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APPLYING CORNER TEACHING METHOD AND SOME ACTIVE TEACHING TECHNIQUES IN TEACHING CHEMISTRY TO DEVELOP COOPERATIVE CAPABILITY FOR HIGH SCHOOL STUDENTS

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Abstract. One of the important competencies that need to be focused on when forming and developing for high school students, is cooperation capability. Students cooperate to solve problems in learning and life; build relationships, learn from each other, and help each other grow together. This article presents the application of the teaching method in the corner, the teaching technique of mind mapping, and the KWL technique to maximize the cooperation between students in the same group to solve the learning tasks in a corner. Instead of teachers using visual methods, experimental methods, and small group cooperation methods to guide students to acquire knowledge, in this experiment, teachers ask students in groups to cooperate with each other to self-determine goals, make plans, assign tasks, share ideas, listen to each other's ideas, and support each other to complete learning tasks in the corners. Teachers only observe students organize learning activities and provide support when needed. The results of applying these teaching techniques and this corner teaching method to the development of students' cooperative capability show that students' cooperative capability is developed through teaching Chemistry in high schools.

Keywords: active teaching methods and techniques, collaborative capability, teaching Chemistry, high school students.

1. Introduction

Cooperation capability is one of the core competencies of students [1], so the formation and development of collaborative competency is an urgent requirement for a new general education program oriented towards quality and capability development. The cooperative capability allows people to work together to solve problems in the best way, mobilize group strength, and select good ideas to solve complex problems. The application of a number of active teaching methods and techniques to form and develop the competencies for students, especially the ability to cooperate, is used more and more effectively.

In the world, these topics have been systematized by some authors. M. Asrori and A. Tjalla [2] designed to examine the effectiveness of a collaborative teamwork learning model to improve the teamwork capability of high school students. There are four aspects of the students' collaborative teamwork learning model that is effective to improve the teamwork capability of experimental high

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school students. Dao Thanh Nga [3] built from the research idea of assessing teamwork capability to develop. These aspects are sharing, collaboration, paying attention to the rights and welfare of others, and caring for others. The results of the study show that the experimental high school students. Dao Thanh Nga [3] built from the research idea of assessing the current situation of developing communication and cooperation capability for primary school students through experiential activities to clarify the shortcomings as a scientific basis. Van Thi Thanh Nhung and Pham Thi Hong Hanh [4] designed a STEM lesson on organic waste treatment, through that theme, the teachers organized learning activities for students to cooperate and work together to complete tasks together. Through the project, cooperation capability is developed. The nature of STEM education is collaborative teaching. Collaboration in STEM teaching is expressed in the content of the subject, in the learning activities, in the learners, and the cooperative learning results in the education model.

In Vietnam, Ha Nhu Hue [5] presented the theoretical basis of cooperation capability and four measures to develop cooperative competence for high school students. The author has built and experimented with three lesson plans with different cooperative teaching methods; program "Chemistry - Biology knowledge contest" and setting up Google Drive website to support group activities for students during project implementation. The author designed a toolkit to assess cooperative capability for students after the pedagogical experiment. Le Thi Minh Hoa [6], proposed five measures to develop the cooperative capability for students through educational activities outside of class time and design four tools to assess the development of students' cooperative capability. Nguyen Thi Thanh Ha [7] presented the theoretical basis of the topic on the following issues: collaborative capability, collaborative problem-solving process; corner teaching method. The author proposes two ways to design teaching plans, five lesson plans applying the method according to the basic non-metallic chemistry corner of grade 10 in high school. The author designs a toolkit to assess the cooperative capability and evaluate the results after the pedagogical experiment.

However, until now, the application of corner-based teaching methods and some active teaching techniques to develop the cooperative capability for high school students has not been widely applied. Therefore, the application of this teaching method to develop cooperation capability for high school students should be given more attention. This paper presents the application of the corner teaching method and some active teaching techniques in the lesson on *Sulfuric acid - Sulfate salts* to assess the development of students' cooperative capability, the criteria table for assessing the levels of this cooperative capability, and the results of developing students' cooperative capability after experimenting.

2. Content

2.1. Cooperation capability

According to ref. [1, 6], “Cooperative capability is a form of competence that allows individuals to combine in an organized and flexible manner the knowledge necessary for cooperation, skills, and attitudes, values, and personal motivations to effectively meet the requirements of cooperation activities in a specific context. In which, each individual demonstrates positivity, self-discipline, interaction, and high responsibility on the basis of mobilizing their knowledge and skills to effectively solve cooperative activities”.

