

# A Comprehensive Study on a Presentation Education Method Applicable to Higher Education and Industry

Junko Toyoshima  
Department of Engineering and Design  
Hosei University  
Tokyo, Japan  
junko.toyoshima.41@hosei.ac.jp

Shinya Doi  
R&D Management Section  
Toyota Central R&D Labs., Inc.  
Aichi, Japan  
Shinya-DOI@mosk.tytlabs.co.jp

Hiroshi Ueda, Yuji Tokiwa  
Research Center for Computing and  
Multimedia Studies  
Hosei University  
Tokyo, Japan  
{uep, yuji.tokiwa.dc}@hosei.ac.jp

**Abstract**— This Innovative Practice Category Full paper presents an integrated approach of a presentation education method utilizing a web-based peer assessment system and video self-reflection to enhance users' presentation skills in extended fields. In this study, we aimed to verify the inclusiveness of the proposed method in improving employee's presentation skills at a corporate training program by examining the results of the users with diverse academic backgrounds, specializations, job types, and ages. In experimenting, three research questions were posed: 1. Does the proposed method of combining a web-based peer assessment system with video self-reflection refine the participant's presentation skills? 2. How does the participant's self-reflection relate to the improvement of team presentations and the subsequent postcard presentation results? 3. Is it possible to apply the proposed method to an employee training program in industry? The results of the second team presentation, evaluated both by the peers and the supervisors, improved. Furthermore, the results of the postcard presentation showed that a majority of the participants developed their presentation skills, especially physical messages. Finally, the results demonstrated that the proposed method is applicable to corporate in-house training. Based on these findings, this full paper verifies the all-round utility and potency of the proposed method in industry as well as higher education.

**Keywords**—video self-reflection, peer assessment, presentation education

## I. INTRODUCTION

Modern graduates are required to have academic expertise as well as various skills to thrive in the global world. As "Criteria for Accrediting Engineering Programs" [1] designates, communication skills development is one of the 11 student outcomes in engineering education. In Japan, the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) also specifies the skills as an essential learning outcome in engineering education [2].

Communication skills cover a wide range of abilities such as conveying information, ideas, and feelings verbally and non-verbally, as well as improving teamwork, critical thinking, and self-reflection [3]. Communication skills are a vital career enhancer that boosts students' employability [4]. Among these abilities in communication skills, the authors mainly focused on the development of students' oral presentation skills and self-reflection to comply with the expectations of higher education and industry.

The power of reflection was first advocated by Dewey [5], who is thought to be the founder of "reflection," and Schön [6] developed Dewey's work by connecting "reflection" with

professional development and practice. Schön's idea greatly influenced the study of teacher education, health care professions, and architectural designs. Furthermore, Mortari [7] advocated the value of reflective activities for becoming not only a technician but also an able practitioner.

Pausch [8] wrote that the best help educators could give to their students is to teach them to become self-reflective. He taught a virtual reality class at Carnegie Mellon University, where students worked in a team to accomplish the tasks during the semester. In the course, the teams were shuffled five times, and the students received peer feedback from other team members. The students saw the peer assessment results in a bar graph, and each student realized how other team members judged him/her. Thus, the course offered students opportunities to be evaluated by and evaluate others. Through this process, the students reflected on what they had done in the team projects and thought about measures to become a better team player.

As the virtual reality class shows, peer assessment is a positive learning experience for students. They learn how to collaborate, evaluate, and practice higher-order thinking, such as critical thinking [9-10]. Furthermore, it is a crucial technique to engage students in active learning and enhance their self-reflection [11-13]. Moreover, the ability to assess peers can even enhance students' employability [14].

Although many studies have been conducted on peer assessment and reflection, little research has been done on the improvement of students' presentation skills by combining peer assessment and video self-reflection. Here we present our presentation education method of utilizing both peer assessment and video self-reflection to refine students' presentation skills.

Generally speaking, Japanese people are not good at using gestures, eye contact, posture, and voice in making presentations [15], and tend to overlook the importance of physical messages. Students, however, will realize the crucial role of these messages by watching the recorded videos of their presentations. Also, they can confirm with their own eyes whether other students' feedback and assessment are right on the mark. To provide students with better opportunities to see themselves objectively, the authors have used the method in higher education. This time we intended to apply the method to a corporate employee training program to verify its feasibility in industry.

