

## Active Learning in Maritime Education - Lecture in the Classroom -

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**Abstract** In recent years, education research has highlighted active learning as an important element for the ‘conversion to study from education’; in other words, active learning has been promoted as a more effective education technique. Professor Mizogami of the Kyoto University Centre for the Promotion of Excellence in Higher Education defined the benefits of active learning as follows: ‘active learning overcomes passive one-sided knowledge transfer-type lessons’. Active learning requires students to participate in ‘writing’, ‘talking’, and ‘presenting’, thereby ensuring that their cognitive processes are engaged. Maritime education has generally comprised a lecture in the classroom and on-board training, which could be considered a type of active learning. We introduced active learning into the maritime education classroom to improve the education effect. Student assessments were conducted twice to receive feedback about the active learning-type lessons. The student assessments of the first exercise, which involved pair and group discussions, showed that approximately 87 percent of the students found the lesson to be ‘very good’ or ‘good’. After giving a presentation following the group discussion, approximately 89 percent of the students felt that the lesson was ‘very good’ or ‘good’. The following categories were determined following qualitative analyses of student comments: (1) The effect of thinking, (2) The effect of group work, (3) The effect of dialogue, (4) The effect of presentations, (5) The effect of idea creation, (6) The importance of explanation, (7) Problem recognition. As part of the assessment, students were encouraged to give detailed comments, which were later analysed qualitatively using a grounded theory approach (GTA). From these analyses, the following hypothesis was drawn: ‘By performing dialogues in a group and conducting group presentations in this lesson, critical thinking was encouraged, which promoted idea creation’.

This will form the basis for further study. Moreover, when developing effective future lessons, ‘group work’, ‘presentations’, and ‘creative thinking’ should be considered.

**Keywords:** active learning, group work, group discussion, group presentation

## **1. Introduction**

In recent years, education research has highlighted active learning as an important element for the ‘conversion to study from education’; thus, active learning is a more effective education technique. In 2012, the Central Council for Education in Japan defined active learning as ‘a general term for teaching and learning methods that involve the participation of the student in active study unlike one-way lectures from a teacher. When a student learns actively, he/she is engaged cognitively, ethically, and socially with the learning, culture, knowledge, and experience. Discovery methods, problem-solving, experiential studies, and investigative studies are included. Debates and group work are examples of classroom methods for effective active learning’. Professor Mizogami of the Kyoto University Centre for the Promotion of Excellence in Higher Education defined the benefits of active learning as follows: ‘active learning overcomes passive one-sided knowledge transfer-type lessons’. Active learning requires students to participate in ‘writing’, ‘talking’, and ‘presenting’; this ensures that students’ cognitive processes are engaged. Active learning is not a specific study method but a teaching and learning process in which students are required to actively perform with a purpose.

## **2. Implementation of an active learning-type lesson**

Maritime education generally comprises a classroom lecture and on-board training, which could be said to be a type of active learning. We introduced active learning into the maritime education classroom to improve the education effect.

In 2016, active learning-type lessons were conducted with 63 students from the Tokyo University of Marine Science and Technology, School of Marine Technology, Undergraduate Maritime Systems Engineering course. From a viewpoint of providing the same service to the student of the same class, since comparison with the one-sided lecture (from instructor) and active learning was difficult, the student's questionnaire and comment were analyzed about the active learning type lesson.

### **2.1 First lesson**

The composition of the first lesson was as follows:

- (1) Setup and explanation of the target (10 minutes),
- (2) Exercise in ship operations (50 minutes),

- (3) Explanation of the exercise content (10 minutes),
- (4) Debriefing (a questionnaire was included) (15 minutes).

‘Acquisition of seamanship’ was set as the lesson target. The definitions for seamanship from Captain Chiba, Professor Sugisaki and the National Institute for Sea Training were first introduced. In each case, seamanship included not only knowledge and skills but also actions, functions and capabilities. When conducting the exercise, the following three-point explanation was provided:

- 1) Students set up and recorded their own target. The target of the lesson was not restricted; thus, students could describe the target freely, making the set up easy.
- 2) A pair discussion was conducted in which students’ ideas were conveyed and taught.
- 3) In the time given, students conveyed and taught their ideas to other teams.

