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CURRENT SITUATION OF COOPERATIVE LEARNING IN TEACHING STATISTICS AT SECONDARY SCHOOLS

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Abstract. Cooperative learning (CL) is a teaching approach to develop learners' qualities and competencies to meet the goals of the 2018 General Education Curriculum. However, in secondary schools, these days, cooperative learning in mathematics in general, and specifically in teaching Statistics, has not received adequate attention. As a result, cooperative learning has not achieved the desired outcome. The paper presents the current situation of cooperative learning at secondary schools in teaching Statistics by collecting and analyzing survey data from teachers and suggests insights serving as a basis for proposing measures to support teachers to implement cooperative learning effectively, contributing to improving the quality of secondary school education. The research results show that most teachers consider cooperative learning to be an effective teaching method, yet its use in the classroom has not been adequate and is still hindered by many difficulties.

***Keywords*:** current situation; cooperative learning; secondary school; teaching statistics.

1. Introduction

Cooperative learning involves students working together through exchanging ideas, solving problems, or working towards a common goal [1], [2]. Cooperative learning is a learning process that fulfills multiple educational goals, namely positive interdependence, individual accountability, mutual interaction, the formation and development of social competencies, as well as group-based assessment [2], [3]. As a result, cooperative learning is considered an effective teaching method in today's educational landscape. However, its application to teaching statistical content is relatively new for educators and poses various challenges in practice. Nguyen and Le (2020) argue that secondary school mathematics teachers in Vietnam face many challenges as statistics is being taught for the first time across all educational levels in secondary schools [4]. This is because of the insufficient presence of statistics education in previous teacher training programs at colleges of education.

Regarding this issue, some researchers have investigated the current state of applying cooperative learning in mathematics education. Notable examples include Tran Xuan Bo (2016) [5] and Nguyen Hong Thuy (2018) [6]. These authors examined the application of cooperative learning in teaching primary school mathematics by teachers in several primary schools in Tuyen Quang province and Hanoi city. The results revealed that teachers still face many difficulties and limitations in implementation. However, with the introduction of the 2018 General Education

Mathematics Curriculum, what challenges will arise in applying cooperative learning in mathematics teaching in general, and in teaching Statistics in particular? Moreover, can cooperative learning serve as an effective teaching method to develop learners' qualities and competencies in alignment with the objectives of the 2018 General Education Program? To better understand this issue in Bac Lieu province, we conducted a practical teaching survey with 95 secondary school mathematics teachers to provide essential insights for proposing suitable and effective cooperative learning strategies and models, contributing to the successful implementation of the 2018 General Education Program's objectives.

2. Content

2.1. Research design

2.1.1. Sampling method

The research survey involved 95 math teachers at secondary schools and high schools (with secondary school level) in 7 districts, towns, and cities (Bac Lieu city, Gia Rai town, Vinh Loi district, Hoa Binh district, Phuoc Long district, Hong Dan district, Dong Hai district) in Bac Lieu province. We also selected a convenient sample of teachers who agreed to answer the questionnaire in provinces: Soc Trang, and Dong Thap.

2.1.2. Survey purpose

The survey aims to explore the perceptions of secondary school teachers of cooperative learning and the current state of teaching Statistics content and teaching Statistics through cooperative learning in the current period.

2.1.3. Data collection procedure and instrument

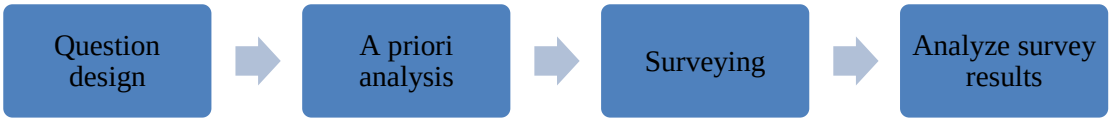

Figure 1. Survey implementation process

Data collection tool: We used Google's Forms application (Forms) to conduct this survey. The survey form (or questionnaire) includes 31 questions, the content is presented in Table 1.

Table 1. The main components of the questionnaire

Content	Number of items
Email, gender, years working in education, highest level of expertise, place of work, workplace, teaching grade level.	7
Cooperative learning	14
Teaching statistics	6
Teaching statistics through cooperative learning	4
Total	**31**

2.2. Survey results and discussion

2.2.1. Participants' demographic information

The total number of teachers participating in the survey was 95 teachers, of which:

- Gender: Male: 53; Female: 42.