## II. COURSE DESCRIPTION OF THE PREVIOUS STUDIES AT HIGHER EDUCATION

### A. *The Presentation Skills course at the university*

The Presentation Skills course started in 2008 as an elective course for sophomore engineering students at the Department of Engineering and Design at Hosei University. Although the direct learning goal of this course is to train students to become competent presenter, the indirect-learning goal is to make them reflective, respectful, and collaborative. To this end, the author introduced peer assessment into the course so that the students would listen to others' opinions open-mindedly, learn to evaluate others' performances respectfully, and collaborate mutually toward the enhancement of their presentation skills.

In many classes, students receive feedback and assessment only from the course instructor. Nevertheless, considering that the speaker is presenting not only to the instructor but also to the whole class, he/she needs to think of other students' impressions of his/her performance. Besides, students are always assessed and rarely have opportunities to evaluate others. Thus, it is a meaningful experience for them to learn how to give accurate, constructive feedback in a respectful tone that may inspire presenters' self-reflection.

On the other hand, there is a saying, "Seeing is believing," which means one cannot believe it until he/she sees it. To make a persuasive presentation, a presenter needs to fully understand the vital role of physical messages and use them. Thus, video self-reflection enables students to check their performances with their own eyes, and at the same time, confirm if other students' feedback is appropriate or not. For these reasons, the authors combined peer assessment with video self-reflection to give students better opportunities to observe themselves objectively. Thus, the two significant pillars of the Presentation Skills course have been "peer assessment" and "video self-reflection" since 2009.

When a student is delivering a speech, other students evaluate his/her performance, which is videotaped. The recorded video will be uploaded to the university's website named OATube. After finishing the presentation, the presenter will check the peer assessment results, watch the recorded video on OATube by reference to the classmates' feedback, and write a self-reflection report to enhance their presentation skills. Since students who take the course are assigned to make three presentations during the term, they need to complete this process at least three times to get credits.

In peer assessment, paper-based forms had been used until 2014. The first-generation Presentation Education Assistance System (PEAS) improved efficiency of the course management [16], and the upgraded PEAS (UPG PEAS) realized peer assessment of group presentations [17].

### B. *The Development of 1<sup>st</sup> generation PEAS*

As reported in FIE2016, the first-generation PEAS, a web-based peer assessment system, was developed mainly for overcoming limitations of the paper-based peer evaluation. Thanks to PEAS, the instructor's workload due to the vast amount of paperwork, such as copying, distributing, and collecting a pile of paper-based forms, was significantly reduced, and timeliness, efficiency, and accuracy of peer assessment were ensured. Furthermore, PEAS was favored by most students because of its utility and promptness, and

the system combined with video self-reflection helped students improve their presentation skills, especially in terms of physical messages.

### C. *Significant Modifications of PEAS (UPG PEAS)*

In FIE 2018, we reported the significant modifications of PEAS (UPG PEAS) to expand its application domain. In the study, the capability and acceptability of UPG PEAS in various educational fields, such as master's STEM students' Technical Writing course and group activities of liberal arts English reading and writing class, were confirmed.

### D. *Lesson Learned from Higher Education*

From these results, we confirmed that peer assessment by prompt feedback and self-reflection by recorded videos are keys to improve students' presentation skills and that the improvement of presentation skills can be evaluated quantitatively. Furthermore, the method applies to all disciplines, both STEM and liberal arts in higher education. Here, we intend to examine the feasibility of the method at a corporate research institution's employee training program.

## III. DESCRIPTION OF THE EMPLOYEE TRAINING PROGRAM IN INDUSTRY

### A. *An Overview of The R&D Labs*

The present study was administered at Toyota Central R&D Labs., Inc. near Nagoya city in Japan. Established as a leading research institution of Toyota Group, it has conducted numerous commissioned researches sponsored by the group companies as well as collaborative studies with universities, research organizations, and companies since 1960. The institution has contributed to outstanding developments, such as the blue LED and QR code.

There are three divisions in the institution: core technology, strategic research, and administration. The core technology division focuses on specific issues such as intelligent mobility and car electrification. The strategic research division conducts fundamental research. The administration division is responsible for administrative work, including human affairs, law work, intellectual property, and welfare.

In the institution, 986 employees (researchers, 80%, and administrative staff, 20%) who have various specializations, job types, academic backgrounds, and ages work. Generally, diversity is an advantage for an institution because each employee can contribute by bringing in different strengths. While at the same time, the differences may cause communication difficulty, which spoils the efficient workflow.

Another issue is the lifetime employment system with rather strict hierarchical grades. Like many other Japanese companies, the institution applies the system, and once entered, the regular employees are ensured of tenure status and salary increase until their retirement. As a result, employees tend to be less motivated to maximize their potentials. In order for the institution to be globally competitive, each employee should keep on growing as a professional. In these circumstances, the institution decided to take another approach to the employee's training and asked the author to instruct the program utilizing the method proved useful in higher education, especially in STEM fields.

