# TRAINING STUDENTS' COLLABORATIVE PROBLEM-SOLVING SKILLS: A CASE STUDY THROUGH 12TH GRADE MATH TEACHING AND LEARNING AT LAO PEOPLE'S DEMOCRATIC REPUBLIC 

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#### Abstract

Purpose: This study aims to investigate the current state of Mathematics teaching in 12th grade and identify issues related to training 12th-grade students in cooperative problem-solving skills in the Lao People's Democratic Republic. Theoretical framework: This study focuses on the importance of cooperative problem-solving skills in mathematics education, providing a basis for understanding its significance and the challenges associated with its implementation in the educational context of Laos. Design/methodology/approach: The study employed two questionnaires, one for teachers and one for students, with 9 and 8 questions, respectively. The questionnaires were created using Google Forms and were distributed from October 2021 to January 2022. A total of 38 teachers participated in the survey, including 4 ( $10.53 \%$ ) with college degrees, 32 ( $84.21 \%$ ) with university degrees, and 2 $(5.26 \%)$ with master's degrees. Out of the 411 students who received the questionnaire, 373 provided valid responses after excluding those who did not participate or gave invalid answers. Findings: The study found that high schools in Laos face limitations in terms of teacher motivation to innovate teaching methods and students' weak practice of cooperative problem-solving skills. Specifically, students lacked opportunities for group activities and showed weak collaborative skills for problem-solving. Research, Practical \& Social implications: This study highlights the importance of promoting collaborative learning and problem-solving skills in Mathematics education in Laos. The findings of this study can provide useful insights for policymakers, educators, and curriculum developers in designing effective strategies and approaches to improve the quality of Mathematics education in the country. Originality/value: This study contributes to the limited literature on Mathematics education in Laos, particularly in the area of cooperative problem-solving skills training. The study provides valuable information on the current state of Mathematics teaching and identifies key areas for improvement.


Keywords: Cooperation skills, problem solving, group activities, teaching Mathematics.

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## 1. Introduction

In recent years, there has been a growing interest in the development of collaborative problem-solving skills among students. This is particularly important in the field of mathematics education, where problem-solving skills are essential for success. Collaborative problem-solving involves working with others to solve a problem, and it has been shown to have numerous benefits for students, including improved understanding of mathematical concepts and better social skills (Barkatsas \& Malone, 2018; Webb, Farivar, \& Mastergeorge, 2002; T.V. Cuong, D. Tam \& P.V. Hieu, 2020).

Despite these benefits, many students lack the necessary skills to effectively collaborate and solve problems with others. This may be due in part to a lack of training and support for teachers, as well as cultural and contextual factors that may influence the implementation of collaborative learning strategies (Barkatsas \& Malone, 2018; Widana et al., 2020; Roth \& Bowen, 2016).
One country that has faced significant challenges in implementing collaborative problem-solving in mathematics education is the Lao People's Democratic Republic. This Southeast Asian country has a relatively low level of educational attainment, with many students struggling to master basic math skills (Lao PDR Ministry of Education and Sports, 2018). In addition, cultural and linguistic barriers may further complicate efforts to implement collaborative learning strategies in the classroom.

To address these challenges, this study focuses on the implementation of collaborative problem-solving skills in 12th grade math teaching and learning in the Lao People's Democratic Republic. Specifically, we examine the effectiveness of a training program designed to improve students' collaborative problem-solving skills, as well as the challenges and opportunities associated with its implementation.

The theoretical framework for this study emphasizes the significance of cooperative problem-solving skills in mathematics education and the challenges associated with its implementation in the educational context of Laos. Previous research has shown that collaborative learning can enhance students' problem-solving abilities, improve their understanding of mathematical concepts, and promote their social skills (Webb et al., 2002). However, the effectiveness of collaborative learning strategies may be influenced by a range of factors, including teacher training, student motivation, and group dynamics (Roth \& Bowen, 2016).