- Years of working in education: Under 5 years: 06; From 5 to under 10 years: 09; Over 10 years: 80.

- Highest level of expertise: Masters: 8; University: 86; College: 1.

- Workplace: Inner suburbs, city center: 38; Suburbs and peri-urban areas: 57.

- Teaching grade level: Middle school: 85; Inter-level Middle School - High School: 10.

2.2.2. Evaluating measurement tools

The Cronbach's Alpha reliability coefficient is an important indicator for assessing the reliability of questionnaires or scales, particularly in social and psychological research. According to studies by Nunnally (1978) and Peterson (1994), a questionnaire is considered very good if the Cronbach's Alpha coefficient ranges from 0.8 to nearly 1, and is considered good if it ranges from 0.7 to nearly 0.8 [7], [8].

The reliability coefficient in Table 2 shows that all factors have good Cronbach Alpha coefficients from 0.735 to 0.947. This means that the questionnaire fulfills the required reliability coefficient.

Table 2. Reliability of the questionnaire

Factor	Number of variables	Cronbach Alpha
Teachers' perceptions of cooperative learning (Q1; Q2;Q3;Q4)	4	0.947
Difficulties when organizing cooperative learning (Q7.1; Q7.2; Q7.3; Q7.4; Q7.5; Q7.6; Q7.7)	7	0.822
Teachers' perceptions of teaching Statistics (Q9; Q10; Q11; Q12.1; A12.2)	5	0.735
Teachers' perceptions of teaching Statistics through cooperative learning (Q13; Q14; Q15)	3	0.840
Total	**19**	

(Cronbach Alpha coefficients of each factor were calculated with the IBM SPSS 29 statistical program)

2.2.3. Survey results

**** Cooperative learning***

✓ *Teachers' perceptions of cooperative learning*

Table 3. Teachers' perceptions of cooperative learning

Content	*Level (%)*					*Mean Value*	*Standard deviation*
	1	*2*	*3*	*4*	*5*		
1. Cooperative learning is a way of organizing teaching in which students work in groups to research together, exchange ideas, and solve problems.	5.26	0	2.11	49.47	43.16	4.25	0.934
2. Cooperative learning has a number of characteristics involving group building activities; positive interdependence; individual and	5.26	0	2.11	58.95	33.68	4.16	0.903

group responsibilities; and Forming and developing cooperation skills.							
3. Cooperative learning has the advantage of forming and developing the following qualities: compassion, responsibility, and honesty of learners.	5.26	0	3.16	54.74	36.84	4.18	0.922
4. Cooperative learning has the advantage of forming and developing the general competence for learners: Autonomy and self-study; problem solving and creativity; communication and cooperation. Especially mathematical competence: solving mathematical problems; and mathematical communication.	5.26	0	3.16	50.53	41.05	4.22	0.936
Medium						***4.20***	

The responses were rated on a 5-point Likert scale from 1 to 5 (1-Completely disagree; 2-Disagree; 3-No opinion; 4-Agree; 5-Completely agree). Completely disagree: 1.81-2.60; Disagree: 2.61-3.40; Agree: 3.41-4.20; Completely agree: 4.21-5.0 [9].

According to the results observed in Table 3, the mean score for each variable ranges from 4.16 to 4.25; The factor average is 4.20. Of all the 5 levels, "*agreement"* reached the highest rate in every variable. It can be said that the surveyed teachers generally had a proper understanding of the concepts, characteristics, and benefits of cooperative learning. Therefore, cooperative learning has increasingly been emphasized by teachers, especially since the 2018 general education curriculum was issued. However, there are still some teachers who have not fully understood these concepts (who completely disagreed, accounting for 5.26% of teachers). Teacher awareness is expected to gradually improve with teaching experience and cooperative learning training. As a result, teachers can better apply these concepts in their teaching process.