## B. Goals of the employee training program

There were three crucial goals for the employee training program: to equip employees with excellent presentation skills, deepen mutual understanding among them, and raise awareness about the importance of developing employability.

First, the primary goal is to equip employees with excellent presentation skills. As previously noted, the training program participants were diverse, which was quite a contrast to the homogeneous students at the university presentation skills course who share the same age and major field. The institution expects the employees to brush up their presentation skills so that they can collaborate and work efficiently with anyone despite their differences.

Second, it aimed to deepen mutual understanding between researchers and administrative staff who have very few opportunities to interact in day-to-day work. As is often the case with organizations, the institution tends to be vertically divided and has had insufficient interdepartmental and cross-sectoral exchange among the employees, while they are also ranked hierarchically. As a result, no training program that mingles employees with different job grades was held in the past. The training program was planned to overcome these challenges and targeted employees between ages 21 and 48 with different specializations, academic backgrounds, job types, and job grades.

Third, it aimed to raise awareness about employability development among the employees. Although the institution expects employees to autonomously enhance their employability, many of them seem to think they already have sufficient work-related skills and knowledge to complete their tasks and are less motivated to make progress. In this situation, the program was implemented to give employees opportunities to reflect on themselves through peer assessment and video self-reflection.

## IV. MATERIAL AND METHOD

In conducting the study, the UPG PEAS and a Network-attached Storage (NAS) of the institution were used for peer assessment and uploading the recorded videos of the presentations. The study was administered by a team of a visiting instructor (the 1st author) and Human Resource (HR) personnel of the institution in charge of the training program (the 2nd author). For further information about the 1st generation PEAS and UPG PEAS, please refer to the proceedings of FIE 2016 [16] and 2018 [17].

The method to examine the two team presentations and the solo postcard presentation was peer assessment by UPG PEAS and video self-reflection.

Each participant made two team presentations, which were videotaped and evaluated by other participants and five supervisors. The supervisors checked each presenter's performance by the recorded video and assessed his/her progress as a non-participant observer. After two days from the team presentations, the peer assessment result and the recorded video were disclosed. Each participant checked the peer assessment results on UPG PEAS and the recorded videos of the team presentations through NAS and wrote self-reflection reports to reflect on their performances.

Two months later, the participants performed a solo postcard presentation, which was evaluated both by the team members and the supervisors.

## V. PRESENT STUDY

In conducting the study, three research questions were posed: 1. Does the proposed method of combining a web-based peer assessment system with video self-reflection refine the participant's presentation skills? 2. How does the participant's self-reflection relate to each participant's improvement in the team presentations and the subsequent solo postcard presentation? 3. Is it possible to apply the proposed method to an employee training program in industry?

The objective of the two team presentations was to enhance participants' presentation skills, including teamwork skills, through video self-reflection and peer assessment. Also, it aimed to provide participants with opportunities to learn about affiliated group companies and collaborate with other members to make a research proposal.

On the other hand, the objective of the postcard presentation was to confirm the participants' improvements after the two team presentations. The author intended to investigate whether they fully utilized their past experiences and the self-reflections to enhance their presentation skills.

### A. Study 1 -Team Presentations

A two-day compulsory training program on presentation skills was held for 68 employees in May and June 2019. There are two job types (researcher and administrative staff) and ten job grades (Grades 1 to 10) in the institution. The participants of this program belong to Grades 7 (middle-level position) through 10 (entry-level position) and have different academic credentials: high-school, technical college, and junior college graduates, bachelor, master's degrees, and doctor's degree. Most of them were hired as new graduates from educational institutions, started professional careers from an entry-level position, and have been working for the institution about 4.3 years on average.

The HR staff divided 68 participants into 19 mixed teams, which consist of members of different job types and divisions. After receiving a lecture on how to structure a persuasive presentation and deliver an impressive team presentation using physical messages, the participants engaged in a problem-solving task designed to fit the institution's needs. Each team made two presentations, which were videotaped and evaluated both by other participants and the supervisors. After their performances, each participant checked the peer assessment results and the recorded videos of the team presentations and wrote self-reflection reports. The schedule of the two-day program is shown in Table I.

After two days from the team presentations, the recorded videos and the peer assessment results were disclosed. Each participant checked the results, watched his/her videos for self-inspection by referring to the peer assessment results, and wrote self-reflection reports.