The exercise included the following two questions:

- 1) Enumerate the uses of Buys Ballot’s law.
- 2) Indicate the cause of a marine accident and develop countermeasures for it.

During explanation time, students presented their ideas. They were asked about what they had considered during the exercise and were encouraged to think deeply about the issues from various perspectives. The target of the lesson was shown again as a ‘debriefing’, which allowed the students to reflect on whether the lesson target had been achieved.

## **2.2 Second lesson**

The composition of the second lesson was as follows. The exercise content was more limited than that in the first lesson; however, the presentation time was extended. The students were positively encouraged to participate by asking them to decide the presentation content.

- (1) Setup and explanation of the target (10 minutes),
- (2) Exercise (20 minutes),
- (3) Presentation (40 minutes),
- (4) Debriefing (a questionnaire was included) (15 minutes).

The target, as with the first lesson, was the ‘acquisition of seamanship’ and was specifically aimed at developing ‘creative thinking’ as part of seamanship. The exercise asked students to invent and develop a new type of ship; concrete themes, such as ‘hull shapes’ or ‘propellers’, were given to guide and make student discussions easier. The exercise had the following structure:

- 1) Groups of 4 to 6 people were formed,
- 2) A leader was chosen,
- 3) Each of three proposals was considered,

4) Each member presented the proposal they preferred; the presentation included the main features and key advantages. While the presentations were being given, the other members of the group neither evaluated nor criticised the presentation.

5) With the encouragement of the leader, the groups decided on the proposal or elements of the proposal that they all preferred; next, a new group proposal was developed, which included further additions and improvements. Finally, a group proposal was determined.

6) The group then developed figures and drawings to easily explain 'the group proposal'.

7) A final group presentation in which all members were involved was prepared and given to the class.

Proposals for the new ship had to be creative and had to consider possible new concepts for elements such as form, propulsion and operations. Even if the type of ship considered was not possible at present, innovative and out-of-the-box proposals were encouraged as the construction of such ships may be possible within the next 50 years.

Thirteen groups gave 3-minute presentations on their new ships; then, in a 'debriefing', students reflected on the lesson target and completed the questionnaire.

### 3. Results

#### 3.1 Student assessments

##### (1) First lesson

The student assessments of the first active learning lesson are illustrated in Fig. 1. Eighty-seven percent thought that the lesson was 'very good' or 'good'. Comments from students who assessed the lesson as 'very good' were as follows:

- It was very intelligible.
- The thinking required in the lesson was very satisfying.
- It was good to consider an actual marine accident case.
- In today's lesson, there was time to discuss by ourselves and think deeply.
- There was an active exchange of opinions when doing the exercise.
- The more I thought, the more ideas I had.
- I noticed that there was a limit to my own ideas, so by working in pairs I could understand what I did not know completely.

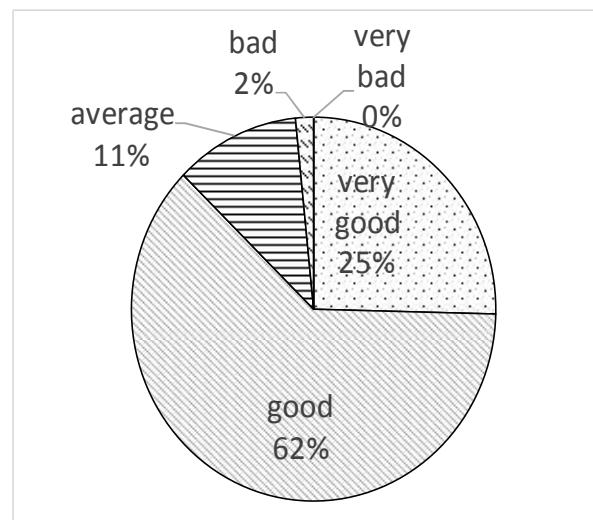


Fig. 1 Student assessment results for the first lesson

- I am happy to have such lessons. I think that there should be more opportunities for discussion.
- I thought that it was a very good lesson as exchanging opinions with another person can deepen the understanding of the subject under discussion and lead to sharing of ideas.
- It was a very significant lesson.