✓ *Conditions for organizing effective cooperative learning*

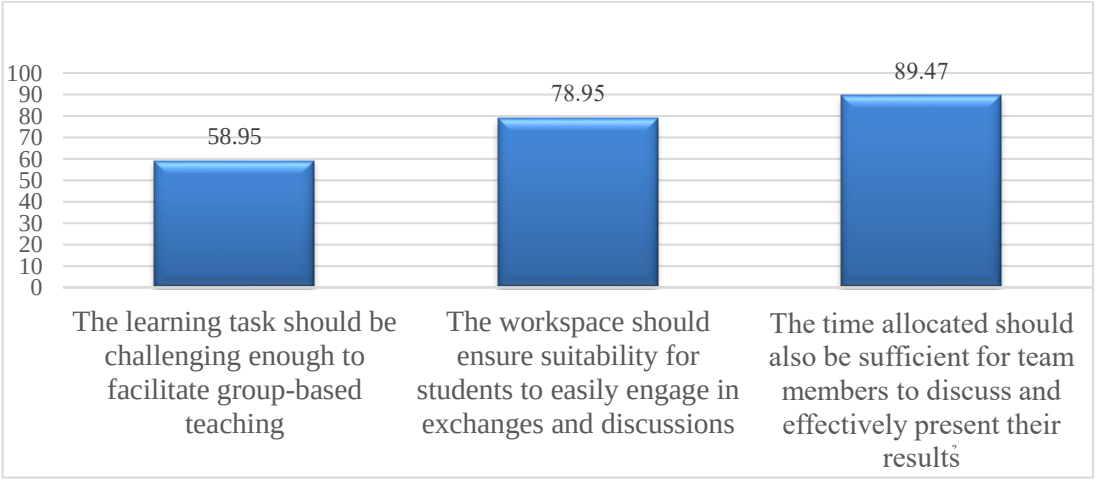

Figure 2. Conditions for organizing effective cooperative learning activities

The survey results show that among the three conditions for organizing effective cooperative learning, "The time allocated should also be sufficient for team members to discuss and effectively present their results" is of greatest concern among the teachers (accounting for 89.47%); "The workspace should ensure suitability for students to easily engage in exchanges and discussions" is their second concern (accounting for 78.95%); Many teachers disagreed with the statement "The learning task should be challenging enough to facilitate group-based teaching" (58.95% of teachers disagreed). It can be said that the awareness of some teachers regarding the conditions for effectively organizing cooperative teaching was not yet comprehensive. This can be explained either by the fact that those teachers have not been fully equipped with theoretical knowledge about this issue by the teachers themselves or by the school's conditions, etc.

