

Active Learning in Maritime Education

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ABSTRACT: In the field of education, the importance of active learning as a more effective educational method has recently been noted. The element of active learning was introduced to the anchoring training of the training ship for third-year students of Tokyo University of Marine Science and Technology, and its effects have been verified. The learning effect of training was confirmed by the questionnaire results of the students. Moreover, the self-evaluations of student and evaluation of instructor confirmed the skill of grasping a ship's position with improved accuracy and learning effects. Self-evaluation and evaluation by the other student, which were introduced as the element of active learning, both demonstrated a positive learning effect. Furthermore, since an effective training method was examined, a result is reported.

1 INTRODUCTION

In recent years, in the field of education, active learning has attracted attention as an important element in the "conversion to the study from education." That is, the importance of active learning as a more effective educational method has been noted. In the Central Council for Education in Japan, active learning was defined in 2012 as follows: "The general term for teaching and learning methods which involve the participation of the student in active study unlike one way lectures from a teacher." When students learn actively, they are engaged cognitively, ethically, and socially with learning, culture, knowledge, and experience. Discovery methods, Problem-Based Learning, Experience Learning, Investigation Learning, etc. are included. Group-Discussion in a classroom, Debate and Group work, etc. are examples of effective active learning. Professor Mizogami of the Kyoto University Center for the Promotion of Excellence in Higher Education defined the benefit of active learning as follows:

"Active learning overcomes passive one-side knowledge transfer-type lessons." Active learning requires students to participate in "writing," "talking," and "presenting," thereby ensuring that cognitive processes are engaged.

Active learning is not a specific learning method, but a teaching and learning process in which the student is required to perform actively, with a purpose.

Maritime education consists of a lecture in a classroom, and training onboard. Training onboard can be said to be a knowledge fixing type-active learning. In prior learning and training, the elements of active learning were further incorporated and anchoring training was performed for the purpose of aiming at substantial training. In the anchoring training of a training ship to the students (68 persons) of the 3rd grade of Tokyo University of Marine Science and Technology, training that incorporated elements of active learning was performed and the effect investigated.

2 THE ANCHORING TRAINING

Anchoring training is performed using the following procedures.

- 1 A student heaves up the anchor of the training ship.
- 2 A student navigates the planned route.
- 3 A student drops her anchor to the planned anchorage.

In the wheelhouse, training consists of four- to five- person groups with the following specified roles: The role of a captain, the role of navigation officers (two persons), the role of a helmsman (one person), and the role of a lookout (only in the case of a five-person group). The captain takes the lead, performing work ranging from weighing anchors to anchoring. The planned route and track of training carried out are illustrated in Fig. 1. In a series of anchoring training classes, the element of active learning was incorporated and conducted as follows.

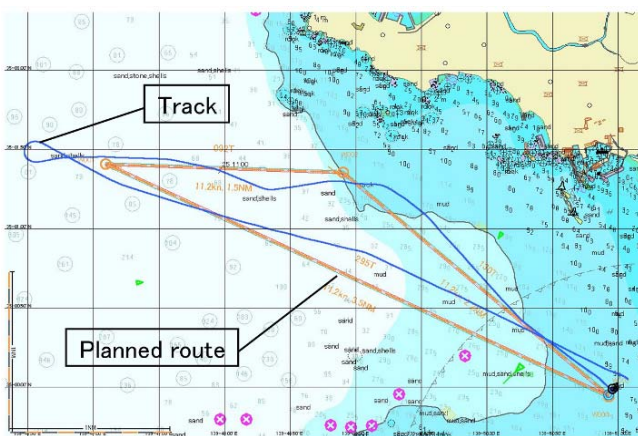


Figure 1 Planned route and track

2.1 Navigation Plan

The instructor gave the students the information required for training in advance, including the targets of land, notes, etc. The students in each group drew up a navigation plan. In the stage planned briefly, the student provided the instructor with an explanation using the chart. Advice was then received from the instructor and the plan was corrected. Fig. 2 shows the scene of navigation planning.

Developing a navigation plan, discussing in a group, planning, and explaining a navigation plan to the instructor may all be conceived as instances of active learning.

2.2 Briefing

The student playing the role of captain explained the drawn-up navigation plan to the team member and the instructor. The instructor then explained the main point and provided notes on navigation.