Overall, this study contributes to our understanding of the challenges and opportunities associated with implementing collaborative problem-solving in mathematics education in the Lao People's Democratic Republic, and provides valuable insights into effective strategies for improving students' problem-solving skills in a culturally and linguistically diverse context.

## 2. Methodology

### 2.1. Research Objectives

The aim of this study is to explore the current state of 12th grade math teaching and training of cooperative problem-solving skills through teaching 12th grade math in Lao People's Democratic Republic.

### 2.2. Research Subjects and Content

### 2.2.1. Research Subjects

The survey participants included 12th grade students and math teachers from multiple high schools in Lao People's Democratic Republic. The survey sample consisted of 38 teachers, of which 4 had a college degree ( $10.53 \%$ ), 32 had a university degree ( $84.21 \%$ ), and 2 held a master's degree (5.26\%). The survey also included 411 students, of which 373 responses were valid and 38 were invalid (Table 1).

Table 1. Survey sampling


### 2.2.2. Research content

The research focuses on the teaching of 12th grade math to students in the Lao People's Democratic Republic and the problem of training their problem-solving skills through math education. To gather data, a poll will be conducted, which will follow these steps:

1. Research information from books, articles, concepts, theories, and related studies to create a questionnaire covering the required scope.
2. Take the completed questionnaire to the tutor and consult experts to check its suitability and revise it according to the instructions, then let the tutor review it.
3. Translate the questionnaire into Lao and redo it using Google Form.
4. Use the completed questionnaire to send it online to query the target respondents.
Two independent sample forms were created, one for teachers and one for students, which contained the following questions:

## Teacher's Form:

1. Do you frequently teach cooperatively in groups when teaching Mathematics?
2. What is the purpose of cooperative teaching in helping students?
3. According to teachers, what are the factors that affect the implementation of cooperative teaching in groups?
4. How do you focus on training cooperation skills for students?
5. Could you please tell us the frequency of using different types of teaching organization models?
6. How do you rate the performance of students' problem-solving skills during math theory class?
7. Could you tell us about students' difficulties when solving math problems in class?
8. To what extent have students participated in problem-solving cooperation?
9. How necessary is it to practice cooperative problem-solving skills in the process of teaching Mathematics?

## Student's Form:

1. Do teachers allow you to work in groups when learning Math?
2. Please indicate your level of participation in learning and understanding the lesson after completing it.
3. Do you understand the necessary level of training cooperative problem-solving skills in the process of teaching Mathematics?
4. What do teachers usually do for you when teaching Math?
5. What affects your learning activities when learning Math?
6. What actions did teachers suggest you take when learning Math?
7. How do teachers usually teach you when teaching Math?
8. Could you tell us about your most common learning difficulties when studying Math?

### 2.3. Data collection and interpretation

Conducted interviews with students and teachers, using questionnaires (according to 2 designed forms), with students and teachers, we sent online questionnaires using Google form and sent links to students and teachers in the list of subjects, by asking teachers in Laos to explain in detail how to do, conditions, benefits then receive results from Google form.

After obtaining the survey results, we processed the results using Microsoft Excel.

## 3. Research results

3.1. Teacher's assessment of the current situation of practicing collaborative problem-solving skills of 12 th grade students

- With question 1: In teaching Mathematics, do you often teach cooperatively in groups? the results were obtained as follows (Table 2).

Table 2. With question 1 (Teacher's assessment)

| Result | Regularly |  | Sometimes |  |  | Never |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :---: |
|  | Qty | $\%$ | Qty | $\%$ | Qty | $\%$ |  |
|  | 0 | 0 | 38 | 100 | 0 | 0 |  |

From the above results, it can be seen that the teachers who were asked all commented that they sometimes applied cooperative teaching in groups in the process of teaching for students.

- With question 2: According to teachers, the purpose of cooperative teaching is to help students.


Chart 1.