✓ *Conditions for an effective cooperative learning process*

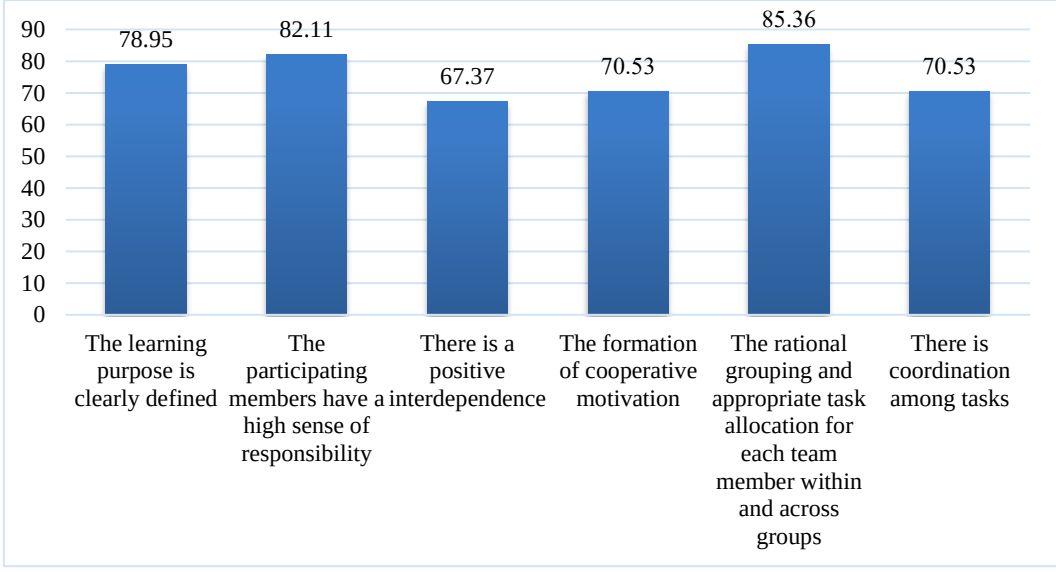

Figure 3. Conditions for the cooperative learning process to be effective

As shown from the survey findings, the conditions for the effective cooperative learning process were highly agreed upon by the teachers (accounting for 67.37% to 85.36% of the respondents). In particular, "rational grouping and appropriate task allocation for each team member within and across groups " was considered the most important condition, claimed by 85.36% of the participating teachers. “Positive interdependence " was chosen by the fewest teachers (accounting for 67.37%). Each condition has its own significance in facilitating an effective cooperative learning process. Cooperative learning is expected to create positive interdependence, encouraging students to link and coordinate activities to carry out common tasks based on the proactive organization of each member. However, some teachers were not fully aware of modern teaching theories. This situation highlights that, in order to put interactive teaching into practice and maximize its effectiveness, it is necessary to enhance teachers' understanding of the essence of cooperative learning and to provide more specific pedagogical guidance and support for teachers.

✓ *Difficulties in organizing cooperative learning*

Table 4. Difficulties when organizing cooperative learning

Content	Level (%)					*Mean value*	*Standard deviation*
	1	***2***	***3***	***4***	***5***		
Difficult in designing cooperative activities	9.47	22.11	15.79	49.47	3.16	3.15	1.101
Large class size	5.26	11.58	5.26	46.32	31.58	3.87	1.142
Class time is not enough.	8.42	14.74	9.47	45.26	22.11	3.58	1.225
Unable to accurately assess each student's level.	5.26	12.63	8.42	55.79	17.9	3.68	1.074
Students do not have the skills to communicate and work together.	6.32	12.63	8.42	53.68	18.95	3.66	1.117
Students are complacent and refuse to work.	7.37	1.05	4.21	55.79	31.58	4.03	1.036
Lack of facilities and means for organizing cooperative learning	9.47	7.37	11.58	48.42	23.16	3.68	1.187
Medium						***3.66***	

The responses were rated on a 5-point Likert scale from 1 to 5 (1-Completely disagree; 2-Disagree; 3-No opinion; 4-Agree; 5-Completely agree). Completely disagree: 1.81-2.60; Disagree: 2.61-3.40; Agree: 3.41-4.20; Completely agree: 4.21-5.0 [9].

According to Table 4, it can be seen that all the difficulty statements generally receive a mean value leaning towards level 4 on the 5-point Likert scale, meaning the surveyed teachers mostly agreed that when implementing cooperative learning, they encountered the above challenges. Specifically:

The difficulty reported by most teachers is "Some students are complacent and refuse to work." with 31.58% of all respondents at level 5 and 55.79% at level 4. In second place is "Large class size", claimed by 31.58% at level 5 and 46.32% at level 4. Moreover, the mean values of the two difficulties mentioned above also clearly illustrate this. In actual teaching, large class sizes are believed to create significant challenges for organizing cooperative learning, as teachers find it difficult to manage students during cooperative activities.

In addition, due to insufficient awareness, some teachers did not recognize the role of learning tasks which are difficult enough to necessitate group teaching and mutual dependence - characteristics of cooperative learning. The teachers' perceived difficulties probably also stemmed from this issue.

Next, the lack of communication and teamwork skills among students was another challenge mentioned by teachers. The habit of relying on and placing absolute trust in teachers was very common among students, limiting their independence and creativity. This can be improved if teachers organize more cooperative activities. The final challenge identified by the teachers was the insufficient class time, which required their skills to organize cooperative learning among students. Therefore, teachers need to regularly implement cooperative teaching activities.

✓ *Teachers' implementation of cooperative learning activities during the teaching process*

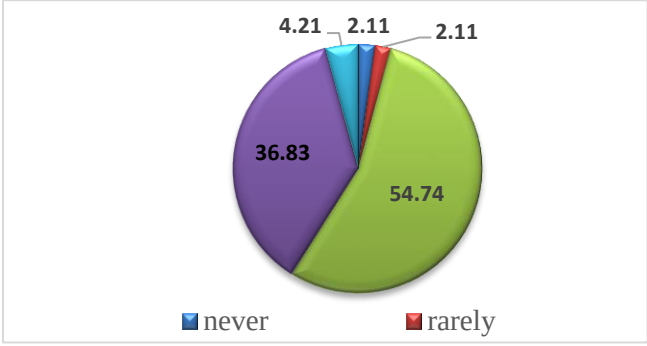

Figure 4. Frequency of implementing cooperative learning activities

According to the results obtained from the survey, 4.21% of the surveyed teachers claimed to apply CL very often, 36.83% often, 54.74% only occasionally, and 2.11% rarely. However, 2.11% of the respondents never used it in teaching. The figures suggest that the application of cooperative learning in teaching was still limited and inadequate. It's probably because some teachers were intimidated by innovations following the initial difficulties they encountered when implementing innovative techniques and ideas. Some teachers reported already knowing about cooperative learning and have applied it to teaching, yet their understanding was really incomplete and completely inaccurate.

