists as a teaching thought and teaching method. As a teaching method, the classroom emphasizes the " four helps) "four steps:(

Step 1 .Stimulate students' interest in learning new courses

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The evaluation criteriaof appropriateness of lesson plans are five-point rating scales which are shown below;

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|---|---|---|---|---|---|---|
| | | 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 | √ | | | | |

Other suggestions

……

(Chen Yongguang) Name of Expert

**APPENDIX D**
**THE EVALUATION FORM OF TEST**

**The evaluation form of the test**

**Thesis title: The Effect of Cooperative Learning Using STAD Technique on Mathematics Achievement of the Fourth Grade Students in Primary Schools.**

**Directions for expert**

In each item, please determine the congruentscorebetween each test item and objectives/contentsby filling the symbol (✓). The criteriaof verifying the congruence between each test item and objectives/contents which are shown below;

| Congruent score | | Description |
|---|---|---|
| +1 | = | means expert is sure that item really measured what it claims to measure in objectives/contents |
| 0 | = | means expert is not sure that item does or does not measure what it claims to measure in objectives/contents |
| -1 | = | means expert is sure that item does not measure what it claims to measure in objectives/contents |

| Objectives or contents | Test Item/question | Congruent score | | |
|---|---|---|---|---|
| | | +1 | 0 | -1 |
| | 1 .We know that the line segment is straight, so how many endpoints does the line segment have? （）<br>A ： 0 B ： 1 C ： 2 D ： 3 | ✓ | | |
| | 2 . How many endpoints does the ray have? （）<br>A ： 0 B ： 1 C ： 2 D ： 3 | ✓ | | |
| | 3 . If we extend the line segment infinitely in two directions, what line will be formed? （）<br>A : Straight line B : Ray C : Curve D : Parallel line | ✓ | | |
| | 4 . If we extend the line segment infinitely in one direction, what line will be formed? （）<br>A : Ray B : Straight line C : Curve D : Parallel line | ✓ | | |
| | 5 .The price of a box of pencils is 10 yuan, and the price of a box of colored pencils is twice that of a box of pencils .How much is a box of | ✓ | | |

| Objectives or contents | Test Item/question | Congruent score | | |
|---|---|---|---|---|
| | | +1 | 0 | -1 |
| | colored pencils? （）<br>A :12 yuan B :20 yuan C :200 yuan D :5 yuan | | | |
| | 6 .A pencil is 2 yuan and the price of a pen is 5 times that of a pencil .How much is a pen?）<br>A .7 yuan B .10 yuan C .6 yuan D .5 yuan | ✓ | | |
| | 7 .The price of a water cup is 5 yuan, and the price of a schoolbag is 6 times that of a water cup .How much does it cost to buy a water cup and a schoolbag? （）<br>A :25 yuan B :35 yuan C :45 yuan D :55 yuan | ✓ | | |
| | 8 .The price of a coke is 5 yuan .The price of a hamburger is three times that of a coke . How much is a hamburger more expensive than a coke? （）<br>A :2 yuan B :10 yuan C :15 yuan D :5 yuan | ✓ | | |
| | 9 .We know that a straight line cannot form a group of parallel lines, so at least several straight lines can form a group of parallel lines? （）<br>A ：0 B ：2 C ：3 D ： | ✓ | | |
| | 10 . How many lines can a group of parallel lines be at most? （）<br>A :Countless B :2 C :3 D :4 | ✓ | | |
| | 11 .If two straight lines do not coincide in the same plane, how many positional relationships do they have?（）<br>A ：1 B ：2 C ：3 D ：4 | ✓ | | |
| | 12 .Xiao Ling's walking speed is 60 meters per minute .How many meters did Xiao Ling walk after 10 minutes? （）<br>A ：70 B ：60 C ：600 D ：6000 | ✓ | | |
| | 13 . The school is 5 kilometers away from the park . If we drive at a speed of 50 kilometers | ✓ | | |

| Objectives or contents | Test Item/question | Congruent score | | |
|---|---|---|---|---|
| | | +1 | 0 | -1 |
| | per hour, how many hours will it take us to get to the park from the school? （）<br>A ：1　　B ：0.1　　C ：10　　D ：0.01 | | | |
| | 14 . The distance from Beijing to Bangkok is 3200 kilometers .If the flight speed of the plane is 800 kilometers per hour, how many hours does it take to fly from Beijing to Bangkok? （）<br>A ：8　　B ：4　　C ：6　　D ：5 | ✓ | | |
| | 15 .If the speed of the train is 80 kilometers per hour and the speed of the plane is 10 times that of the train, how many kilometers can the plane fly for 2 hours? （）<br>A ：1600　　B ：1800　　C ：800　　D ：160 | ✓ | | |
| | 16 .If the speed of the plane is 800 kilometers per hour and the speed of the plane is 10 times that of the train, how many kilometers can the train travel in 2 hours? （）<br>A ：1600　　B ：1800　　C ：800　　D ：160 | ✓ | | |
| | 17 .If the speed of the plane is 800 kilometers per hour and the speed of the plane is 10 times that of the train, how many kilometers can the train travel in 2 hours? （）<br>A ：1600　　B ：1800　　C ：800　　D ：160 | ✓ | | |
| | 18 .What is the positional relationship between a straight line and two other parallel lines in the same plane? （）<br>A :Both parallel　　B :both intersect<br>C : both parallel or both intersect　　D : unable to judge | ✓ | | |
| | 19 .If two straight lines do not coincide in the same plane, what kind of positional | ✓ | | |

| Objectives or contents | Test Item/question | Congruent score | | |
|---|---|---|---|---|
| | | +1 | 0 | -1 |
| | relationship do they have? （）<br>A :Parallel B :intersection<br>C :parallel or intersection D :unable to judge | | | |
| | 20 .If we draw a 1 cm line segment to represent an item of 5 yuan, how long do we need to draw a line segment to represent an item of 15 yuan? （）<br>A :2cm B :5cm C :3cm D :4cm | ✓ | | |