The student will explain his navigation plan, and not only the student in the role of captain but all team members will participate. This has a greater active training effect.

2.3 The anchoring training

The student in the role of a captain took the lead: he hove up the anchor, navigated the planned route, and anchored to the planned anchorage. These tasks were performed by students alone. It was only when there was risk of a collision and grounding in shallow water that the instructor advised students on the role of a captain.

Active training is that carried out only by students, since a considerable amount of responsibility is required.

2.4 Evaluation of training

Evaluation by an instructor was performed, and, while carrying out the student's self-evaluation simultaneously, evaluation by other students was also performed. All evaluation based on the evaluation list was created in rubric form.

By carrying out self-evaluation, the student can look back upon his shiphandling and strive for improvement. The student can also improve his own shiphandling by evaluating other students. These are also very active training forms.

2.5 Debriefing

Good and improved points in relation to shiphandling were explained after the end of the anchoring training by the student in the role of captain to all students. Then, while the instructor commented, the main point of shiphandling was explained.

The student in the role of a captain presenting his anchoring training, with other students listening to the presentation and recording his comments, encourages other students to think many things, and consequently to think actively.



Figure 2. A scene of navigation planning

3 THE ANCHORING TRAINING IMPLEMENTATION RESULT AND DISCUSSION

3.1 Investigation of consciousness in a student's training

3.1.1 Students' consciousness during anchoring training as a whole

After carrying out the anchoring training, investigations via a questionnaire were conducted in relation to the consciousness students experienced.

Student's consciousness of the anchoring training as a whole is illustrated in Fig. 3. It was 95% when the responses "very helpful" and "helpful" were compared with the whole anchoring training. Almost all students appraise this anchoring training positively. On the other hand, the number of those who responded with "it was not helpful at all" and "it was not helpful" was only 3 (5%).

It may be assumed that, because many elements of active learning are incorporated, almost all students consider the anchoring training a positive activity. Responsibility is given to the student from plan to execution and review of the training, which are led by the student. As a result, a student's motivation increases and this leads to a good result.

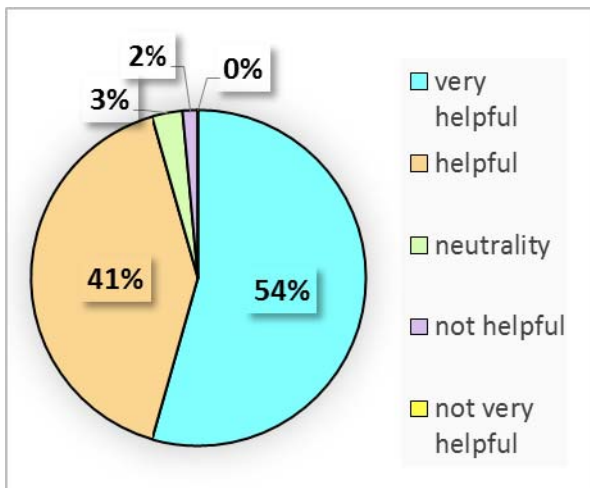


Figure 3. Students' consciousness over the whole anchoring training

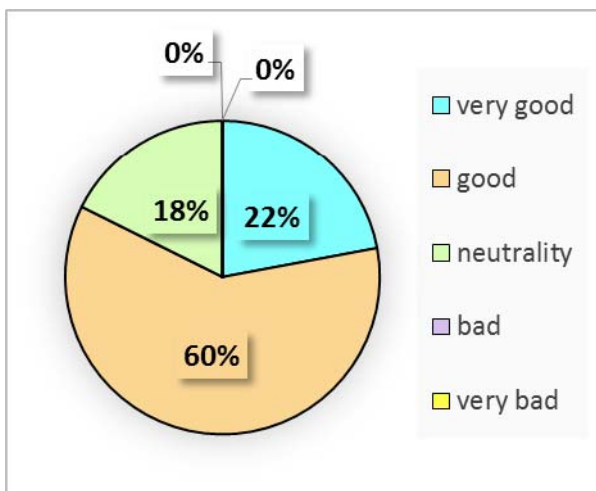


Figure 4 Student's consciousness over navigation planning

3.1.2 Students' consciousness during navigation planning

The result of having investigated the student's consciousness in relation to navigation planning is shown in Fig. 4. The responses "it was very good" and "it was good" constituted 82%. Although there were no negative responses, the response "it can be said to be neither, (neutrality)" was 18%.