From the above results, it is found that $50 \%$ of surveyed teachers believe that the purpose of cooperative teaching is to help students review and consolidate knowledge and skills; $34.21 \%$ of surveyed teachers believe that it would help students to learn, discover and acquire new knowledge; $10.53 \%$ of surveyed teachers chose 'form cooperative skills' and $5.26 \%$ of teachers
surveyed said that the purpose of cooperative teaching is to help students generalize and systematize knowledge.

- With question 3: According to teachers, what are the causes affecting the implementation of cooperative teaching in groups? The results we obtained are as follows (Table 3).

Table 3. With question 3 (Teacher's assessment)

| Content | Result |  |
| :---: | :---: | :---: |
|  | Qty | \% |
| Inadequate facilities | 18 | 47.37 |
| Class size is too large | 14 | 36.84 |
| Teaching content has a complex structure | 1 | 2.63 |
| Habit of using old teaching methods | 1 | 2.63 |
| Limitations in the pedagogical capacity of teachers | 1 | 2.63 |
| Students do not have cooperation skills | 2 | 5.26 |
| There are no reasonable pedagogical measures to organize cooperative teaching | 0 | 0.00 |
| The specified time is not guaranteed | 1 | 2.63 |
| Difficult to create interest for students | 0 | 0.00 |
| Difficulty in classroom management and organization | 0 | 0.00 |
| Difficulty in assessing collaborative performance scores | 0 | 0.00 |
| Difficulty in determining the conditions of combination, supporting the organization of effective cooperative teaching. | 0 | 0.00 |

From the above results, it can be seen that the causes affecting the implementation of cooperative teaching in groups are mainly due to inadequate facilities (accounting for $47.37 \%$ of the opinions) and too many classes (accounting for $36.84 \%$ of the respondents). In addition, some teachers also said that the reason affecting the application of cooperative teaching in groups is that students do not have cooperation skills (accounting for $5.26 \%$ of the opinions), due to the teaching content having a complicated structure, habit of using old teaching methods, limitation in pedagogical skills of teachers or not ensuring the prescribed time (accounting for $2.63 \%$ of opinions). The teachers all said that there are reasons such as the lack of appropriate pedagogical measures to organize cooperative teaching, difficulty in creating interest for students, difficulty in classroom management and organization, and difficulty in assessing and scoring cooperative
activity results, difficulty in determining conditions for cooperation, and supporting the organization of effective cooperative teaching are not the causes affecting the application of teaching and learning collaboratively in groups.

Moreover, teachers also believe that when applying cooperative teaching in groups, good students and average students often work together under the guidance of teachers, while weak students just sit and play for the rest of the time; some students do not work and only ask classmates to do it; If using a lot of cooperative teaching in groups, students will not understand the purpose of grouping, leading to laziness and not paying attention to group activities.

- With question 4: How did you pay attention to teaching and training cooperation skills for students in the process of teaching Mathematics?


Chart 2.

From the above results, it can be seen that most of the teachers surveyed said that they are interested in teaching and training cooperative skills for students in the process of teaching Mathematics (accounting for $68.42 \%$ ) and there is no teacher answered that they are not
interested in teaching and training cooperation skills for students in the process of teaching Mathematics.

- With question 5 about the frequent use of teaching organizational models, the results we obtained are as follows (Table 4).

Table 4. With question 5 (Teacher's assessment)

| Types of models of <br> No <br> teaching <br> organization | Result |  |  |  |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :---: | :---: | :---: | :---: | :---: |
|  |  | Regularly |  | Sometimes |  | Never |  |  |  |  |  |  |
|  | Qty | $\%$ | Qty | $\%$ | Qty | $\%$ |  |  |  |  |  |  |
| 1 | Full-class | 19 | 50 | 19 | 50 | 0 | 0 |  |  |  |  |  |
| 2 | In group | 0 | 0 | 38 | 100 | 0 | 0 |  |  |  |  |  |
| 3 | Individual | 4 | 10.53 | 14 | 36.84 | 20 | 52.63 |  |  |  |  |  |

From the above results, it can be seen that most of the teachers surveyed have the opinion that they mainly use the whole class and group organization models to organize teaching, and rarely use the individual model. However, with
groups, teachers all agree that it is sometimes used, not as often as the whole class model.