**** The practice of teaching Statistics***

✓ *Teachers' perception of teaching Statistics*

Table 5. Teachers' perceptions of teaching Statistics

Content	Level (%)					*Mean value*	*Standard deviation*
	1	*2*	*3*	*4*	*5*		
Incorporating Statistics into the curriculum from grade 6 to grade 9 in the 2018 general education mathematics curriculum is essential in the current period.	6.32	1.05	12.63	54.74	25.26	3.92	0.996
To contribute to achieving the goal of teaching Statistics content according to the 2018 general education curriculum for mathematics, teachers need to innovate teaching methods.	4.21	1.05	3.16	53.68	37.9	4.2	0.894
The amount of knowledge of Statistics content is extensive.	10.53	13.68	23.16	42.11	10.52	3.28	1.155
Content is too difficult for students to comprehend.	10.53	30.53	21.05	27.37	10.52	2.97	1,198
The time allocated in the curriculum for teaching statistics is still limited.	4.21	17.9	21.05	44.21	12.63	3.43	1.058
Medium						***3.56***	

The responses were rated on a 5-point Likert scale from 1 to 5 (1-Completely disagree; 2-Disagree; 3-No opinion; 4-Agree; 5-Completely agree). Strongly disagree: 1.81-2.60; Disagree: 2.61-3.40; Agreed: 3.41-4.20; Totally agree: 4.21-5.0 [9].

The data in Table 5 shows that most teachers were properly aware of the importance of incorporating statistics into the secondary education curriculum (with 54.74% of the teachers agreeing and 25.26% fully agreeing). Moreover, a majority of the teachers acknowledged that innovating teaching methods contribute to achieving the educational goals of teaching statistics (with 53.68% agreeing and 37.9% fully agreeing). Additionally, the Ministry of Education and Training has organized many training programs on teaching content and methods, which have shown some initial positive results. According to the 5-point Likert scale, the statement "The amount of knowledge of Statistics content is extensive." (with a mean score of 3.28) and "Content is too difficult for students to comprehend." (with a mean score of 2.97) indicate that the asked teachers generally did not agree. This suggests that the current statistical content in the mathematics curriculum is appropriate for students. However, the 2018 general education curriculum for mathematics has only been implemented in grades 6, 7, and 8. Starting from the 2024 - 2025 school year, it will be implemented in grade 9 as well. Once it is fully integrated across all levels, there will be a more comprehensive perspective on this issue.

Regarding the statement "The time allocated in the curriculum for teaching statistics is still limited", 44.21% of the respondent teachers agreed, and 12.63% fully agreed. In the mathematics curriculum, three areas of knowledge need to be provided to students. Statistics is just one of them and may receive limited time due to the need to cover other aspects [8]. Additionally, the way teachers approach statistics teaching can impact time allocation; with appropriate teaching methods, teachers can achieve their goals within a certain amount of time.