Thus, cooperative capability can be understood as the ability of individuals to interact with other individuals and groups in learning and life activities to jointly solve a common problem, towards a common goal. Collaborative capability shows the ability to effectively mobilize knowledge, skills, and attitudes of individuals in combination with sharing, interacting in a

relationship with the collective, and supporting each other to effectively solve cooperative activities. This is an important and necessary capability to develop not only in the educational environment but also in today's highly integrated and cooperative social environment.

The structure of collaborative capability is described in Table 1.

Table 1. Building criteria and assessment level of collaborative capability

Criteria	Level 1	Level 2	Level 3
Setting the goal and form of cooperation based on tasks			
1. Excited to share all their own insights related to the lesson knowledge and jointly define the group's common tasks.	Not ready to share knowledge and determine the group's goals with other members.	Willing to share knowledge and understandings but not fully determine the group's goals.	Willing to share knowledge and fully understand the group's goals.
2. Setting the goals, topics, and forms of cooperation when working with other members.	The purpose and content to cooperate have not been determined and how to cooperate with other members has not been determined.	Proactively propose cooperation purposes, know how to choose cooperation methods, but the effectiveness of cooperation is not high and incomplete.	Proactively propose cooperation purposes and contents and cooperate effectively with other members.
Job analysis, assignment of responsibilities organizes activities			
3. Task assignment, taking on responsibility.	Participating passively and not ready to take the given tasks.	Ready to take tasks from the team leader but not actively propose cooperation.	Ready to take tasks from the team leader and actively propose cooperation.
4. Drawing a plan.	Still confused and passive in building a plan to perform the group's common tasks.	Actively contribute to the development of the plan to carry out the group's common tasks, but it is not complete and effective.	Actively contribute ideas and come up with an effective plan to carry out the group's common tasks.
Establishment and operation			
5. Performing the given tasks.	Organization of activities to perform assigned tasks is not effective and has not actively completed the assigned tasks.	Actively organize activities to perform assigned tasks, but the efficiency is not high.	Actively organize assigned activities effectively and complete assigned tasks.
6. Monitor work progress; adjust operation, help other members.	- Not actively monitoring the work progress of each member and the	- Monitoring the work progress of each member and the whole group but	- Monitoring the work progress of each member and the whole group to come

	whole group to come up with plans to adjust cooperation.	unable to come up with plans to adjust cooperation.	up with plans to adjust cooperation effectively.
7. Listening to the responses.	Not enthusiastically sharing ideas, not listening, and not absorbing the suggestions of other members.	May not listen to all responses or rarely help other members	Listen to all responses and learn from these responses and give feedback to other members.
8. Presenting the results and discussing the overall results of the group.	- May not present the result of cooperation. - Do not participate in the group discussion to evaluate the overall results.	- Presenting the result of cooperation but may not be adequate. - Participating in the group discussion to evaluate the overall results but may not give valuable ideas.	- Fully presenting the result of cooperation. - Participating in the group discussion to evaluate the overall results and give valuable ideas.
9. Resolving conflicts between oneself and other members.	Unable to identify the reasons and solutions of the conflicts between oneself and other members.	Able to find the causes of conflicts but unable to resolve conflicts with other members.	Able to find the causes and solutions to resolve conflicts with other members.
Evaluating the result of cooperation			
10. Evaluating the level of goal achievement. Learning from experiences and giving feedback to other members.	Evaluating incorrectly individual and group work results or unable to learn from experience, unable to help other members learn from their mistakes.	Evaluating but not adequately individual and group work results or able to learn from experience but unable to help other members learn from their mistakes.	Accurately evaluate individual and group work results or able to learn from experience and help other members learn from their mistakes.

According to ref. [1], cooperation capability includes five component competencies: "Determining the purpose and mode of cooperation; Defining your responsibilities and activities; Determining the needs and capabilities of the collaborator; Organizing and persuading others; Evaluation of cooperation activities" and nine manifestations of collaborative capability. Based on the criteria and manifestations of the cooperative capability [1], a Rubric is built to evaluate the component capabilities and presented in Table 1.

From Table 1, we build a cooperative capability assessment form for teachers as shown in Table 2 (Levels 1, 2, and 3 are evaluated as shown in Table 1).

Table 2. Form to evaluate students' cooperative capability (for teachers)

Criteria	Level			
	1	*2*	*3*	
1. Sharing knowledge, mutual understanding, and setting group goals.				KWL tables
2. Setting the goals, topics, and forms of cooperation when working with other members.				By observing
3. Task assignment, taking on responsibility.				By observing
4. Drawing a plan.				By observing
5. Performing the given tasks.				By Observing
6. Monitor work progress; adjust operation, help other members.				By Observing
7. Listening to the responses.				By Observing
8. Presenting the results and discussing the overall results of the group.				By Observing
9. Resolving conflicts between oneself and other members.				By Observing
10. Evaluating the level of goal achievement. Learning from experiences and giving feedback to other members				Students evaluate each other
Total				

2.2. Some active teaching methods and techniques to develop the cooperative capability for students

2.2.1. Teaching method according to the corner

"Corner learning is a learning method whereby students perform different tasks at specific locations in the classroom space but work towards mastering the same content in different learning styles" [8].

