



The Influence of Learning to Incorporate Instruction on Formulation of Consideration Description Under Peer Evaluation Activity on Awareness of Consideration

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Abstract

The purpose of this study was to clarify the influence of learners' awareness of consideration by practicing a junior high school science class that incorporates the instruction on formulation of consideration description under peer evaluation activity. The peer evaluation activity is a learning activity in which learners use Goto's (2013) mutual evaluation sheet to exchange opinions with others about their considerations in observations and experiments, using the evaluation criteria to conduct self-assessment and peer evaluation, and then revise and improve their consideration based on the mutual evaluation sheet that shows their score evaluation and comment evaluation [1]. The instruction on formulation of consideration description is an instruction using the "I thought (conclusion) from (results). The reason for this is that (evidence)" stereotyped sentence shown by Matsubara (1997) [2]. In a previous study on the instruction on formulation of consideration description under peer evaluation activity, it was reported that it was effective in promoting improvement of consideration description including "results (data)," and "evidence (reason)" that constitute scientific expression, but there was no report on learners' awareness of consideration (Yamauchi, Iida, Goto, 2022) [3]. Therefore, in order to achieve this objective, we conducted classes in which one group was set up to incorporate the peer evaluation activity, one group to incorporate the instruction on formulation of consideration description, and one group to incorporate the instruction on formulation of consideration description under peer evaluation activity, and administered a post-class questionnaire that asked students about their awareness of consideration. The results of the analysis comparing the responses of each group suggest that the group that the instruction on formulation of consideration description under peer evaluation activity has more influence on the students' awareness of revising the consideration written by their friends as a scene of consideration, compared to the group that the instruction on formulation of consideration description.

Keywords: *peer evaluation activity, instruction on formulation of consideration description, awareness of consideration*

1. Background of this study

One of the issues in science education in Japan is that students do not write their considerations in scientific expression and that collaborative learning is not realized. One approach to solving these issues is to incorporate the instruction on formulation of consideration description under peer evaluation activity. Previous studies on the peer evaluation activity and the instruction on formulation of consideration description have reported improvements in the logical expression of consideration description (e.g., Iida and Goto, 2019, Matsubara, 1997) [4] [2]. Furthermore, in a previous study on the instruction on formulation of consideration description under peer evaluation activity, it was reported that it was effective in promoting improvement of consideration description including "results (data)," and "evidence (reason)" that constitute scientific expression (Yamauchi, Iida, Goto, 2022)[3]. Thus, in the previous studies on the peer evaluation activity and the instruction on formulation of consideration description, findings on the development of learners' scientific expression have been



reported, but there are not enough reports on learners' awareness of consideration. Regarding learners' awareness of consideration, Yamauchi, Gunji, Iida, and Goto (2022) reported that the use of peer evaluation activity made learners aware of how to write easy-to-understand consideration, and that including activities such as exchanging and revising opinions with friends was viewed positively because it made the lessons easier to understand [5]. In addition, Yamauchi and Gunji (2022) reported that the use of instruction on formulation of consideration description enhances students' awareness of the elements necessary for scientific expression, namely, results (data), claim (conclusion), and evidence (reason), to be described in the consideration [6]. However, these reports are based on the analysis of the case in which the peer evaluation activity and the instruction on formulation of consideration description were conducted independently, and it is not clear whether the effect continues when the instruction on formulation of consideration description under the peer evaluation activity. Therefore, it is meaningful to set up a group of classes that incorporate the peer evaluation activity, a group of classes that incorporate the instruction on formulation of consideration description, and a group of classes that incorporate the instruction on formulation of consideration description under the peer evaluation activity, and to compare the responses of each group to clarify the influence on learners' awareness of consideration.

2. Purpose of this study

The purpose of this study was to clarify the influence of learners' awareness of consideration by practicing a junior high school science class that incorporates the instruction on formulation of consideration description under peer evaluation activity.

3. Research Methods

First, students do a lesson with an experiment and write a consideration description. In the lesson with an experiment, students conducted a combustion experiment of magnesium in carbon dioxide. Next, students rewrite their consideration description in three groups: one group is set up to incorporate the peer evaluation activity (Group A), one group to incorporate the instruction on formulation of consideration description (Group B), and one group to incorporate the instruction on formulation of consideration description under peer evaluation activity (Group C). After that, students do a questionnaire to determine their awareness of the consideration. Then, by comparing the question items of each group, we analyze the impact on the learners' awareness of the consideration.