In four- to five-person teams, the student playing the role of captain took the lead and drew up the navigation plan. Active discussion was conducted in the process of planning, and it is considered that students' understanding progressed through drawing up a plan. Moreover, if all navigation plans were made, the student explained the plan to the instructor. When the instructor gave advice, students' understanding deepened. Moreover, the students corrected the navigation plan in accordance with the instructor's advice.

3.1.3 Students' consciousness during self-evaluation

Students looked back upon their own navigation and the good points and bad points were clarified through self-evaluation. The consciousness of a student engaging in self-evaluation is shown in Fig. 5. The responses "it was very effective" and "it was effective" were 81%. There were many affirmative responses, since the method resulted in future improvements for trainees. Moreover, evaluation conducted through the evaluation list could be evaluated for every item, and provided an effective rather than vague evaluation.

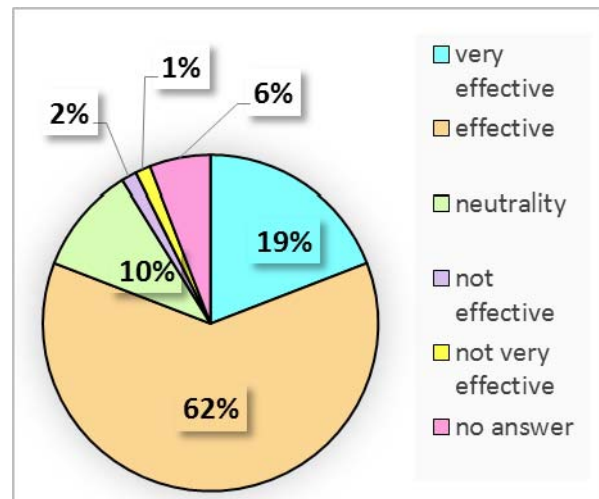


Figure 5. Consciousness of the student about self-evaluation

3.1.4 Students' consciousness of evaluation by other students

By evaluating other students, the student can observe navigation from another position and can harness navigation abilities through observation. This is considered to become helpful when the student navigates. The consciousness of students with regard to the evaluation of other students is shown in Fig.6. The reply "it was very effective" and "it was effective" was 70% in all. The "Neutrality" evaluation was 21%, twice that of self-evaluation. Since the student was concentrating on his navigation, this can

be surmised to have been unable to concentrate on the evaluation of the others. Students' comments included much affirmative content. For example, "Since the part which I should be careful of can be understood by evaluating the other students, I think that it was good." Another comment was, "By seeing a ship operator's command in order to evaluate, the part in which the navigation is bad was found and the good effect in case I next carry out was acquired."

On the other hand, there were other sorts of less positive comments, such as "Although I myself could not do it, evaluating others hesitated." "The index for evaluation was incomprehensible." "I think that evaluation of the others is unnecessary."

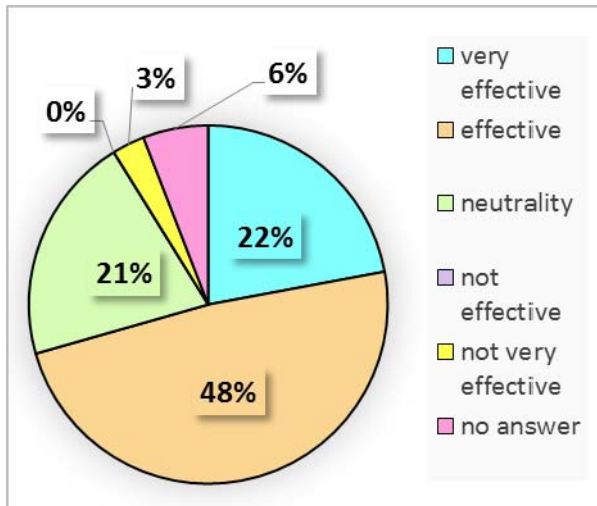


Figure 6. Consciousness of students to evaluation by other students

3.1.5 Students' consciousness during debriefing

The consciousness of the student while debriefing after the anchoring training is shown in Fig. 7. Approximately 93% responded with "it was very good" and "it was good." The data looks back upon navigation after the anchoring training completion, and presents a result. A student performs self-evaluation of the method of avoiding the other vessel, course establishment, etc. Furthermore, the instructor comments on the navigation the student performed.

