

Original Paper

Blended Learning in Maritime Education and Training: Effects of On-demand E-learning before and after Training

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Abstract

Blended learning that combines e-learning and face-to-face lessons is spreading from employee training to school education. To improve its educational effect, we conducted training after students watched on-demand teaching materials, that is, e-learning in advance. In addition, students' watched on-demand review material created from the video of the practical training, aiming to confirm their knowledge and skills. The authors have so far proposed a Group work, Training, Group work and Presentation (hereinafter "GTGP") training model that combines group work, training, group work and presentation. As a result of comparing blended learning that combined in-advance, on-demand teaching materials and the GTGP model training with the previous GTGP model training alone, we found that the average achievement rate improved by 6.0%. In addition, students' expressions about watching on-demand review material after training indicated the material was effective.

Keywords

blended learning, on-demand teaching material, group work, on-demand review material

1. Introduction

Miyaji et al. showed "Blended learning fuses various learning media in combinations appropriate for optimal lessons" in their book (2009). Bersin J. wrote "Learning media include, for example, face-to-face classroom lessons, synchronous e-learning, asynchronous e-learning and workbooks" in his book (2006). In 2020, because of COVID-19, training on our university's training ship was held only once in the fall, as only a day trip. Since the ship handling plan, usually made on board at night for several hours, would be achieved in a limited time of about one and a half hours, we decided to conduct

actual ship training after students watched the on-demand teaching materials. In 2021, due to COVID-19's re-expansion, spring training was also limited to one-day trips, so, again, students watched the on-demand teaching materials in advance. In addition, review materials for students were created from videos of the practical training conducted. In this study, we report survey results of the effects of group work, on-board training, presentations of reflections and attempts at blended learning, in which on-demand teaching materials as asynchronous e-learning are viewed before and after training.

2. Purpose

In various studies, the authors have verified the positive effects of developing and implementing on-board training. So far, we have shown the positive effects of self-evaluation and mutual evaluation and of a rubric-style evaluation list (2018). In addition, analysis of trainees' impressions has helped improve training models qualitatively (2019) (2020). In this study, we investigate the effect of blended learning in combination with pre-on-demand video teaching materials and our proposed training model. We also investigate the effectiveness of on-demand review materials created from actual ship training videos. From these results, we aim to propose even more effective blended learning.

3. Investigation Method

3.1 Anchoring Training

Anchoring training, performed by student teams without instructor assistance, is a suitable exercise for improving ship handling skills through various manoeuvres. First, students heave up the anchor and sail a planned route and then, after passing planned waypoints, anchor at a planned anchorage. Kashima et al. showed "Anchor training is suitable not only for learning manoeuvring procedure based on actual performance but also for learning various elemental techniques for manoeuvring, for information exchange and management skills and for improving ability related to those skills" through their experiments (2001).

Anchoring training is generally performed by a team of four, each with defined roles: captain (role of captain—ROC), first officer (role of first officer—RO1O), third officer (role of third officer—RO3O) and quartermaster (role of quartermaster—ROQ). Thus, anchoring training is considered effective group work, with a flow as follows:

- (1) Taking the lead, the ROC develops a navigation plan for anchoring. This active student planning of ship handling is designed to develop the ROC's leadership skills and create opportunities for peer learning. The ROC explains the navigation plan to teammates and instructors, who then give advice and feedback to correct the plan. After correcting the navigation plan, the ROC briefs team members and instructors, who then check their notes and roles (group work).

- (2) Conduct actual ship training (training on actual ship)
 - a) The ROC positions the leaving anchorage station and, before heaving anchor chains, directs the RO30 to prepare the main engine and then directs the heaving up of the anchor.
 - b) When the anchor is aweigh, the ROC sets off on a predetermined course using the main engine and rudder.
 - c) The ROC appropriately corrects the course to ensure that the planned route can be navigated. The ship then passes two scheduled waypoints and navigates the predetermined route.
 - d) The ROC slows the main engine, adjusts the course and stops the ship by applying the main engine to the sternway to ensure its correct position at the planned anchorage.