3.1 Questionnaire

Yamauchi, Gunji, Iida, and Goto (2022) created and surveyed a questionnaire asking students in public junior high schools about their attitudes toward consideration [5]. The question items were set to "matters related to science class," "content of consideration," "scene of consideration," and "support in writing the consideration," and were in the form of six choices ranging from "agree/apply" to "disagree/not applicable." In the questionnaire survey in this study, we extracted the "content of consideration" question items and the "scene of consideration" question items (Table 1). The reason for this is that in the "Content of Consideration" section, there are items that question the results (data), claim (conclusion), and evidence (reason) that are necessary elements for scientific expression, and in the "Scenes of Consideration" section, there are items that question students' awareness of collaborative learning, such as explaining their own considerations, receiving explanations from their friends, and revising their own and their friends' considerations.

Table 1. The question items

Content of consideration	(1) Results(data) (2) Impressions (3) What I thought was important (4) claim (conclusion) (5) evidence (reason)
Scene of consideration	(6) Explain your consideration to those around you. (7) Receive an explanation of your friend's considerations. (8) Revise your own written consideration. (9) Revise your friend's considerations.



4. Analysis

In order to see how the peer evaluation activity and the instruction on formulation of consideration description influenced the learners' awareness of Consideration, we analyzed the question items in the questionnaire. The distribution of responses for groups A, B, and C were compared for multiple groups by the Kruskal-Wallis test (Table 2). The analysis showed that the question item (9) produced a significant difference ($p=.00<.05$), and the question item (5) ($p=.05<.10$) showed a significant trend.

The question item (9), which showed a significant difference, asked about "scene of consideration" and asked whether "Revise your friend's considerations. Therefore, in order to confirm which group showed a significant difference, a Mann-Whitney's U test was performed using multiple comparisons with the Bonferroni method. The analysis revealed that Group A ($p=.04<.05$) and Group C ($p=.00<.05$) were significantly higher than Group B. There was no significant difference ($p=.74>.05$) between groups A and C. Since this was a characteristic of Groups A and C, it was considered to be an effect of the activity in which the students evaluated others' consideration of their friends' consideration in the process of conducting the peer evaluation activity.

The question item (5), which showed a significant trend, asked about "content of consideration" and asked whether "evidence (reason)". The total number of learners who gave positive "6" and "5" responses was 20 in Group A, 26 in Group B, and 22 in Group C.

In the class comments of the learners in Group C, many of them mentioned "collaborative learning, such as exchanging and revising opinions with friends" and "the teacher's guidance of writing results (data), claim (conclusion), and evidence (reason)". This was one of the findings that supported the present analysis.

Table 2. Kruskal-Wallis test

	Group A (n=26)						Group B (n=26)						Group C (n=26)						P
	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	
(1)	13	1	2	4	3	3	14	6	2	3	1	0	12	7	5	0	1	1	<i>n.s.</i>
(2)	6	3	7	3	3	4	1	2	6	6	4	7	4	2	7	7	2	4	<i>n.s.</i>
(3)	6	5	5	7	2	1	3	2	9	4	4	4	4	7	1	9	2	3	<i>n.s.</i>
(4)	20	2	1	1	2	0	18	6	0	0	1	1	17	6	1	2	0	0	<i>n.s.</i>
(5)	16	4	3	1	1	1	22	4	0	0	0	0	15	7	2	1	0	1	†
(6)	8	5	7	4	1	1	11	4	6	3	1	1	7	9	8	1	0	1	<i>n.s.</i>
(7)	14	6	3	2	1	0	19	4	2	0	0	1	13	9	4	0	0	0	<i>n.s.</i>
(8)	8	10	4	2	0	2	7	11	6	1	0	1	9	12	4	0	0	1	<i>n.s.</i>
(9)	2	7	6	6	2	3	1	3	1	9	6	6	7	4	7	4	3	1	*

* $p<.05$ † $p<.10$ *n.s.* $p>.10$

5. Conclusions

This study suggested that the group that the instruction on formulation of consideration description under peer evaluation activity has more influence on the students' awareness of revising the consideration written by their friends as a scene of consideration, compared to the group that the instruction on formulation of consideration description. However, this is also an effect that can be obtained even when the peer evaluation activity is conducted independently, and it cannot be said that this is an effect that can be obtained only when the instruction on formulation of consideration description under peer evaluation activity. In the future, it is necessary to analyze the free descriptions of the classes and examine the effects that can be obtained only when the instruction on formulation of consideration description under peer evaluation activity. In addition, it is necessary to examine whether it is effective to conduct all the learning activities indicated in the peer evaluation activity and the instruction on formulation of consideration description, based on the actual conditions of the learners.

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