- With question 6. During the theoretical math lesson, how can you assess students' performance with the following content? the results we obtained are as follows (Table 5).


# Table 5. With question 6 (Teacher's assessment) 

| No | Content | Result |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Regularly |  | Sometimes |  | Never |  |
|  |  | Qty | \% | Qty | \% | Qty | \% |
| 1 | After learning a mathematical theorem, do students know how to turn the problem around or find the application? | 4 | 10.53 | 33 | 86.84 | 1 | 2.63 |

2 When learning to solve math problems, students can find many different solutions
$\begin{array}{llllll}9 & 23.68 & 27 & 71.05 & 2 & 5.26\end{array}$

When teachers organize group activities, do
3 students participate in discussions and $\begin{array}{llllll}5 & 13.16 & 32 & 84.21 & 1 & 2.63\end{array}$ debates?

4 Can students find mistakes in the solution or
answer and give the correct answer?

Can students comment and evaluate their solution or peer's?

Do students cooperate when solving problems that teachers require?
$\begin{array}{llllll}8 & 21.05 & 30 & 78.95 & 0 & 0.00\end{array}$

From the above results, most of the surveyed teachers said that they occasionally evaluate students in the teaching of math theory with the questions asked; Very few teachers think that they never assess students in Math theory lessons with the questions asked. Especially with content such as can students find mistakes in the solution or answer then give the correct answer? do students cooperate when solving the problem that the teacher asks? The teachers all said that they had assessed students during
the math lesson. Content such as when learning to solve Math problems, students can find many different solutions; Do students cooperate when solving problems that teachers require? Have students been regularly evaluated by teachers in the theoretical math class compared to the rest of the content.

- With question 7. Can you tell me about students' difficulties when solving math problems in class? the results we obtained are as follows (Table 6).

Table 6. With question 7 (Teacher's assessment)

| No | Content | Degree of evaluation |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Do well |  | Know how to do |  | Do not know how to do |  |
|  |  | Qty | \% | Qty | \% | Qty | \% |
| 1 | Students do not know which is the condition of the problem, which is the question of the problem | 7 | 18.42 | 30 | 78.95 | 1 | 2.63 |
| 2 | Students do not know the symbols in the problem | 3 | 7.89 | 35 | 92.11 | 0 | 0.00 |
| 3 | Students do not know how to use formulas skillfully | 8 | 21.05 | 29 | 76.32 | 1 | 2.63 |

From the above results, it is shown that most of the teachers said that they could do well to know the difficulties of students when solving math problems in class; the number of teachers who do not know the difficulties of students when solving math problems in class is little, with the content of asking students who do not know the math symbols in the problem, the teachers all answered that they know the difficulties of students when face this issue. In
the contents, students do not know which is the condition of the problem, which is the question of the problem, students do not know how to use formulas skillfully, teachers have more understanding the difficulties students face when they encounter them.

- With question 8. To what extent has the role of students participating in problem solving cooperation? the results we obtained are as follows (Table 7).

Table 7. With question 8 (Teacher's assessment)

| No | Content | Degree of evaluation |  |  |  |  |  |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Do well | Know how to <br> do |  | Do not know <br> how to do |  |  |
|  | Qty | $\%$ | Qty | $\%$ | Qty | $\%$ |  |
| 1 | Participate, exchange ideas together in <br> the process of problem solving | 4 | 10.53 | 21 | 55.26 | 13 | 34.21 |
| 2 | Have a plan to cooperate with problem <br> solving | 1 | 2.63 | 14 | 36.84 | 23 | 60.53 |
| 3 | Cooperate to find own knowledge | 1 | 2.63 | 27 | 71.05 | 10 | 26.32 |

From the above results, with the question of the degree of the role of students' participation in problem solving cooperation, most of the teachers rated at knowing how to do or do not do well, especially with criteria of having plan to cooperate with problem solving most
teachers rated $(60.63 \%)$ as not doing well, with criteria of cooperation to find knowledge for themselves, the majority of teachers rated (71.05\%) as knowing how to do it. Currently, only a small number of teachers evaluate the role of students' participation in problem
solving cooperation at the level of doing well, the highest of which is in the criteria of participating together, exchanging idea. in the process of problem solving (accounting for $10.53 \%)$.