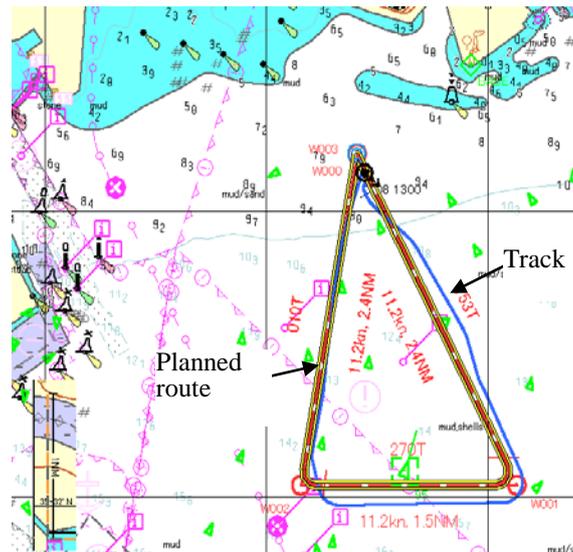


Figure 1. The Planned Route and an Example of Track in the Training Area

- e) The ROC lets the anchor go at the planned anchorage, lets out the cables to a predetermined length, stops the main engine and finally dismisses the anchoring station.
- (3) Shortly after the training ends, students self-evaluate based on a rubric.
 - (4) Each team then discusses the anchoring training, that is, its positive aspects and those needing improvement (group work).
 - (5) Each team member presents ship handling notes, while the others engage in active listening and thinking. Instructors comment based on the evaluation rubric (presentation).
 - (6) Students consider and suggest improvements to the self-evaluation rubric.

This was the basic content of the anchoring training conducted in 2018 and 2019. Figure 1 shows the planned route and a tracking example in the training area.

3.2 Comparison by Anchoring Training

Due to COVID-19's influence in 2020, the actual ship training usually conducted in October for two nights and three days was readjusted a schedule of three day-trips. Normally, on the night of the first day, group work was conducted for 3 to 6 hours to create an anchoring ship handling plan. However, due to the one-day voyage, group work for the plan was limited to about one and a half hours. To enable efficient and effective training within such a short time, on-demand teaching materials enabled students to learn before the actual ship training. Figure 2 shows the flow of anchoring training. "Watching on-demand teaching materials" in the figure was added in 2020, and because it can be watched easily in advance on a smartphone, some students watched it immediately before the actual ship training.

Since in 2021, the training was also a day trip, students watched the on-demand teaching materials as in 2020, and after the training, they created review materials from the videos taken during the training and distributed them as on-demand review materials.

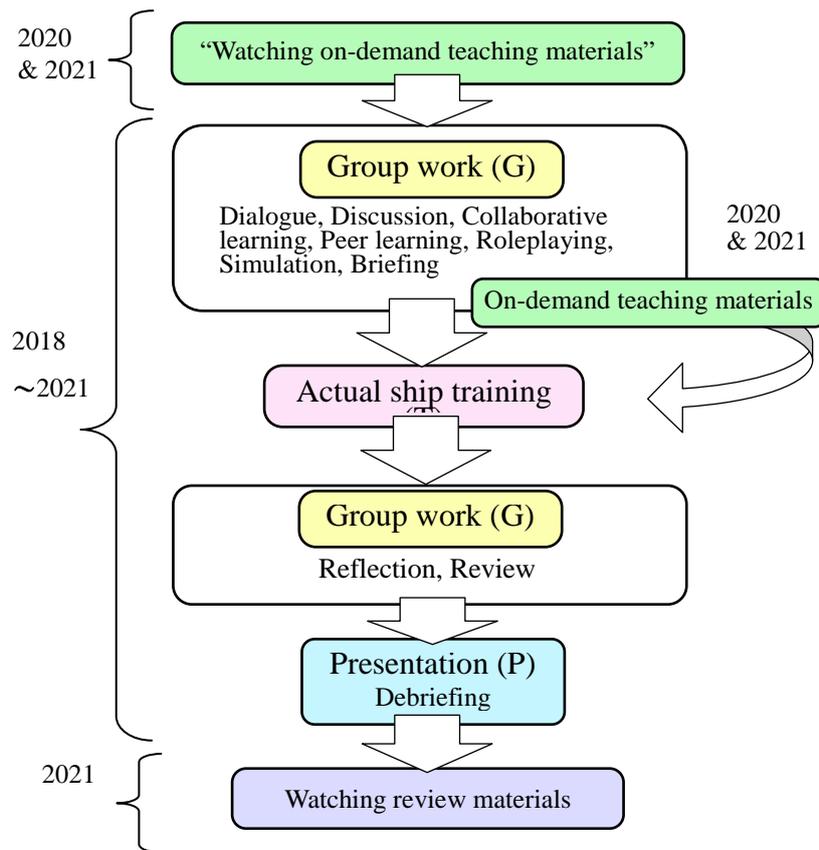


Figure 2. Flow of Anchoring Training

The advance on-demand teaching materials include the following two videos, which, in 2018 and 2019, were explained during boarding:

- (1) Explanation video of “Shiojimaruru anchoring training implementation procedure and anchoring training implementation plan” (about 1 hour)
- (2) Explanation video of ‘Points of anchoring training’ (about 45 minutes)

In contrast, as shown in Figure 3, the video created as review material explained the following points according to the actual situation by integrating the image inside the bridge, the image in the bow direction of about 90° and the Electronic Chart Display and Information System (ECDIS: A navigation system that displays GPS position information on an electronic chart, similar to a car navigation system.) screen.