……

(Wei Hanyu) Name of Expert

**The evaluation form of test**

**Thesis title: The Effect of Cooperative Learning Using STAD Technique on Mathematics Achievement of the Fourth Grade Students in Primary Schools.**

**Directions for expert**

In each item, please determine the congruentscorebetween each test item and objectives/contentsby filling the symbol (✓). The criteriaof verifying the congruence between each test item and objectives/contents which are shown below;

| Congruent score | | Description |
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| Objectives or contents | Test Item/question | Congruent score | | |
|---|---|---|---|---|
| | | +1 | 0 | -1 |
| | 1 .We know that the line segment is straight, so how many endpoints does the line segment have?<br>A : 0 B : 1 C : 2 D : 3 | ✓ | | |
| | 2 .How many endpoints does the ray have? ()<br>A : 0 B : 1 C : 2 D : 3 | ✓ | | |
| | 3 .If we extend the line segment infinitely in two directions, what line will be formed? ()<br>A :Straight line B :Ray C: Curve D :Parallel line | ✓ | | |
| | 4 .If we extend the line segment infinitely in one direction, what line will be formed? ()<br>A : Ray B : Straight line C : Curve D : Parallel line | ✓ | | |
| | 5 .The price of a box of pencils is 10 yuan, and the price of a box of colored pencils is twice that of a box of pencils . How much is a box of colored pencils? () | ✓ | | |

| Objectives or contents | Test Item/question | Congruent score | | |
|---|---|---|---|---|
| | | +1 | 0 | -1 |
| | A :12 yuan B :20 yuan C :200 yuan D :5 yuan | | | |
| | 6 .A pencil is 2 yuan and the price of a pen is 5 times that of a pencil .How much is a pen? （）<br>A .7 yuan B .10 yuan C .6 yuan D .5 yuan | ✓ | | |
| | 7 . The price of a water cup is 5 yuan, and the price of a schoolbag is 6 times that of a water cup . How much does it cost to buy a water cup and a schoolbag? （）<br>A :25 yuan B :35 yuan C :45 yuan D :55 yuan | ✓ | | |
| | 8 . The price of a coke is 5 yuan . The price of a hamburger is three times that of a coke . How much is a hamburger more expensive than a coke? （）<br>A :2 yuan B :10 yuan C :15 yuan D :5 yuan | ✓ | | |
| | 9 . We know that a straight line cannot form a group of parallel lines, so at least several straight lines can form a group of parallel lines? （）<br>A : 0 B : 2 C : 3 D : 4 | ✓ | | |
| | 10 .How many lines can a group of parallel lines be at most? （）<br>A :Countless B :2 C :3 D :4 | ✓ | | |
| | 11 . If two straight lines do not coincide in the same plane, how many positional relationships do they have? （）<br>A : 1 B : 2 C : 3 D : 4 | ✓ | | |
| | 12 . Xiao Ling's walking speed is 60 meters per minute . How many meters did Xiao Ling walk after 10 minutes? （）<br>A : 70 B : 60 C : 600 D : 6000 | ✓ | | |
| | 13 . The school is 5 kilometers away from the park .If we drive at a speed of 50 kilometers per hour, how many hours will it take us to get to the park from the school? （）<br>A : 1 B : 0.1 C : 10 D : 0.01 | ✓ | | |

| Objectives or contents | Test Item/question | Congruent score | | |
|---|---|---|---|---|
| | | +1 | 0 | -1 |
| | 14 . The distance from Beijing to Bangkok is 3200 kilometers .If the flight speed of the plane is 800 kilometers per hour, how many hours does it take to fly from Beijing to Bangkok? （）<br>A ：8 B ：4 C ：6 D ：5 | ✓ | | |
| | 15 .If the speed of the train is 80 kilometers per hour and the speed of the plane is 10 times that of the train, how many kilometers can the plane fly for 2 hours? （）<br>A ：1600 B ：1800 C ：800 D ：160 | ✓ | | |
| | 16 . If the speed of the plane is 800 kilometers per hour and the speed of the plane is 10 times that of the train, how many kilometers can the train travel in 2 hours? （）<br>A ：1600 B ：1800 C ：800 D ：160 | ✓ | | |
| | 17 . If the speed of the plane is 800 kilometers per hour and the speed of the plane is 10 times that of the train, how many kilometers can the train travel in 2 hours? （）<br>A ：1600 B ：1800 C ：800 D ：160 | ✓ | | |
| | 18 .What is the positional relationship between a straight line and two other parallel lines in the same plane? （）<br>A :Both parallel B :both intersect<br>C :both parallel or both intersect D :unable to judge | ✓ | | |
| | 19 . If two straight lines do not coincide in the same plane, what kind of positional relationship do they have? （）<br>A :Parallel B :intersection<br>C :parallel or intersection D :unable to judge | ✓ | | |
| | 20 .If we draw a 1 cm line segment to represent an item of 5 yuan, how long do we need to draw a line segment to represent an item of 15 yuan?<br>A :2cm B :5cm C :3cm D :4cm | ✓ | | |

(Chen Yongguang) Name of Expert

# CURRICULUM VITAE

| | |
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