In contrast, comments given by students who assessed the lesson as ‘bad’ did not include a clear statement.

## (2) Second lesson

The main feature of the second active learning lesson was that all students were given the opportunity to prepare a presentation.

The student assessments of the second active learning lesson are illustrated in Fig. 2.

Eighty-nine percent of the students rated the lesson as ‘very good’ or ‘good’, with no one assessing the lesson as ‘bad’ or ‘very bad’.

This active learning lesson created some tension as all members were required to participate in the presentation.

In the exercise in the second lesson, a ‘creative way of thinking’ was set as the concrete target for seamanship.

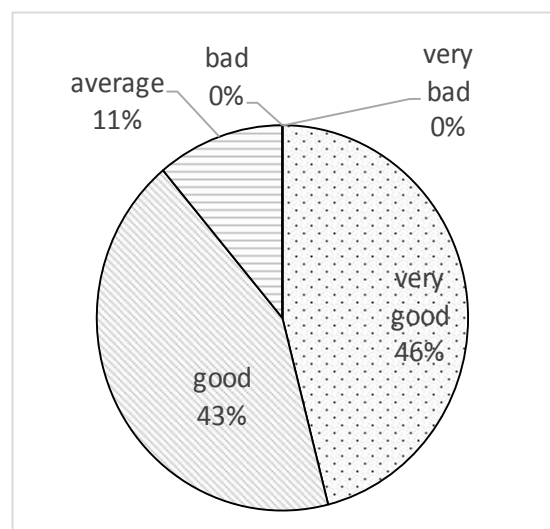


Fig. 2 Student assessment results for the second lesson

### 3.2 Qualitative data analysis of the comments on the lesson

A generally positive assessment was made of both the first and second active learning lessons. To investigate these positive assessment results further, students’ comments were analysed using a grounded theory approach (GTA). The first and second active learning type lessons were analysed by GTA. This paper shows the analysis result of the second lesson. On the other hand, the difference in the learning effect by the lesson (the first and second lessons) from which the contents differ is to present at Japan Creativity Society.

After each comment was analysed, it was classified according to a process called ‘sectionalisation’. Then, the characteristics and dimensions of the data were shown and further processing, termed coding, was conducted to identify a label name that expressed the general focus of the comments. An example of the coding done for the comments on the second lesson is shown in Table 1.