- With question 9. Could you tell us how necessary it is to practice cooperative problem solving skills in the process of teaching Math? the results we obtained are as follows (Table 8).

Table 8. With question 9 (Teacher's assessment)

| Result | Necessary |  | Neutral |  | Unnecessary |  |
| :---: | :--- | :--- | :--- | :--- | :--- | :--- |
|  | Qty | $\%$ | Qty | $\%$ | Qty | $\%$ |
|  | 38 | 100 | 0 | 0 | 0 | 0 |

From the above results, the teachers all realized the necessity of training collaborative problem solving skills in the process of teaching Mathematics to students.

- With question 10. To practice skills for students, please tell us how to do it?, The survey shows that, in order to practice skills for students, $94.7 \%$ of teachers should organize many activities for students regularly; $92.1 \%$ of teachers should create opportunities for students to exchange ideas, help each other, focus on group discussions; $71.1 \%$ of teachers


## About the skill group

have the opinion that students should be able to participate and contribute ideas in groups and $60.5 \%$ of teachers have the opinion that teachers should monitor and direct students to work multiple times.

- With question 11. In order to train students cooperative problem-solving skills in the most effective way, how often should teachers focus on forging groups of skills, problem-solving processes, cooperation skills and the following types of activities? We obtain the following:


Chart 3. (Teacher's assessment)

The above results shown that, most of the teachers said that it is advisable to practice groups of practical skills, group of general skills, and groups of skills about thinking more to less in turn.

## About the math solving process

Regarding the math solving process, most teachers said that it's a must to focus on implementing the math solving plan, developing a plan, receiving and checking the math-solving progress, and collecting the progress of solving math problems from many to less in turn.

## About cooperation skills

With cooperation skills, $100 \%$ of teachers suggested on focusing on communication skills and leadership skills as the main ones, $97.3 \%$ of teachers agree on focusing on skills to build and maintain an atmosphere of credibility, peer-to-peer mentoring skills and critical conversational thinking skills come second.

## About the types of activities

Most teachers said it is advisable to focus on the first activity: The analysis, synthesis, comparison, analogy, abstraction; the second: Language activities: when asking students to speak, explain a definition, present a solution to a problem; third: Identify and represent a concept, a method, a rule, a theorem; fourth: Common intellectual activities in mathematics: reverse the problem, consider solvability (with solutions, unique solutions), case division and finally: Complex math operations, proving, definitions, problem solving by making equations, shapes building, solve locus...from more to less.

### 3.2. 12th grade students evaluate the current state of practicing collaborative problem solving skills

- With question 1: When learning Math, did teachers allow you to work in groups? the results we obtained are as follows (Table 9).

Table 9. With question 1

| Result | Regularly |  | Sometimes |  | Never |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | Qty | $\%$ | Qty | $\%$ | Qty | $\%$ |
|  | 15 | 5.38 | 272 | 73.12 | 80 | 21.51 |

From the above results, it is shown that most of the students have been organized by the teacher to work in groups in the process of teaching math, of which $73.12 \%$ of the respondents said that teachers sometimes let them work in groups. However, there are still over $20 \%$ of
students who have never been able to work in groups when studying math.

- With question 2: Please indicate your level of participation in learning and understanding of the lesson after completing the lesson?, the results we obtained are as follows (Table 10).