The advantage of this method is that through the implementation of learning tasks from different corners, students can acquire knowledge according to different learning styles. In order to complete the tasks in the corners in a limited time, they need to know how to cooperate with each other to determine the common tasks of the group, assign tasks appropriately, contribute ideas, know how to listen and absorb other people's opinions from that to learn for themselves, develop the capability to cooperate and work as a team. The learning corners can be divided as shown in Figure 1.

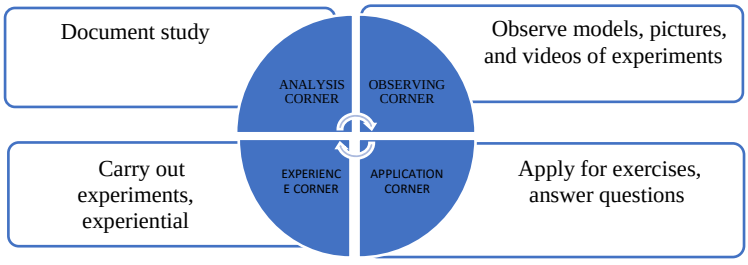

Figure 1. The model of learning corner in the teaching method according to the corner

2.2.2. The technique of using mind maps

"Mind map is a thinking organization tool, a way to transfer information into the brain and then get information out of the brain easily. A mind map is a form of note-taking that uses color and images to expand and deepen ideas. The attractiveness of images, sounds, etc. causes strong stimulation to the limbic system of the brain, helping to remember long-term and create

favorable conditions for the cerebral cortex to analyze, process, and draw results, discuss or build a model about the object of study" [8].

In order for students to be able to implement mind maps for the learning process, teachers need to introduce and guide students about mind maps, how to organize information, and the steps to draw if students do not have knowledge and experience. The teacher raises general questions related to the lesson content to prompt students to find the central keyword, develop sub-topics - the primary keyword is complementary to the central keyword. Starting from the level 1 keywords, the teacher can use the 5W1H questioning technique (What, When, Who, Where, Why, How) to suggest to the students the content related to the secondary keywords. Students give different opinions and agree on the 2nd level keyword system for mind maps. Building a mind map requires students to know how to cooperate. When students discuss to build a mind map, students need to give their own opinions for each big branch and a small branch of the mind map, listen to each other's sharing, give suggestions and comments to each other then agree on a common opinion for the group and assign tasks to each member to complete the diagram. In order to complete the mind map at a certain time, they need to cooperate well and in harmony with each other.

2.2.3. KWL technique

"KWL is a diagram that connects known knowledge related to the lesson (K - Known), the knowledge wanted to know (W - Want to know) and the knowledge learned after the lesson (L - Learned)" [8-10].

KWL Table

Lesson name: ..... Group: .....

Known	Want	Learned
-	-	-

The advantage of this teaching technique is to mobilize all the learned knowledge of the group members through column K; Students cooperate to share and contribute ideas to complete two columns K and W before starting to study the lesson and together to synthesize ideas to complete item L after finishing the lesson. Through the group members working together to complete the KWL, the children help each other recall knowledge, identify what needs to be learned, and summarize what they have learned.

2.3. Applying some active teaching methods and techniques in the lesson on *Sulfuric acid - Sulfate salts* to develop cooperation capability for students

2.3.1. The process of implementing corner-based teaching

❖ ***Step 1: Select the appropriate lesson content and classroom space***

- Content: The teacher chooses the lesson Sulfuric acid - Sulfate salt.

- Space: The space is suitable for the number of students and the arrangement of teaching equipment.

❖ ***Step 2: Design the lesson plan***

- Determining the lesson objectives including knowledge, skills, attitudes, and competencies that students need to achieve after the lesson, namely cooperation capability.

- Identify teaching methods that can be combined with corner-based teaching methods such as visual methods, small group collaboration methods, experimental methods to make lessons diverse, engaging, and effective. The groups perform tasks at different corners to complete the worksheets in a fixed time. To complete the assigned learning tasks, students must determine

the common task of the group, assign work to group members reasonably, and organize activities to perform the assigned tasks, then monitor the work progress, adjust and support each other to complete the group's common tasks. Students also need to be able to listen to, share and absorb the ideas of other members.