✓ *Teachers' awareness of the goals of teaching Statistics*

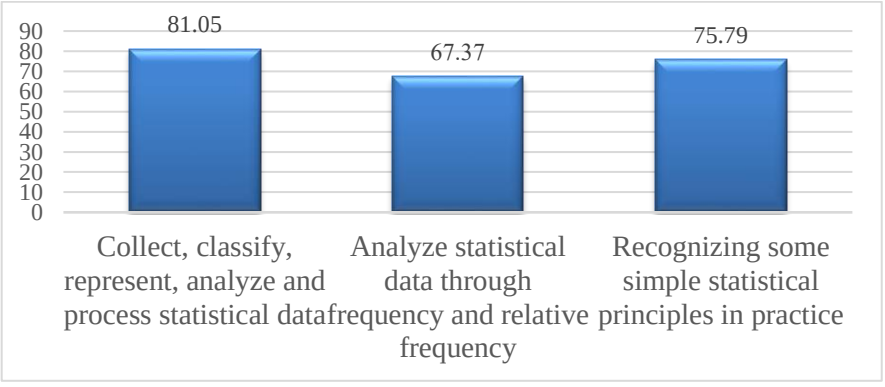

Figure 5. Objectives of teaching statistics

In Figure 5, it is shown that the majority of the teachers demonstrated an adequate understanding of the goals of teaching statistics in middle schools. The goals of "Collect, classify, represent, analyze and process statistical data" were claimed by 81.05% of the teachers, "Analyze statistical data through frequency and relative frequency" by 67.37%, and "Recognize some simple statistical principles in practice" by 75.79%. This shows that most teachers fully understood the statistical content in the 2018 general education curriculum in mathematics. Understanding teaching goals helps teachers determine directions for teaching and create an effective learning environment to support students in gaining the necessary skills and knowledge. However, there was still a proportion of the teachers who did not have a proper perception of this content, as they failed to recognize the practical values of learning statistics for students in daily life, leading to a lack of teaching motivation. Sometimes, teacher training programs may not provide enough statistical knowledge and skills, or even if they do, they do not focus on how to apply them in actual teaching. A teaching plan that is unclear, unspecific, and lacks well-defined objectives for teaching statistics can lead to confusion for the teacher. To help teachers grasp the goals of teaching statistics, it is necessary to provide appropriate training, rich resources, and

opportunities for practical application in the teaching environment. At the same time, it is important to boost teachers' confidence and motivation so that they will appreciate the value and application of statistics in education.

**** Teaching statistics through cooperative learning***

- Teachers' perceptions of teaching Statistics through cooperative learning

Table 6. Teachers' perceptions of teaching Statistics through cooperative learning

Content	Level (%)					*Mean Value*	*Standard deviation*
	1	*2*	*3*	*4*	*5*		
The current statistics curriculum facilitates the design of cooperative activities.	3.16	5.26	9.47	60	22.11	3.93	0.902
When teaching statistics using cooperative learning methods, students' interest and confidence in learning mathematics significantly increase.	2.11	3.16	7.37	61.05	26.31	4.06	0.810
Cooperative learning is an effective teaching method, helping to achieve goals in teaching statistics content.	3.16	2.11	10.53	57.89	26.31	4.02	0.863
Medium						***4.00***	

The responses were rated on a 5-point Likert scale from 1 to 5 (1-Completely disagree; 2-Disagree; 3-No opinion; 4-Agree; 5-Completely agree). Strongly disagree: 1.81-2.60; Disagree: 2.61-3.40; Agreed: 3.41-4.20; Totally agree: 4.21-5.0 [9]

According to the table above, The responses were rated on a 5-point Likert scale from 1 to 5 with a medium of 4.00, of which: "The current statistics curriculum facilitates the design of cooperative activities" was supported by 60% of the respondents; 22.11% completely agreed; "When teaching statistics using cooperative learning methods, students' interest and confidence in learning mathematics significantly increase" was agreed by 61.05%, and completely agreed by 26.31%; "Cooperative learning is an effective teaching method, helping to achieve goals in teaching statistics content" with 57.89% agreeing, 26.31% completely agreeing. This shows that the majority of the surveyed teachers agreed and were aware of the need to teach statistics through cooperative learning.

- Teachers' current implementation of cooperative learning in Statistics content during the teaching process

Figure 6 illustrates how frequently the participant teachers implemented CL in teaching statistics. Specifically, CL was applied Very often by 8.42% of the teachers, often by 49.47%, and only occasionally by 40%; however, there were also 2.11% who never did. It can be implied that the majority of these teachers initially recognized the effectiveness of applying cooperative learning in teaching statistics and paid attention to this issue. However, this application was still limited and inadequate, given the fact that a proportion of the teachers never practiced it in teaching; or did apply CL to a very limited degree. This underscores that teaching statistics through cooperative learning was not popular with the teachers.