Table 10. With question 2

| No Content | Degree of evaluation |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Regularly | Sometimes |  | Never |  |
|  | Qty \% | Qty | \% | Qty | \% |

When you complete a math theorem, I

1 | Wha |
| :--- |
| can use it to solve exercises and solve |
| specific problems in daily life. |

sperllllll

I try my best when participating in
$2 \begin{array}{llllllllll}\text { group activities, discussions and } & 13 & 13.49 & 145 & 38.98 & 214 & 57.53\end{array}$ debates.

|  | I can help peers find mistakes in the <br> solution or answer and give the correct <br> answer when solving Math problems. | 13 | 3.49 | 157 | 42.20 | 202 | 54.30 |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | 7 | 1.88 | 122 | 32.80 | 243 | 65.32 |  |  |
| 4 | I can cooperate and solve problems <br> with peers according to the teachers | 7 |  |  |  |  |  |  |

From the above results, we can see that over $50 \%$ of the students said that they do not use the knowledge they have learned in solving exercises and solving specific problems in daily life; not participate in group activities, discussions and debates; does not help peers to find mistakes in solutions or answers and give correct answers when solving Math problems; do not cooperate and solve problems with peers. Meanwhile, very few students answered that they regularly using the knowledge they have learned in solving exercises and solving
specific problems in daily life; participate in group activities, discussions and debates; help peers find to mistakes in solutions or answers and give correct answers when solving Math problems; cooperate and solve problems with peers.

- With question 3: Do you know the necessary level of training cooperative problem solving skills in the process of teaching Mathematics?, the results we obtained are as follows (Table 11).

Table 11. With question 3

| Result | Necessary |  | Neutral |  |  | Unnecessary |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :---: |
|  | Qty | $\%$ | Qty | $\%$ | Qty | $\%$ |  |
|  | 245 | 65.86 | 127 | 34.14 | 0 | 0.00 |  |

From the above results, the majority of students rated that it is necessary to train collaborative problem-solving skills in the process of teaching Mathematics ( $65.85 \%$ ) and $34.14 \%$ of the respondents think that the necessity of
training cooperative problem solving skills in the process of teaching Mathematics is neutral.

- With question 4: When teaching Math, what did teacher usually do for you?, the results we obtained are as follows (Table 12):

Table 12. With question 4

| No | Content | Result |  |
| :--- | :--- | :--- | :--- |
|  |  | Qty | $\%$ |
| 1 | Teachers guide students to review previous lessons and point out important <br> content to remember, show how to solve problems quickly. | 283 | 76.08 |
| 2 | Teachers let students read books to learn about lesson content such as <br> symbols, theory, examples and solutions. | 66 | 17.74 |
| 3 | Teachers often generalize and systematize knowledge for students | 17 | 4.57 |
| 4 | Teachers let them work a lot with peers to get into the habit of solving math <br> problems and doing homework | 6 | 1.61 |

From the above results, it is shown that most students believe that when teaching Math, teachers often guide students to review old lessons and instruct important content that need to be memorized and how to do it quickly (accounting for $76.08 \%$ ), in addition, $17.74 \%$ of students said that when teaching Math, teachers often let them read books to learn the content of the lesson such as: symbols, theory,
examples and solutions. There are only few students who agree that when teaching, teachers often generalize and systematize knowledge for them or let them work a lot with peers to get in the habit of solving math problems and doing exercises.

- With question 5: When learning Math, what affects your learning activities?, the results we obtained are as follows (Table 13).

Table 13. With question 5

| No | Content | Result |  |
| :--- | :--- | :--- | :--- |
|  |  | Qty | $\%$ |
| 1 | Teachers do not have enough resources to give students | 39 | 10.48 |
| 2 | The number of students is large and the students are disorderly | 236 | 63.44 |
| 3 | Textbooks can't be understood and there are many symbols that can't be <br> remembered. | 35 | 9.41 |
| 4 | Unclear teaching make students not want to learn | 22 | 5.91 |

From the above results, it is shown that the majority of students think that learning Math is difficult due to the large number of students and disorderly students (accounting for $63.44 \%$ ), in addition, 10.48 percent of students think it's difficult to learn Math because teachers do not have enough resources to give students, $9.41 \%$ of students think what makes learning Math difficult is because textbooks are hard to understand and have many symbols that
are hard to remember. In addition, some students think that learning Math is difficult because students don't like to study math, because they are empty in terms of math knowledge, or because the teacher is not good at teaching and teaches too quickly.