- (1) Early detection of fishing boats and collision avoidance methods
- (2) Points of route navigation
- (3) Timing and points of procedure for altering course
- (4) Passing distance of the anchored ship
- (5) Points of avoidance methods for a crossing vessel
- (6) How to deal with wind pressure flow (leeway)
- (7) How to utilise the bow target and stern target
- (8) How to use the horizontal target and radar
- (9) How to deal with other various actual situations

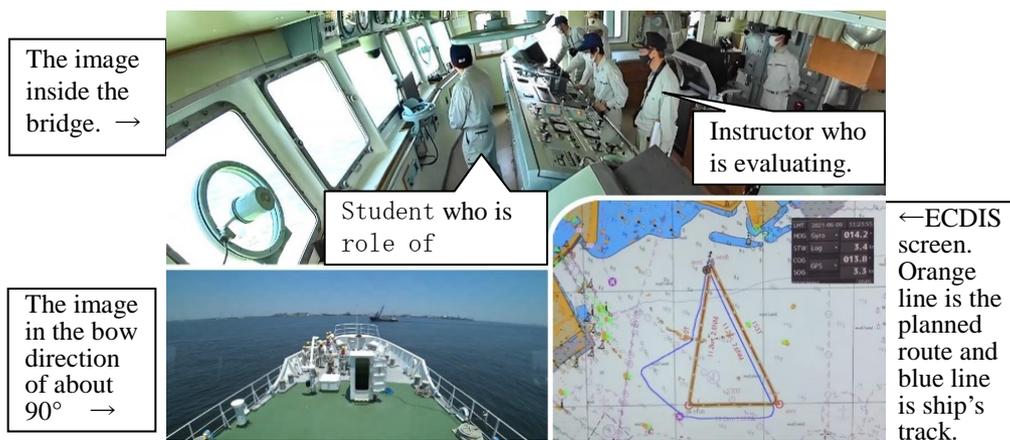


Figure 3. One Scene of Review Material

4. Results and Considerations

4.1 Comparison of Instructors' Evaluations

In anchoring training, two instructors, that is, experienced captains of a large training ship, conducted training evaluation; the same two instructors performed consecutive evaluations from 2018 to 2021. For evaluation of anchoring training, 14 specific items were determined, and the rubric evaluation, which sets evaluation criteria for each item, was adopted. Evaluation criteria were scored in four stages: 4 points (90 or more of 100 points), 3 points (80-90 points), 2 points (60-80 points) and 1 point (fewer than 60 points). Then, average scores for each year of scored evaluations were compared. Figure 4 shows comparison of each evaluation item between the average of 2018 and 2019 without viewing the on-demand teaching materials in advance and the average of 2020 and 2021 with viewing. Evaluation items are ① procedure for heaving up anchor, ② acceleration and course setting after heaving up anchor, ③ look-out (visual, finding/recognition), ④ look-out (visual, continuous monitoring), ⑤ course setting, ⑥ altering course, ⑦ give-way/stand-on ship handling, ⑧ ship position grasp, ⑨ anchor position, ⑩ anchoring procedure, ⑪ speed reduction, ⑫ Bridge Resource Management (BRM (sharing information)), ⑬ Bridge Resource Management (BRM (sharing intention)), ⑭ overall impression and ⑮ average. Except for the evaluation item of ⑨ anchoring position, averages of 2020 and 2021 when students viewed on-demand materials in advance were high for all items, and the overall average achievement rate improved by 6.0%. In particular, the improvement rate of ⑥ altering course, ⑩ anchoring procedure and ② acceleration and course setting after heaving up anchor was high, and the improvement greater than 20% compared to the 2018-2019 average without the on-demand material.