- Divide the class into 3 corners: observation corner, analysis corner, and experience corner.

- Design tasks and activities in each corner: Teachers develop worksheets to assist students in performing tasks in the corners.

- Design activities to reinforce lessons: After students complete tasks in the corners, teachers organize student evaluation activities through product reports. Finally, the teacher summarizes the lesson and highlights the main points of the lesson.

- Design the form and toolkit to assess the cooperative capability of individuals and groups of students: Teachers can choose the form of assessment through observation, mutual assessment, or self-assessment.

❖ ***Step 3: Organize teaching activities***

- The teacher divides the class into 3 large groups: Each group has from 12 to 13 students.

- The teacher asks each group to do the task at a corner. After completing the tasks in one corner the group of students rotated to other corners.

- Students perform tasks at starting corners under the supervision and support of teachers.

- At the end of the corner activity, the teacher guides students to rotate to the next corner.

- After students participate in learning at all corners, the teacher organizes the group reports at the corners. At the last corner, a representative of the group will present the results, and the other students will comment, supplement, and evaluate.

2.3.2. Lesson plan for *Sulfuric acid - Sulfate salts*

**** Goals***

✓ *Development of Chemistry competence*

- *General competence:* Developing communication and group cooperation competence. Students give their individual opinions then combine with other members of the group, agreeing on common ideas to solve the group's work. Students assign each other to solve group tasks.

- *Specific competence*

+ Students state the physical properties of H_2SO_4, the application of H_2SO_4.

+ Students can explain that H_2SO_4 is strongly acidic (makes litmus red turn red, reacts with metals, bases, basic oxides, and salts of weak acids).

+ Students demonstrate that hot, concentrated H_2SO_4 acid has strong oxidizing properties (oxidize most metals, many non-metals, and compounds) and hydrophilic properties.

+ Developing practical chemistry competence: Students observe experiments, predict, state phenomena, explain, write illustrative chemical equations. Students know how to operate experiments, how to use tools and chemicals safely and effectively.

+ Developing the competence to use chemical language: write mathematical equations, name substances, products, name experiments.

✓ *Development of quality*

- Hard-working: Students study and work hard, are eager to learn, and enthusiastically participate in the group's work.

- Honesty: Students honestly complete the assigned tasks, are honest in doing experiments, report the results obtained from the process of doing experiments.

- Responsibility: Students complete the assigned work, without affecting the general work or the overall working progress of the group.

- Kindness: Students are always ready to help team members and class members complete academic tasks. Students learn to respect differences; sympathy, tolerance with classmates.

**** Prepare***

✓ *Teacher*

- A0 paper, study card, support card, function room (Projector, computer).

- Equipment and chemicals:

+ Equipment: Test tube (15 test tubes), suction meter (5 pieces), glass rod (1 piece), glass spoon (1 piece), small glass cup (7 pieces), alcohol lamp (1 piece), matches (1 bag), glass brush.

+ Chemicals: Concentrated sulfuric acid, dilute sulfuric acid, Copper flake metal, NaBr salt in solid form, sucrose ($C_{12}H_{22}O_{11}$), sulfur powder (S), $Fe_2(SO_4)_3$, solution NaOH, distilled water (H_2O), purple litmus.

✓ *Students*

- Colored pens (3 boxes).

- Study old lessons, read and study new ones.

**** Teaching methods***

- The main method is the corner method - The corners carry out the same learning content and goals but in different styles and use different means and learning materials: Observation corner (observation of the experiment in the form of a video, from which to draw comments on the physical and chemical properties of concentrated and dilute sulfuric acid, applications, write chemical equations to illustrate the comments); analytical corner (studying textbooks, reference materials, making mind maps to draw chemical properties of sulfuric acid, summarizing physical properties and applications of dilute sulfuric acid); experience corner (doing required experiments under the guidance of teachers, drawing physical, chemical, and application properties of sulfuric acid).

- Using KWL and mind map teaching techniques.

**** Designing teaching activities***

- *Stabilize the class:* The teacher checks the number of students, divides them into groups, draws a diagram to move the corners.

- *Check the old lesson:* Do not check the old lesson.

- *New lesson.*

- *Activity 1: Complete items K, W of the KWL sheet*

- *Target:*

+ Students discuss to mobilize knowledge learned about acids in 9th grade, creating a need to continue learning new knowledge by each member giving at least one opinion on the content of knowledge learned about sulfuric acid, what they want to learn after finishing this lesson, then synthesize them into the group's ideas. This activity aims to evaluate the expressions 1, 2, 7, and 8 of cooperation capability according to Table 1.