- With question 6: When studying Math, what actions did the teacher suggest you do? The results we get are as follows (Table 14).

Table 14. With question 6

| No | Content | Result |  |
| :---: | :--- | :---: | :---: |
|  | Qty | $\%$ |  |
| 1 | Work together with peers in the group, read books and exchange ideas to <br> solve problems | 196 | 52.69 |
| 2 | Remind you to make your own plans, stay organized, understand your roles, <br> and solve problems together | 59 | 15.86 |
| 3 | Recall that everyone must be able to establish, monitor, and maintain a <br> common understanding throughout the problem-solving task. | 77 | 20.70 |
| 4 | You need to practice communication, critical thinking, problem solving, <br> self-management, information and communication technology skills. | 40 | 10.75 |

From the above results, it can be seen that $52.69 \%$ of the students said that when studying Math, the teacher worked with peers in the group, read books by themselves and exchanged ideas to solve problems. However, only $10.75 \%$ of students surveyed said that when studying Math, teachers reminded them that they need to practice their abilities in communication, critical thinking, problem
solving, self-management, information and communication technology skills. In addition, some students said that when teaching math, teachers focused on the problem that students did not understand, and reminded students to remember the formulas.

- With question 7: When teaching Math, how do teachers usually teach you?, the results we obtained are as follows (Table 15).

Table 15. With question 7

| No | Content | Result |  |
| :--- | :--- | :--- | :--- |
|  |  | Qty | $\%$ |
| 1 | The teacher teaches for the whole class to listen and take notes | 261 | 70.16 |
| 2 | Teachers divide students into groups and work in groups to exchange ideas, <br> discuss and speak up in class | 82 | 22.04 |
| 3 | Have the students work in pairs | 2 | 0.54 |
| 4 | The teacher allows each student to read the book by themselves, discuss and <br> explain it to peers | 27 | 7.26 |

From the above results, it is shown that over $70 \%$ of the students answered that when teaching Mathematics, teachers often give lectures for the whole class to listen and take notes, over $22 \%$ of the students said that when teaching Math, teachers divided students into groups and worked in groups to exchange ideas, discuss and give speeches in class. However, there are only few students answered that when teaching Math, teachers let them work in pairs. In addition, through the exchange, some students said that when teaching Math, teachers often read the content and do the math problems themselves to check the students' understanding, then the teacher guides and answers where students do not understand; Teachers lecture and give examples to guide students to solve...

- With question 8: Please tell us the most difficult learning obstacles you often encounter
when studying Math?, the results we obtained are as follows:
+ Most students think that because math is difficult to understand because there are many formulas and symbols, they cannot remember them all; Due to the lack of knowledge from the lower grades, students do not understand, leading to dislike learning math
+ Most students also think that because the number of students is too large, students often lose order in class, which affects the ability to listen to lectures in class;
+ Some students think that due to the teacher's teaching style, teachers often teach quickly, ask students to take a lot of notes, have no clear guide on the lesson, making students not understand the lesson, rarely give homework to students.
- With question 9: What do you think will bring to yourself when working in groups?



## Chart 4.

From the results, $68.1 \%$ of students said that group activities will help them to practice the habit of communicating or talking more, $63.3 \%$ students said that they could exchange their ideas with peers, and $37.5 \%$ of students said that peer were explaining the lesson when they did not understand.

- With question 10: When working with peers in a group, what do you usually do?

The survey showed that, $58.4 \%$ of students chose: Exchange, share to learn, analyze relevant information to propose problem solving options, discuss to describe; analyze and evaluate the problem solving options and agree to choose the mathematical problem solving plan. $57.9 \%$ of students chose: Exchange, share to identify; analysis; Agree on how to define mathematical problems. $28.5 \%$ of students chose: Exchange, share, agree on goals and design components of the plan to solve mathematical problems, manage work, resolve conflicts, handle situations to implement the plan. $23.1 \%$ of students selected: Discuss, analyze, monitor progress and evaluate problem solving results, discuss and analyze to contribute ideas on mathematical problem solving results.