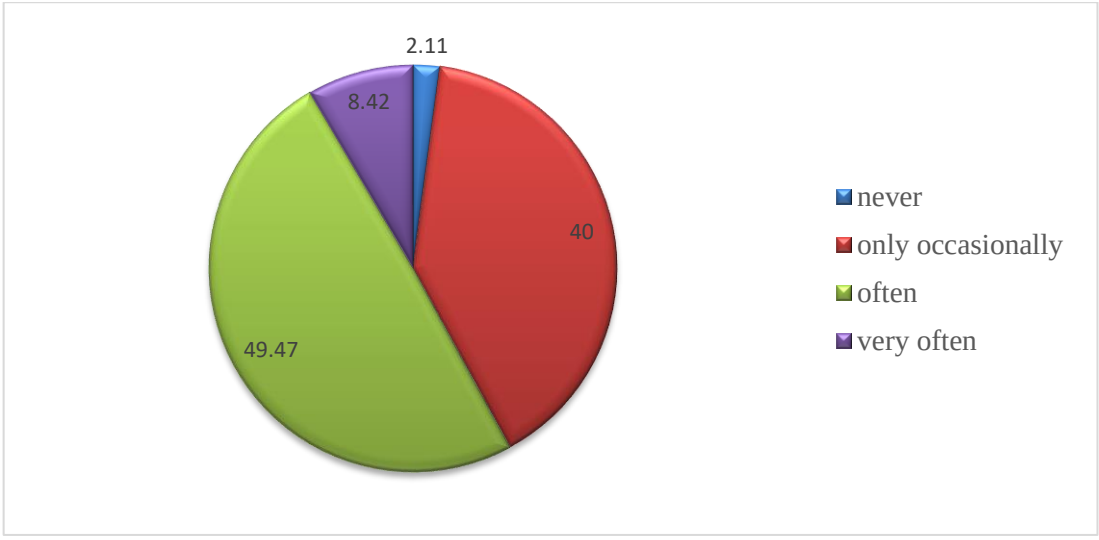

Figure 6. Frequency of applying cooperative learning in teaching statistics

2.3. General assessment of the current situation

Through analyzing the survey results on the current status of teachers' perceptions of cooperative learning, teaching statistics, and teaching statistics through cooperative teaching, the following conclusion can be drawn:

- Currently, most secondary school teachers have a fairly comprehensive understanding of cooperative learning methods. They have been equipped with knowledge and theories related to the overall innovation of teaching methods, including cooperative learning in particular. In practice, they have applied this knowledge to their teaching. However, during the application process, teachers encounter certain difficulties and challenges. In addition to issues such as lack of facilities, large class sizes, and students' over-dependence on the teacher, a primary cause of this situation is teachers' limited awareness and skills in applying the theories of cooperative learning to practical teaching. A deeper root cause is their lack of specific instructional materials on how to organize, the teaching procedures, instructional design techniques, as well as supportive measures to effectively apply these methods to specific teaching.

- The 2018 general education mathematics curriculum has introduced the teaching of statistics consistently from grade 2 to grade 12 [10]. This is a new content area, but overall, teachers have explored and grasped it quite deeply. Most teachers agree that the current statistics content is essential for students and that innovative teaching methods are a way to achieve the goals of teaching statistics. However, a proportion still lacked a complete and accurate understanding of this content.

- Although most teachers recognize that cooperative learning is an effective teaching method in mathematics education in general, and in teaching statistics in particular, its implementation in current teaching practice still faces many challenges and shortcomings. Due to its novelty in the 2018 general education mathematics curriculum. Therefore, it is necessary to provide teachers with solid theoretical and practical skills, along with practical and effective models or processes for cooperative learning that are suitable for the subject's characteristics, to help them overcome difficulties and contribute to improving the quality of teaching.

3. Conclusions

Based on the research results and the investigation into the current state of applying cooperative learning in teaching Statistics at secondary schools, it can be observed that the majority of teachers consider cooperative learning an effective teaching method that can develop students' qualities and competencies, in line with the goals of the 2018 General Education Curriculum. However, the actual implementation of this method in teaching Statistics at secondary schools still faces many limitations and difficulties.

The main issues teachers face include a lack of specialized knowledge and skills to organize cooperative learning activities, insufficient supporting materials, and a lack of specific teaching methods for effective implementation. Additionally, the condition of facilities and the preparedness of students also influence the effectiveness of applying cooperative learning in the classroom.

Based on the findings, the study suggests several supportive measures, such as organizing training courses, providing teaching materials, and creating favorable conditions for teachers to effectively implement cooperative learning. This will not only improve the quality of teaching Statistics but also contribute to enhancing the quality of mathematics teaching, meeting the requirements of the new educational curriculum.

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