+ Training cooperation skills and language: Expressing, presenting opinions and judgments of oneself.

- *Content*: Students discuss proposed knowledge, identify what is known and problems that need to be solved.

- *Product:* Contents of columns K, W in the KWL diagram of the group.

K	W	L
- Physical properties of sulfuric acid. - Chemical properties of sulfuric acid. - Application and method of preparation of sulfuric acid.	- How to dilute concentrated sulfuric acid. - Chemical properties of concentrated sulfuric acid (Oxidant and hydrophilic properties). - Method of preparation of sulfuric acid.	
What did you do well during group activities? What did you still not do well? Remedy like?		

- *Implementation organization*: The teacher divides the class into 3 groups. The teacher asks the students to work individually and then in groups to complete items K and L. The groups hang KWL tables in the corners of their groups.

- *Activity 2: Students perform tasks in corners*

- *Target*

+ State the physical properties of sulfuric acid, the characteristic chemical properties of dilute sulfuric acid and concentrated sulfuric acid. Learn about the chemistry of dilute and concentrated sulfuric acid through experiments. Compare the chemical properties of dilute sulfuric and acid concentrated H2SO4 acid.

+ Develop cooperation capability, capability to use chemical language, communication capability and teamwork capability.

- *Content:* Students work in groups at different corners using support cards

+ Analysis corner: Students discuss in groups combined with the "tablecloth" technique to complete study sheet 1.

+ Observation corner: Watch the video, discuss, and complete study sheet 2.

+ Experience corner: Assign each other to do experiments according to the instructions, observe the experiment to complete study sheet 3.

- *Product*: Students complete worksheets. Representatives of the groups present high-performance results.

- *Implementation organization*: Students complete the requirements in the worksheet. Each group of students will simultaneously perform tasks at three different corners. After students complete all the tasks in the starting corner, they will move to the next corner and continue to complete the tasks in the last corner according to the diagram: experience corner, observation corner, analysis corner, experience corner. In the first two learning corners, students have 10 minutes to complete the task. In the last learning corner, students have 15 minutes to complete the task and then report the results of the activity. While students perform tasks in the corners, the group leader has the role of assigning tasks to group members, monitoring the spirit of cooperation and teamwork of group members. The team leader based on the manifestations of cooperation capacity in Table 1 to evaluate the achievement of the group members, then synthesize the evaluation to comment and inform the group members and adjust their attitudes group members' work. Finally, submit the comments sheet to the teacher. The teacher observes the members of each working group, combined with the evaluation results of the group leaders to assess the cooperative ability of students.

EXPERIENCE CORNER

- *Task:* Conduct the following experiments according to the instructions: To complete the tasks in this corner in 10 minutes, students must assign each other to do experiments, each large group is divided into 4 small groups of 3 to 4 students in charge of 1 experiment. Each student performs a task, then they will exchange and share ideas, give each other suggestions, and agree

on the common opinion of the whole group. The team leader is responsible for monitoring the overall progress of the team, adjusting, and providing timely support, and evaluating and commenting on the ability of each team member to cooperate and work in groups.

- *Experiment 1: NaBr reacts with concentrated H_2SO_4 acid solution.*

+ Take 1 teaspoon of NaBr crystal glass into the test tube.

+ Slowly drop a small amount of concentrated H_2SO_4 acid solution into a test tube containing solid KBr, cover the test tube with a cotton pad impregnated with NaOH solution (according to the available sample).

+ Observe phenomena, explain, and write chemical equations.

- *Experiment 2: $Fe(OH)_3$ reacts with concentrated and dilute H_2SO_4 acid solution.*

+ Prepare $Fe(OH)_3$ from $Fe_2(SO_4)_3$ and NaOH and then dissolve the obtained $Fe(OH)_3$ with concentrated sulfuric acid and dilute sulfuric acid.

+ Observe phenomena, write chemical equations, explain.

- *Experiment 3: Cu reacts with concentrated and dilute H_2SO_4 acid solution.*

- Complete the following worksheet: State the role of sulfuric acid in these reactions by writing immediately below the chemical symbol for sulfuric acid in the chemical equation for the experiments.

- *Experiment 4: Sucrose reacts with concentrated sulfuric acid.*

Number	**Experiment name**	**Phenomenon**	**Chemical equation**
Experiment 1	NaBr reacts with concentrated H_2SO_4 acid solution.		
Experiment 2	$Fe(OH)_3$ reacts with concentrated and dilute H_2SO_4 acid solution.		
Experiment 3	Cu reacts with concentrated and dilute H_2SO_4 acid solution.		
Experiment 4	Sucrose reacts with concentrated sulfuric acid.		