Table 1 Example of the coding for the second lesson

No.	Data	Property	Dimension	Label name
1	<ul style="list-style-type: none"> <li>• Critical thinking turned out to be satisfying.</li> <li>• The future was considered through complex critical thinking.</li> </ul>	<ul style="list-style-type: none"> <li>• Thinking is satisfying.</li> </ul>	<ul style="list-style-type: none"> <li>• Time in a lesson to think.</li> </ul>	(1) The effect of thinking.
2	<ul style="list-style-type: none"> <li>• I thought that the group work was full of ideas.</li> <li>• Within the group, various ideas emerged, which was interesting.</li> </ul>	<ul style="list-style-type: none"> <li>• The effect of group work.</li> </ul>	<ul style="list-style-type: none"> <li>• Idea creation from group work.</li> </ul>	(2) The effect of group work.
3	<ul style="list-style-type: none"> <li>• Talking with another person allows for new discoveries.</li> <li>• There were many things I had previously not thought of.</li> </ul>	<ul style="list-style-type: none"> <li>• Discovery through dialogue.</li> </ul>	<ul style="list-style-type: none"> <li>• The number of discoveries made through dialogue.</li> </ul>	(3) To discover and develop using dialogue.
4	<ul style="list-style-type: none"> <li>• The ideas from the other groups were very interesting.</li> <li>• It was good to hear other people's opinions.</li> </ul>	<ul style="list-style-type: none"> <li>• The effect of presentations.</li> </ul>	<ul style="list-style-type: none"> <li>• Idea sharing through presentations.</li> </ul>	(4) The joint effect of the other group proposals through presentations.
5	<ul style="list-style-type: none"> <li>• Various ideas and opinions were heard, which was significant.</li> </ul>	<ul style="list-style-type: none"> <li>• The effect of a dialogue and a presentation.</li> </ul>	<ul style="list-style-type: none"> <li>• The effect of others' opinions on the self.</li> </ul>	(5) Self-growth through dialogue and presentation
6	<ul style="list-style-type: none"> <li>• I felt the difficulties and pleasures of creation.</li> </ul>	<ul style="list-style-type: none"> <li>• The effects of creation.</li> </ul>	<ul style="list-style-type: none"> <li>• Difficulties and the pleasures of creation.</li> </ul>	(6) Creating ideas.
7	<ul style="list-style-type: none"> <li>• The importance of explanation was shown.</li> </ul>	<ul style="list-style-type: none"> <li>• Importance of explanation.</li> </ul>	<ul style="list-style-type: none"> <li>• An understanding of the importance of explanation.</li> </ul>	(7) An understanding of the importance of the explanation in a presentation.
8	<ul style="list-style-type: none"> <li>• I thought that it was interesting because various ideas emerged.</li> <li>• Many ideas emerged in the group.</li> </ul>	<ul style="list-style-type: none"> <li>• A variety of ideas.</li> </ul>	<ul style="list-style-type: none"> <li>• The amount of ideas.</li> </ul>	(8) Creation of several different ideas. (9) Comments about idea creation.
9	<ul style="list-style-type: none"> <li>• People had ideas, and it was a wonderful idea to combine them.</li> </ul>	<ul style="list-style-type: none"> <li>• Many ideas created and the combined effects.</li> </ul>	<ul style="list-style-type: none"> <li>• Comprehension of combining ideas.</li> </ul>	(10) Idea creation and idea combination.
10	<ul style="list-style-type: none"> <li>• When inconsistencies in opinions arose, a new idea was developed.</li> </ul>	<ul style="list-style-type: none"> <li>• Opinion concentration and the creation of new thinking.</li> </ul>	<ul style="list-style-type: none"> <li>• Opinion concentration</li> <li>• The amount of new thinking created.</li> </ul>	(11) Conflicting opinions and the effect of correspondence. (12) Concentrating opinions and developing new thinking.
11	<ul style="list-style-type: none"> <li>• By considering a possibly new ship, the demerits of the present ship were clearly understood.</li> </ul>	<ul style="list-style-type: none"> <li>• The effect of critical thinking.</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding the demerits of the present ship.</li> </ul>	(13) Grasping the present situation through critical thinking.
12	<ul style="list-style-type: none"> <li>• It was good to realise that critical thinking was difficult.</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding the pliability of critical thinking.</li> </ul>	<ul style="list-style-type: none"> <li>• The pliability of critical thinking.</li> </ul>	(14) Noticing the pliability of critical thinking.
13	<ul style="list-style-type: none"> <li>• Noticing the existing challenges showed me that I would like to have more from now on.</li> </ul>	<ul style="list-style-type: none"> <li>• Discovering how to challenge oneself.</li> </ul>	<ul style="list-style-type: none"> <li>• The effects of challenges.</li> </ul>	(15) Overcoming the challenges faced in the lesson.