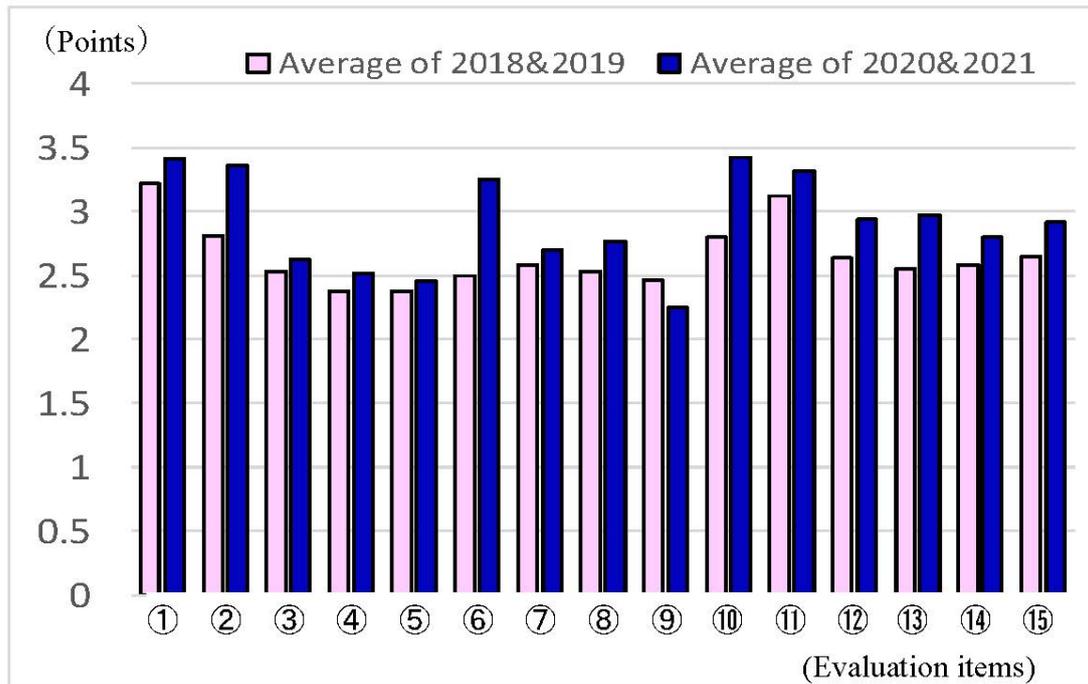


Figure 4. Comparison of Evaluation Scores with and without On-demand Teaching Materials

In 2020 and 2021, the time for group work to create a plan of ship handling for anchoring was reduced to less than half, but the on-demand teaching materials viewed in advance seemed to be more effective. Yoshida and Takahashi show the effect of group work in the education field (2004) (2006). However, on-demand teaching materials might be considered even more effective. Still, this does not mean group work was not conducted, so we believe that more effective group work could be achieved by watching on-demand teaching materials in advance. In-advance, on-demand teaching materials are effective because: (1) Group work for planning the ship handling was achieved briefly and efficiently, (2) on-demand teaching materials can be viewed many times, (3) can be watched easily on smartphones and (4) the materials were good and appropriate.

Why evaluation of ⑨ anchor position decreased is unclear, as is why evaluation of ⑥ altering course, ⑩ anchoring procedure and ② acceleration and course setting after heaving up anchor improved. We presume that this is due to the good explanation of the on-demand teaching materials. In other words, in the on-demand teaching materials, the turning diameter and wheel over point for “⑥ altering a course” are explained in an easy-to-understand manner. In addition, since “⑨ anchor position” is related to many factors, we think that the video teaching materials alone were not enough.

4.2 Student

4.2.1 Evaluation of On-demand Teaching Materials

Figure 5 shows students’ evaluation of on-demand teaching materials after actual ship training. As is

clear from the figure, 98% of students rated it effective. There was no response without any effect, and only one responded, "I can't say either [one]".

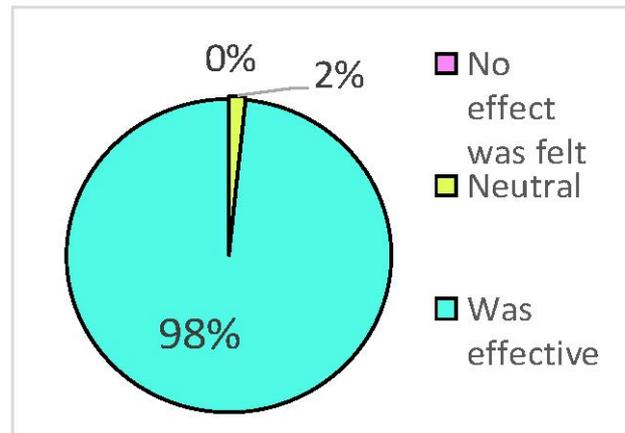


Figure 5. Student Evaluation of On-demand Teaching Materials

4.2.2 Impressions of On-demand Teaching Materials

Figure 6 shows results of classifying students' impressions of pre-on-demand teaching materials using the affinity projection method. Students' most common impressions were recognition of the on-demand teaching materials' effects and how they were used. The main ones follow:

- (1) Effective because it is possible to do image training
- (2) Effective by understanding the implementation content (flow) and purpose in advance
- (3) Effective in carrying out group work in ship handling plans
- (4) Effective because it is possible to study just before
- (5) Effective for understanding roles
- (6) Effective for resolving doubts and anxieties
- (7) Effective for understanding precautions
- (8) Effective because it can be used for reflection after implementation

In addition, there were the following impressions about the viewing method:

- (1) Effect that it is possible to watch repeatedly
- (2) Effect that it is possible to watch anytime, anywhere
- (3) Effect that it is possible to watch on a smartphone

When I saw the students lying down, watching the on-demand teaching materials on their smartphones, I felt that a new learning style was being established.

There were also many student comments on the excellence of the on-demand teaching material itself, which integrated video from the inside of the bridge, the image in the bow direction and the ECDIS screen—all of which were conducted during past training. The on-demand materials included explanations of subtitles and explanations by the captain’s voice, and we think they were excellent, easy-to-understand teaching materials.

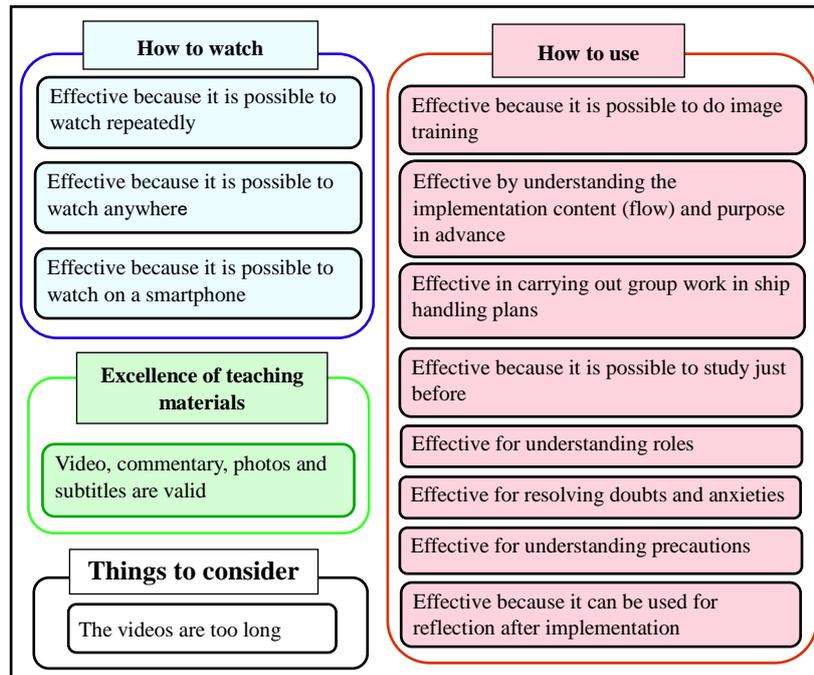


Figure 6. Classification of Student Impressions

4.2.3. Impressions about Review Materials

The following summarises students’ main impressions of the review material.

- (1) Effective for individual technical improvements, such as lookout, ship handling and resource management.
- (2) It is helpful to see the practical training of my group and other groups from an objective, bird’s-eye view.
- (3) It is effective because it has subtitles, explanations, a short summary of the main points and a short summary of the whole.

Students expressed opinions such as the following: “I think it would be better to have cameras in the left-right direction as well as cameras in the bow direction and inside the bridge” and “I think it’s better to have the whole image instead of shortening it”. Even so, all students commented that the review materials were effective. However, what knowledge and skills students have improved and how much

they have improved remain unclear. In the future, we must consider verification methods, for instance, questionnaire surveys.

5. Conclusion

We applied blended learning during which on-demand teaching materials were watched before the actual ship training, and we presented review material created from videos after the training was conducted. Results of the instructors' evaluations revealed that watching on-demand teaching materials in advance was evaluated more highly than face-to-face commentary, perhaps because on-demand materials can be watched multiple times and at any time. It also suggests that group work [10] for creating a ship handling plan, thought to have an educational effect, is effective even at about one and a half hours. Furthermore, students' evaluations and impressions also demonstrated that watching on-demand teaching materials in advance was effective.

Students also highly evaluated watching the review material. Their impressions and opinions show that its effect is sufficient. However, we think it necessary to verify further these materials' effectiveness. In the future, we would like to investigate combinations of other learning strategies such as simulators and different e-learning methods. In addition, we would like to consider and implement a more effective combination of blended learning with certain evaluation methods.

Acknowledgement

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