OBSERVING CORNER

- *Tasks:* Access YouTube, search for experiments, watch videos of experiments on the screen, observe what happens. To complete the tasks in this corner within 10 minutes, students need to divide the tasks among the members appropriately. The students were again divided into small groups of four students each. Each small group accessed YouTube to observe an experiment, then recorded, explained, and wrote the chemical equation for each experiment. Finally, this small group gathers ideas and explains to each other about each experiment, and completes a group worksheet. Write the results in the following table:

Number	**Experiment name**	**Phenomenon**	**Chemical equation**
Experiment 1	Add H_2O to concentrated H_2SO_4 acid.		
Experiment 2	Cu reacts with hot, concentrated H_2SO_4 acid.		
Experiment 3	S reacts with concentrated H_2SO_4 acid.		
Experiment 4	Sucrose ($C_{12}(H_2O)_{11}$) reacts with concentrated H_2SO_4 acid.		
Determine the role of concentrated H_2SO_4 in the above reaction? 1) 3) 2) 4)			

ANALYSIS CORNER

- *Tasks:* The large group is divided into two small groups, group 1 is in charge of completing sentences 1 and 2, group 2 is in charge of completing sentences 3 and 4. Using the tablecloth technique, each member works independently for around 3 minutes, writes down their opinions, then the group members cooperate to share ideas and reach a consensus. Small groups share and synthesize knowledge with each other and complete these corner learning tasks. Study the textbook (Lesson 33 page 140 + 141) and fill in the following table:

1. Describe the chemical properties of dilute sulfuric acid. Write chemical equations to illustrate each chemical property. ……..... 2. The cause of the strongly oxidizing properties of hot, concentrated sulfuric acid ……..... 3. Write 3 chemical equations illustrating the strongly oxidizing properties of hot concentrated sulfuric acid? (Reacts with metals, reacts with non-metals and reacts with compounds) ……..... 4. Applications of hydrophilic properties of concentrated H_2SO_4 acid in practice …….....

- *Activity* 3: Product presentation

- *Target*: Students state the physical properties of sulfuric acid; strong acidity of sulfuric acid; oxidizing properties of concentrated sulfuric acid and the cause of the strongly oxidizing properties of concentrated sulfuric acid; Compare the properties of dilute and concentrated sulfuric acid.

- *Product:* Complete study sheets.

- *Organization of implementation*: After students complete the task at the corners, at the last corner, the group's representative reports the work results. Students from other groups listen, ask questions, and discuss. Teachers comment, supplement, and finalize knowledge.

- *Activity 4: Consolidation (Using mind map techniques)*

- The teacher uses the mind map technique (general form) to ask students to discuss in groups to complete a mind map to summarize the knowledge of the lesson.

- Within 5 minutes to complete this diagram, the group leader must divide the task among all team members, each student is responsible for completing a sub-branch of the diagram and a sub-task, then the student will one's idea each other to complete the mind map in Figure 2.

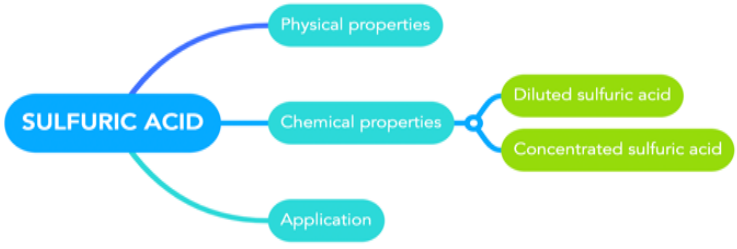

Figure 2. General mind map (provided by the teacher)

2.4. Assessing the development of students' cooperative capability through the application of some active teaching methods and techniques on the lesson of *Sulfuric acid - Sulfate salts*

To evaluate the feasibility and effectiveness of the proposed teaching process, we conducted a pedagogical experiment in class 10A (40 students), 10B (42 students), 10K

(44 students), and 10H (39 students) of Thanh Mien high school, Hai Duong with 2 lessons "Sulfuric acid and sulfate salt"; "Oxygen and Ozone". Through the process of pedagogical experimentation, we evaluate the development of students' cooperative capability based on the manifestations of cooperative capability built-in Table 1, combined with the results of group work, products student's learning. In addition, after completing two experiment lessons, we asked students to complete a test, questions designed to assess some manifestations of cooperative capability. Results from the teacher's rubrics, student rubrics through observation, and test results show that students' capability to cooperate in the experimental class is developed. Some experimental images are shown in Figure 3.