For example, data no.1 in Table 1 were ‘critical thinking turned out to be satisfying’ and ‘the future was considered through critical thinking’, which were assigned the property of ‘thinking is satisfying’ and the dimension ‘time in a lesson to think’. A property expresses the characteristics of the data in the exercise. As the exercise content was to ‘consider a new ship’, this presupposed the property of ‘thinking is satisfying’, with the dimension ‘time in a lesson to think’ indicating the assessment grade and degree. Therefore, the label name—‘the effect of thinking’—was developed from these. Although there was a comment about a new type ship, the point of almost all comments was the thinking and the creativity by group work and a presentation. From the main comments about the second lesson, 15 distinct labels were

identified. Comments that were similar or common in the coded data were then summarised under each category. The 15 items shown in Table 1 were then summarised into seven categories. The relation of each category is illustrated in Fig. 3. First, the categories were extracted by sorting the 15 labels into seven categories. For example, the label names ‘(1) The effect of thinking’, ‘(12) Concentrating opinions and developing new thinking’, ‘(13) Grasping the present situation through critical thinking’ and ‘(14) Noticing the pliability of critical thinking’ were grouped under category (A) ‘A lesson in which critical thinking is encouraged’.

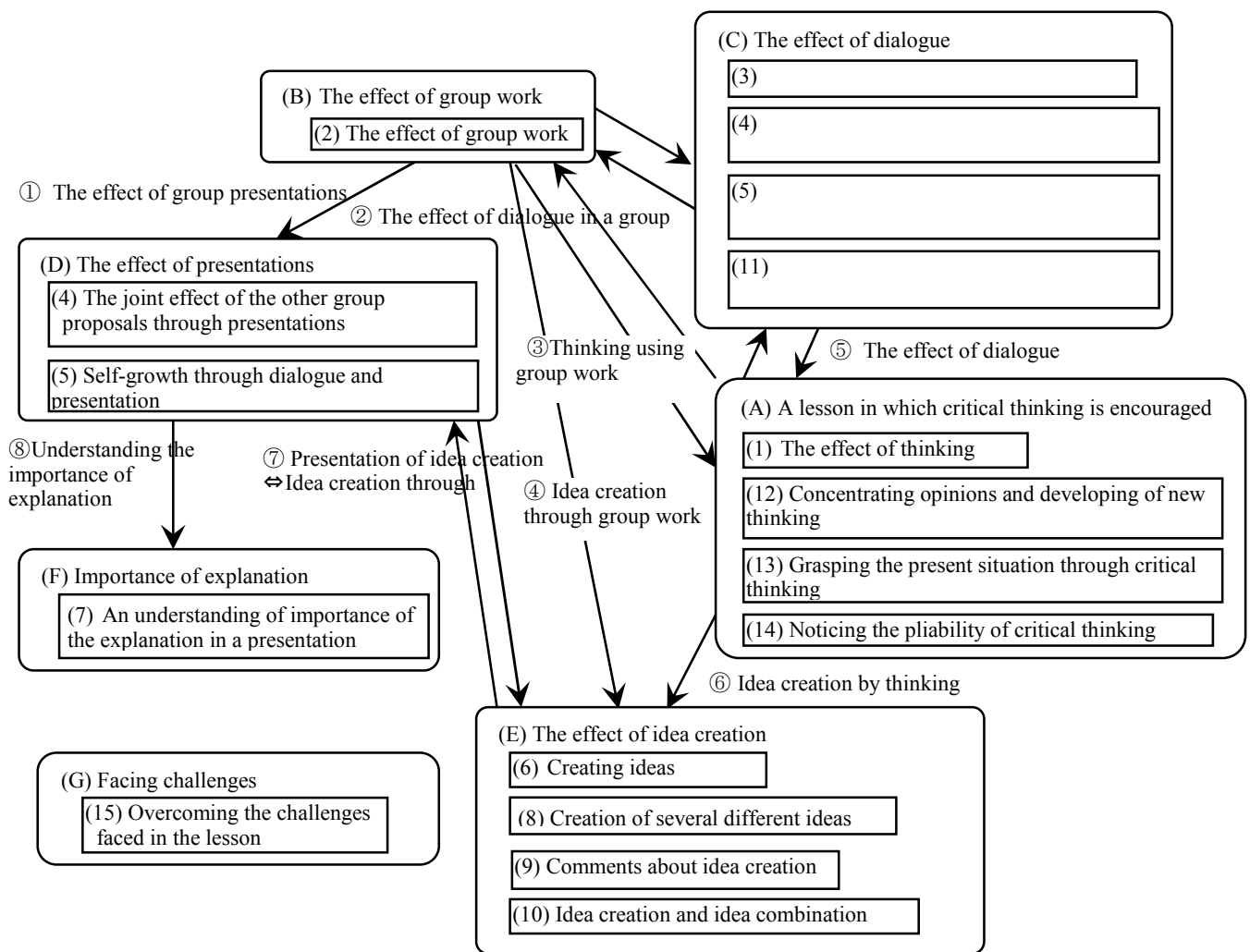


Fig. 3 Categorization using GTA

The categories related to group work and presentations were directly related to active learning. For example, (C) ‘The effect of dialogue’ indicated the effect of the group work discussions and, although there was few comments that assessed the lesson as whole, ‘(A) A lesson in which critical thinking is encouraged’ was considered to be a good assessment of the critical thinking required for active learning to occur.

Although there is no arrow showing the relation with '(G) Facing challenges', this was considered to be a comprehensive summary of the entire lesson because it was connected with all the actions taken throughout the lesson, such as '(B) Effect of group work' and '(D) Effect of presentations'.