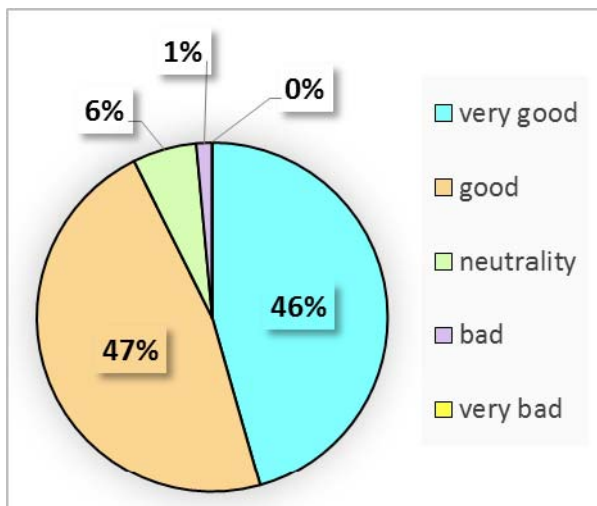


Figure 7. The consciousness of students in debriefing

In addition, the main point and skill in the anchoring navigation are explained. It is considered that the acquisition of a student's knowledge and skill have progressed through this process.

Affirmative responses occupied 80% or more by each item investigated in this way. Furthermore, the following comments were made by students: "It became good learning to carry out only by a student as much as possible." "I think that it was more effective training since it was training by a small number of people." "Although it was difficult to plan and carry out the anchoring training plan only by ourselves, it was motivated." "Though it was a status called a student, work with a strong sense of responsibility was able to be done." "It was good to sail and anchor only by a student." "By discussing in a team, it was good to find out subjects when carrying out shiphandling for the anchoring navigation." "Since it had training by the small number, each action was able to have checked firmly. And since I was able to understand the flow of a series of anchoring navigation, it was good for me." These comments all indicate that students receive further education by considering themselves actively, discussing with each other and carrying out evaluation.

3.2 Evaluation by instructors

Two instructors who experienced the captain were evaluated according to the assessment list rubric. In this anchoring training, since only active learning type training was conducted, comparison with non-active learning type training could not be performed. Following this, we examined the contents of evaluations, which were comparatively good. Active learning does not have an effect on a specific skill from the definition, and originally is effective as a whole. We examined the contents observed, as they were especially effective in this training. The evaluation list is constituted through nine items shown below:

- 1 The procedure, which heaves up the anchor
- 2 Lookout and using instruments
- 3 Setting up the course
- 4 Action by give-way vessel or action by stand-on vessel
- 5 Grasping the ship's position, and anchoring position
- 6 The anchoring procedure.
- 7 The procedure, which gradually decreases the ship's speed
- 8 Bridge Resource Management/Bridge Team Management (BRM/BTM)
- 9 The overall impression

The overall impression is that effective training was acquired. This is especially so for the evaluation score of "(5) Grasping the ship's position, and anchoring position," which was comparatively high. Therefore, this practice may have been more effective than the others. This is considered true based on the use of bow targets, the targets of a transverse direction, and the use of radar. That is, it is thought that it is an effect of the student having investigated these processes in advance.

At the very least, grasping the ship's position is indispensable to prevent grounding. Since it is navigated only by students, it is thought that this navigation was carried out with considerable strain and was carefully performed. Thus, it is thought that students utilized the bow target etc. effectively. The anchoring position shows the result of grasping the ship's position. Except for two instances, the anchoring position was contained in the circle within a radius of 130 m of planned anchoring position as shown in Fig. 8. It can be said that anchoring was performed with sufficient accuracy.