Experience corner *Observing corner* *Observing corner* *Analysis corner*

Figure 3. Students do discussion working in the corners

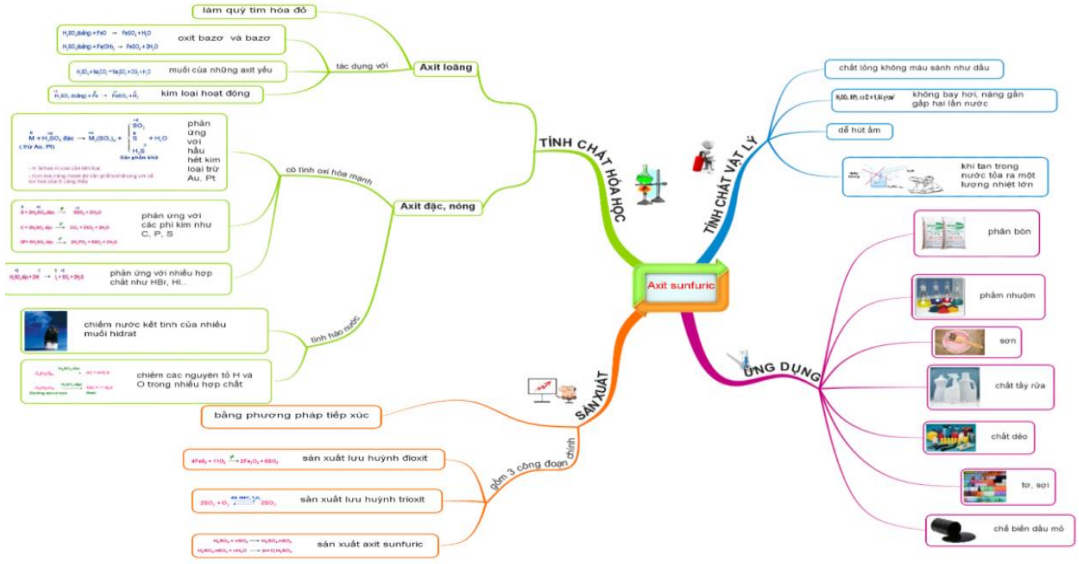

Figure 4. Mind map post sulfuric acid

Students discuss and complete the mind map shown in Figure 4.

Some products of students in the experiment lesson "Sulfuric acid - Sulfate salt" are shown in Figure 5.

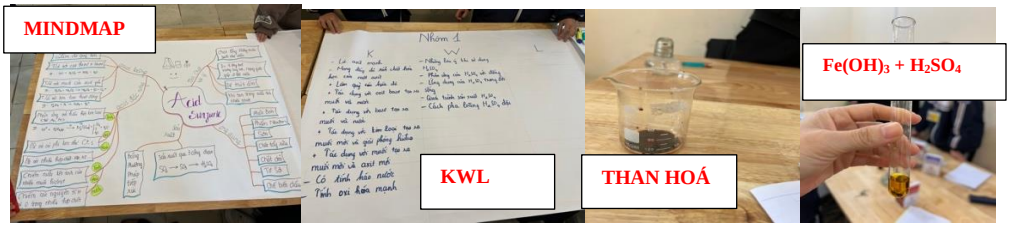

Figure 5. Some student products in learning corners

The development of the cooperative capability of students in the experimental classes and the control classes was assessed by the teacher and self-assessed by the students through a toolkit including a criterion-based assessment sheet (for teachers), rubrics, KWL tables, and tests. The experimental data are processed and presented below (Figure 6, Figure 7, and Table 3) [11, 12].

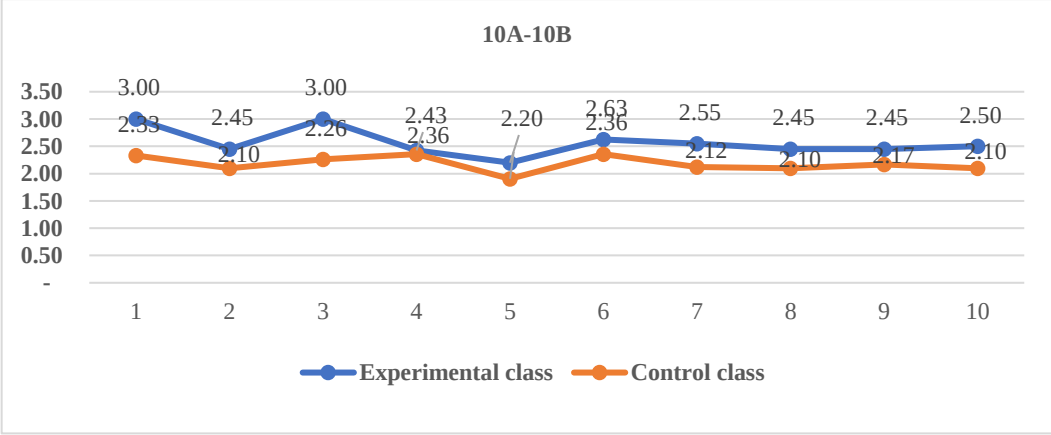

Figure 6. Graph of developing the cooperative capability of the students in class 10A (experimental class) compared with 10B (control class) through the teacher's assessment