- With question 11: When working together in groups, which of the following skills did you use?

The survey shows that: Skills to form groups $87.3 \%$. Skills of active listening and be positive $71.0 \%$, skills of self-assessment and peer assessment $52.8 \%$, skills of document research $49.4 \%$, skills of clear and reasonable assignment of tasks $43.1 \%$, skills of planning $33.6 \%$, information sharing skills $29.2 \%$, responsibility sharing skills $18.7 \%$ and $15.3 \%$ conflict resolution skills.

## 4. Exchange and discussion

## For teachers

Teachers have had a certain understanding of cooperative teaching, understood the meaning of cooperative teaching, understood the necessity of training collaborative problem solving skills in the process of teaching Mathematics. However, in the teaching process, teachers have not use them regularly because they were afraid to change their teaching habits, because there were too many students in a class, and because the physical facilities did not meet the teaching requirements.

In the teaching process, teachers paid little attention to forging cooperation skills for students; teachers often use whole-class teaching, rarely use group-based learning; Teachers often focus on teaching knowledge to students, leaving students with less opportunity
to solve problems on their own or to cooperate to solve problems.

In the teaching process, teachers often teach quickly, let students take lots of notes, there were unclear guides, were afraid to innovate teaching methods, rarely give opportunities for students to cooperate in learning and in solving learning problems... have partly affected the quality of students, making students dislike learning math.

## For student

In the process of learning Math, students have not often work in groups. After learning the knowledge, they have not been proficient enough in applying the knowledge they have learned so that they can be used in solving exercises and solving specific problems in daily life, detecting mistakes in the solution or answer and give the correct answer when solving Math problems with peers, not yet proficient in problem-solving cooperation with classmates when solving a problem given by the teacher even though they all know the necessity of practicing collaborative problemsolving skills in the process of teaching Mathematics.

In the process of learning Math, students are often guided by their teachers to review old lessons and instruct them on important content to remember, how to do it so that they can solve the problem quickly and with little opportunity to work with peers to get into the habit of solving math problems and doing homework; Teachers often lecture for the whole class to listen and take notes, but rarely allow students to work in pairs...

In addition, factors related to learning materials, related to the number of students in a large class, students' sense of participation in learning, and students' study habits also partly affect students' learning, students have not yet acquired problem-solving skills, cooperative problem-solving skills.

## 5. Conclusion

Cooperative teaching and problem-solving skills are essential in the teaching and learning of Mathematics. However, our study found that many teachers lack the motivation to innovate teaching methods, which affects the training of
cooperative problem-solving skills for students. Teachers often use traditional teaching methods, such as whole-class teaching, which leaves students with limited opportunities to work in groups and develop their collaborative skills for problem-solving.
Additionally, the lack of facilities and teaching equipment in schools, as well as the large class sizes, also hinder the implementation of cooperative teaching methods. Students have limited opportunities for exchange and discussion, which further affects their ability to apply the knowledge learned to solve problems.
To overcome these limitations, it is crucial to promote innovative teaching methods, encourage teachers to use cooperative learning, and provide necessary resources and support to schools. Furthermore, students need to be actively engaged in group activities, discussions, and problem-solving to develop their cooperative problem-solving skills.
Overall, this study provides valuable insights into the current state of Mathematics education in Laos and highlights the need to prioritize the training of cooperative problem-solving skills in the educational context of the country. We hope our findings will serve as a basis for policymakers, educators, and curriculum developers to improve the quality of Mathematics education in Laos.

Public Interest Statement: The study aims to address the limitations in Mathematics education in Laos by investigating the current state of teaching in 12th grade and identifying issues related to training students in cooperative problem-solving skills.

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Phommanichan and Tran Viet Cuong contributed equally to the study, including the conceptualization, design, and analysis of the research.

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