The following hypotheses about students' comments were derived from the coding and the category classification shown in Fig. 3. 'By performing dialogues in a group and conducting group presentations in this lesson (the second lesson), critical thinking was encouraged, which promoted idea creation'. 'The dialog in a group was promoted by the presentation, and many thinking and idea creation were performed by it'. From these hypotheses, it can be guessed that not only fixing of a student's knowledge but the thinking for problem solving was cultivated.

### **3.3 Utilisation of the lesson content**

In the second lesson, in addition to the general comments on the lesson, students were also asked to assess their future use of what they learnt in the lesson. The following responses were provided for this question:

- The group dialogue was a reference for future critical thinking. I plan to refer to others' opinions, consider others' opinions and combine opinions from now on using dialogue.
- The effect of group work was very positive and mirrored reality. I plan to utilise group work in the future to make discoveries and solve problems.
- The difficulty of summarising an idea was learnt through the presentation. Therefore, I plan to continue training in summarising ideas clearly when giving a presentation.
- The ideas were coherently arranged when preparing for the presentation. I plan to utilise skills for preparing individual and group presentations when thinking critically in the future.
- From the presentations, many interesting ideas emerged. I plan to exercise my thinking so as to develop the ability to conceptualise a range of ideas.
- Creative critical thinking was excellent. I plan to apply this creative critical thinking to my future work.
- I enjoyed the difficulties associated with complex critical thinking. I plan to apply such thinking to my future study and to my life.
- There were many good ideas that were difficult for me to imagine. I plan to apply such type of analysis into my thinking processes so that it becomes a custom.
- My interest in ships increased, and the faults in the present ship were identified. I would like to continue to improve.



- I would like to think that a safe and useful ship can be developed.

Fig. 4 summarises these ideas. By considering a new type ship, the students were able to acquire the knowledge about a hull shape or a propulsion. More than it, there is an overall understanding of the importance of creative thinking and how group work and presentations can be used to encourage creative thinking as I ideas can be suggested, selected, combined, added to and deleted, all of which require the current concrete target of ‘creative thinking’, through conversations (dialogue) and presentations.