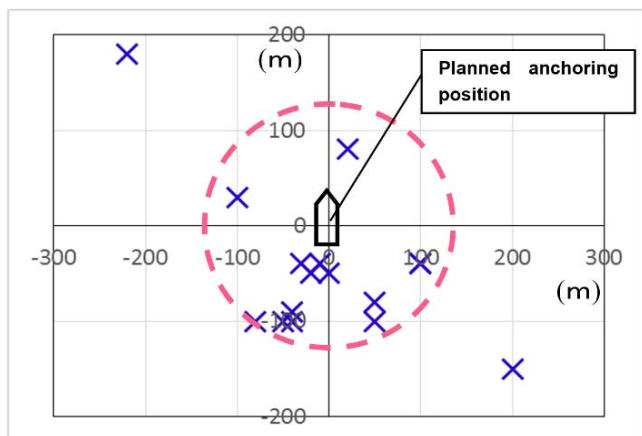


Figure 8. Anchoring positions

Moreover, the instructor's comments are relayed below from a viewpoint with "the acquisition and improvement in the various navigation skills by implementation of anchoring navigation," which is the purpose of the training: "Planning performed in advance has taken considerable time and efforts including the exchange of opinions in a team, therefore, it seems that an understanding deepened." "Although there was a scene for which it depends on the others in a team too much, the consciousness which heightens the capability as a team being conscious of BRM/BTM was able to see." "Although there was a scene where the distance with a fishing boat or an SDF vessel to pass was near, look-out was continued carefully and give-way shiphandling was carried out appropriately." These comments show that the learning effect increased by introducing the element of active learning.

3.3 Effect of self-evaluation

Since the self-evaluation introduced as an element of typical active learning was lower than the instructor's evaluation as a whole, it is thought that students evaluated severely. While two instructors' average score was 19.4 points (36 points full marks), the average score of self-evaluation was 18.6 points. The difference between instructor's evaluation score and the self-evaluation of procedures involving leaving up the anchor, gradually decreasing speed, and the anchoring procedure, were large. In the self-evaluation of the leaving up the anchor procedure, many students provided an evaluation lower than the instructor's evaluation. Approximately 44% of students provided a self-evaluation lower than the instructor's evaluation. On the other hand, the instructor's evaluation score and self-evaluation score

were almost the same for the following evaluation items.

- 1 Setting up the course
- 2 Action by give-way vessel or action by stand-on vessel
- 3 Grasping the ship's position, and anchoring position

Figure 9 shows the relationship between an instructor's evaluation score and the corresponding self-evaluation score. The horizontal axis shows the instructor's score and the vertical axis shows the self-evaluation score. A dashed line shows the straight line of $x = y$ and the solid line shows an approximated straight line. As shown in Figure 9, the narrow score range of the self-evaluation score is 0.5 points, and the range is more than double the instructor's evaluation of 1.1 points. In the low score range, self-evaluation scores were evaluated more highly than were instructor evaluations. On the other hand, in the high score range, self-evaluation scores were lower than instructor evaluation scores. Moreover, items with the instructor's high evaluation score had a low self-evaluation score, and the difference compared with the instructor's evaluation was large. That is, it turns out that items that received a high instructor's evaluation were evaluated more critically via self-evaluation.

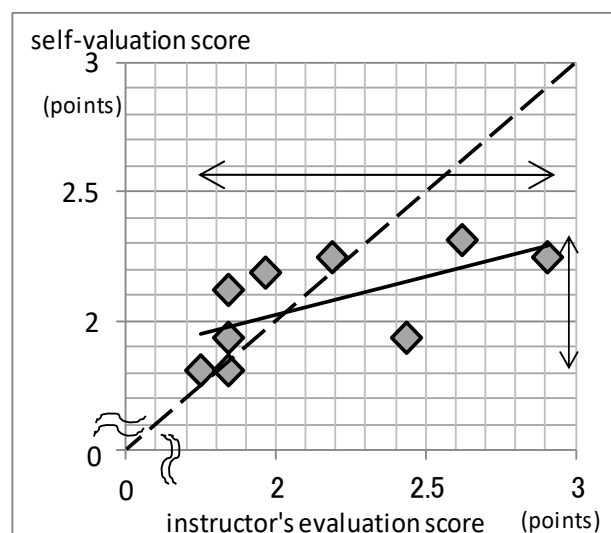


Figure 9. Relationship between instructor's evaluation score and self-evaluation score

The self-evaluation scores of one of the students were as good as the instructor's evaluation scores. Moreover, the comment of self-evaluation was described with certainty. And since the contents of the comment are exact, it may be supposed that the student's skill has improved. Moreover, since the student is evaluating his skill calmly and precisely, it is understood that his skill is also high. The student's comments are shown below: "Although I could have grasped the position of fishing boats, I was not able to have grasped motion of the fishing boats. Therefore, I thought it important to observe continually." "I understood that the tide was ebbing. I was able to reduce the speed suitable to the influence of the wind and tide." As a whole, an instructor's evaluation of the student who performed self-evaluation appropriately was high. As mentioned above, enforcement of self-evaluation is effective for training

and it is suggested that self-evaluation is more effective.