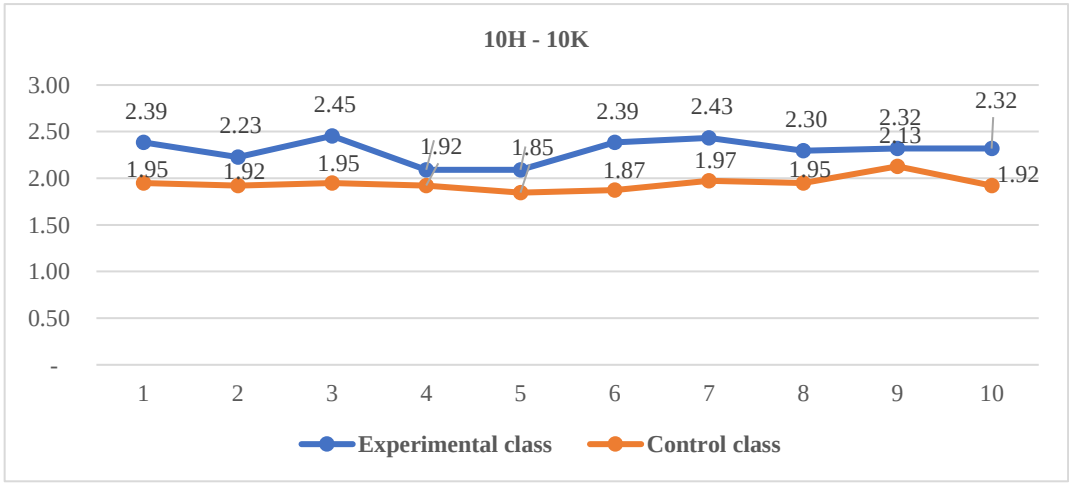

Figure 7. Graph of developing the cooperative capability of the students in class 10K (experimental class) compared with 10H (control class) through the teacher's assessment

The graphs in Figure 5 and Figure 6 show that through the assessment of the teachers, the scores of students' cooperative capability according to the following criteria have increased significantly in the experimental class compared to the controlled class. From the analysis results, it is shown that students' cooperative capability is developed in the experimental class compared to the controlled class, this change is not due to randomness but due to impact. The ES value from the evaluation questionnaire of the teachers shows that the application of some active teaching methods and techniques has a great influence on the development of the cooperative capability of the students. In addition, since the p-value in the T-Test ($p = 4{,}1.10^{-10}$ and $p = 2{,}4.10^{-8}$) is always less than 0.05, they show that the obtained data is reliable, and the project is significant in cooperative capability for the students. This reflects the cooperative capability of the students through the experimental process.

Table 3. Results of the analysis of the evaluation form on the level of development of the cooperative capability of the students in the experimental class and the control class (reviewed by the teachers)

Parameter	Experimental class (10A)	Control class (10B)	Experimental class (10K)	Control class (10B)
Mode	2.5	2.6	1.9	2.2
Median	2.30	2.60	1.90	2.30
Mean	2.18	2.57	1.94	2.30
Standard deviation	0.31	0.14	0.33	0.18
Pair test T – test	$4.1.10^{-10}$		$2.4.10^{-8}$	
Level of influence ES	1.24		1.07	

3. Conclusions

The application of the teaching method in the corner, the KWL technique, and the mind map technique in the lesson aims to maximize the cooperation of group members to solve the group's common learning tasks. To complete these learning tasks within a given amount of time, team members must work closely together to complete the assigned tasks. While students perform tasks in the corners, through observation, teachers assess students' cooperative capability based on a set of tools to assess the manifestations of the component competencies of the cooperative capability. Combined with student products, student presentations, and students' understanding of knowledge, teachers evaluate the development of students' cooperative capability through the lesson "Sulfuric acid - Sulfate salt". The experimental process shows the feasibility and effectiveness of applying these active teaching techniques and methods to develop the cooperative capability for students in the experimental class. From there, it is possible to expand the application of the corner-based teaching method, the technique of using mind maps, and the KWL technique to teach lessons on substance, especially those in which students already have a bit of background the lower grades to develop students' cooperative capability. Thereby meeting the requirements of the reform of general education according to the current capability development orientation.

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