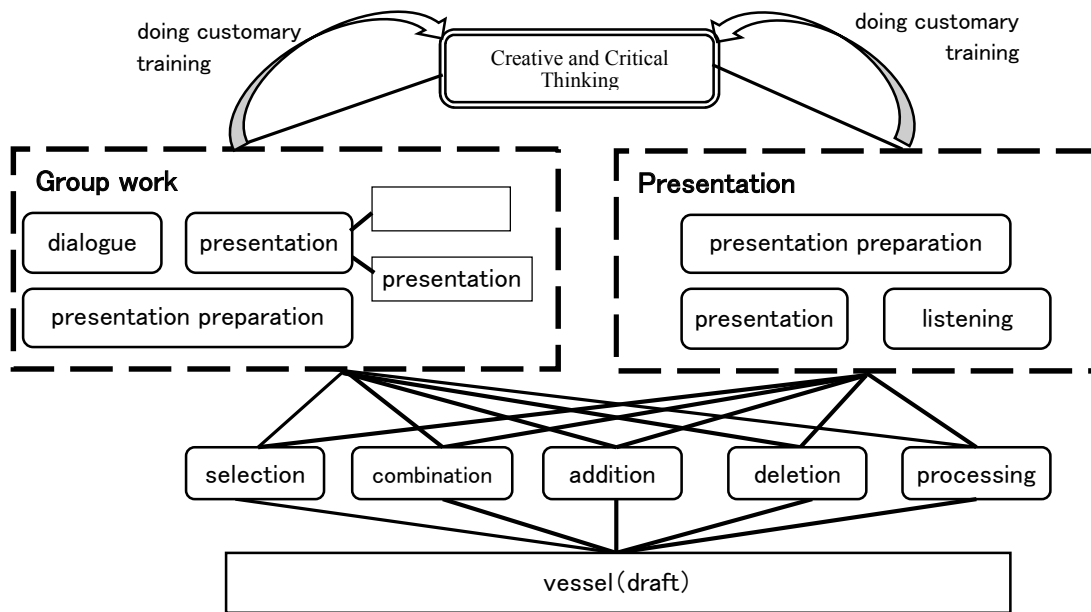


Fig. 4 Utilization of the content acquired from the lesson

The group work and presentations exemplified the effect of the active learning in the lessons. By using these techniques, students could develop a complex understanding of the ‘vessel’ and the improvements that would positively affect operations. The group work and presentations improved students’ motivation and encouraged effective critical and creative thinking. And students think that they would like to routinize or train critical thinking and creative thinking.

### 3.4 Improvements to the lesson

The following negative comments were given: ‘it was boring’, ‘I did not understand well’, ‘the tempo was bad’ and ‘it was too long’.

To guide further improvement, an analysis of the following comments was conducted.

(1) Consider the exercise content: I think that it is necessary to consider more suitable exercise content and the volume, combination, etc. of the subject content. When performing two or more exercises, I think it is necessary to also consider the relevance of the question,

and modify the difficulty.

(2) Examination of the time distribution: Since the time for several questions was short, it is necessary to consider the time distribution for the subject.

(3) Classroom improvements: A classroom where it is easier to perform group work is required.

(4) Suitable explanation and facilitation

(5) Proper group setting: Groups including various members are a good idea.

(6) Suitable utilisation of information and communications technology (ICT).

#### **4. Summary**

Two active learning-type lessons were conducted as part of a maritime education course; an overall positive student assessment of about 90% was obtained for each lesson. Student comments regarding the lessons were generally positive, with most students being able to understand the effects.

To investigate the reasons for the positive assessment results, the student comments were analysed using a GTA. The theoretical hypothesis extracted from the GTA for the second lesson was 'By performing dialogues in a group and conducting group presentations in this lesson (the second lesson), critical thinking was encouraged, which promoted idea creation'. And 'The dialog in a group was promoted by the presentation, and many thinking and idea creation were performed by it'.

A group work and a presentation lead to a valid dialog and thinking, and it is thought that it can contribute to a student's improvement in some kinds of capability. Moreover, we would like to improve an active learning type lesson.

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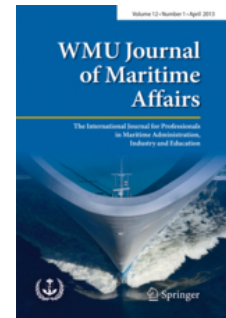
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