3.4 Effect of the evaluation of other students

It seems that evaluating other students improves the skill of the student who evaluates, since the evaluation of other students involves observing and evaluating the contents of shiphandling of other students. Many students think that evaluating other students is effective, as evidenced through questionnaire results.

In all evaluation items, evaluation of other students by a student was higher than the instructor's evaluation. While the average evaluation score by an instructor was 2.16 points, the average evaluation score by a student was 2.87 points, which is 0.71 points higher. An instructor's evaluation score and the student's evaluation score had the great difference for the following item:

- 1 Lookout and using instruments
- 2 Setting up the course
- 3 Grasping the ship's position and anchoring position
- 4 BRM/BTM

The relationship between an instructor's evaluation and the evaluation of other students by a student is shown in Fig. 10. The horizontal axis shows an instructor's evaluation score, and the vertical axis shows the student's evaluation score. The dashed line shows $x = y$ and the solid line shows an approximation straight line. In all evaluation items, the student's evaluation score was higher than the instructor's evaluation score. Furthermore, the difference became smaller as the evaluation score increased.

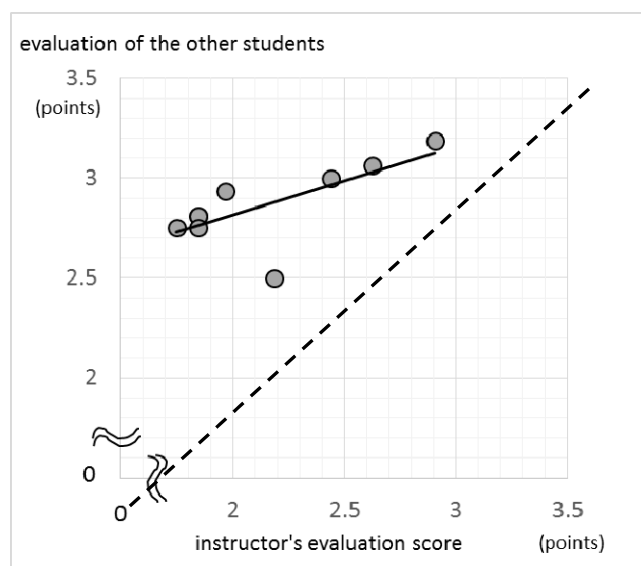


Figure 10. Relationship between instructor's evaluation score and evaluation score of other students

Evaluation of other students by a student results in evaluation before his/her anchoring training performance. However, the student who has training first evaluates the last student after finishing his/her own training. After evaluating the other student, the

evaluation score by the instructor of the student who had had training was 19.33 points. On the other hand, the evaluation score of the instructor of the student who had training previously was 14.13 points. Although there is little data on this point, it is guessed that it is effective in the case in which training occurs after evaluating the other student.

4 INCREASING THE LEARNING EFFECT IMPROVEMENT

In order to increase the learning effect, the result of having considered future training based on this result is as follows:

- 1 Although the anchoring position was determined beforehand, students should determine all navigation plans, including selection of an anchoring position.
- 2 The rubrics evaluation list used for evaluation was created in advance. From now on, students should assume the lead and create evaluation lists, while including a valuation index with an instructor.
- 3 While presenting the results of self-evaluation and evaluation of other students, an opportunity to carry out an exchange of ideas is established.
- 4 The situation assumed in advance should be discussed in a team, and image training should be performed so that urgent management may be attained.
- 5 The student himself establishes concrete targets (for example, setting anchor within a 100-m radius of the planned anchoring position), and discusses them about a result.

5 SUMMARY

Elements of active learning are incorporated in the anchoring training currently performed in maritime education, and the effects of this training have, in this study, been verified. The result has confirmed that a considerable learning effect occurs through incorporating the element of active learning. I would like to implement the content considered, in order to improve future training and the learning effect, as well as further to verify the learning effect itself.

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