The morning lecture on the first day was mostly about how to make an excellent presentation with a structured story, great visuals, and effective delivery using impressive body language. In giving the lecture, the author excerpted the essence of the university presentation skill course and tailored it to the institution's needs. The participants also studied the "Heilmeyer Catechism" [18], a set of well-known questions for evaluating research proposals, which would be useful in addressing the task and, at the same time, helpful for them to reflect. At the end of the morning lecture, the participants were

informed of the team presentation rubric used for peer assessment and learned how to evaluate by UPG PEAS with their smartphones.

The assigned topic of the team presentation was as follows:

Suppose you are an employee of Toyota group-affiliated supplying company. Your assignment is to develop a joint research proposal with other group-affiliated supplying companies that can attract a group-affiliated vehicle OEMs and present it to your upper management. In doing this, consider the strengths and weaknesses of each company. Second, decide the topic of the joint research proposal related to Connected, Autonomous, Shared, and Electric (CASE). Prepare a 10- minute team presentation using slides.

After two hours of preparation, each team took a turn and presented their proposals, assuming that the upper management was there to listen. The team presentations were videotaped and evaluated by other participants who watched the performance from the viewpoint of the upper management. At a later day, the five supervisors watched the video recordings of the team presentations and evaluated each participant's performance. Each participant checked their recorded video and the peer assessment result and wrote a self-reflection report afterward.

The rubric in Table II shows the team presentation criteria for the participants, which the author designed based on the ideas of Harrington & LeBeau [19] and Brown [20]. It is a combination of a five-point scale questions (Q1-Q12) and written questionnaire (Q13-19).

Questions 1 to 4 relate to the Heilmeier's questions [18] studied in the morning lecture. Questions 5 and 6 refer to visual messages; Questions 7 to 9 are about physical messages. Questions 10 to 12 deal with teamwork. The participants provide feedback to each speaker's performance (Q13-16) and comment on the significant point, strength, and challenge of the team presentation in Q17-19. The participants evaluate their presentation as follows: Questions 1 to 12,

TABLE I. THE SCHEDULE OF THE TWO-DAY PROGRAM

Day/ Time	Content	Description
<Day 1> 9:00~12:00	Lecture	<ul style="list-style-type: none"> <li>The objectives of the training program</li> <li>Lecture on presentation skills, The Heilmeier Catechism</li> <li>How to evaluate mutually with UPG PEAS</li> </ul>
13:00~13:30 13:30~15:00	Lecture Team Activity	<ul style="list-style-type: none"> <li>Announcing the topic of the team Presentation</li> <li>The participants work with their team members and prepare for the team presentation.</li> </ul>
15:30~17:30	The 1 <sup>st</sup> Team presentation	<ul style="list-style-type: none"> <li>Each team performs a 10-minute presentation, which is videotaped.</li> <li>Other participants watch and evaluate the presentation on the spot using UPG PEAS.</li> </ul>
<Day 2> 9:00~12:00	The 2 <sup>nd</sup> Team presentation	<ul style="list-style-type: none"> <li>Each team performs a revised version of the presentation, which is again videotaped.</li> <li>Other participants evaluate the revised team presentation on the spot using UPG PEAS.</li> </ul>
13:00~16:00	Lecture Exercise	<ul style="list-style-type: none"> <li>How to make an effective English presentation</li> <li>Exercise – Preparing slides for the postcard presentation</li> </ul>
16:00~17:00	Lecture	<ul style="list-style-type: none"> <li>How to structure an English abstract</li> </ul>

☆☆☆☆ for “strongly agree” (5 points), ☆☆☆ for “agree” (4 points), ☆☆☆ for “neutral” (3 points), ☆☆ for “disagree” (2 points), ☆ for “strongly disagree” (1 point).

Table III shows a simplified rubric used by the supervisors to assess the team presentations as a non-participant observer. In assessing, the supervisors watched the recorded videos, concentrated on each individual performance, and checked each participant's progress by comparing the two team presentations. The supervisors rate their presentations as follows: Questions 1 to 5, ☆☆☆ for “remarkable improvement” (2 points), ☆☆ for “some improvement” (1 point), ☆ for “no improvement” (0 points).

The 2nd team presentation, a revised version of the 1st presentation, was performed after two weeks from the 1st day of the training program. Each team had two weeks to brush up their presentation. Based on the peer assessment results and the recorded video, the participant first reflected individually on his/her performance, and then cooperate with other team members to upgrade their presentation.

The 2nd team presentation was again videotaped and evaluated on-the-spot by other participants using the criteria shown in Table II. Also, the supervisors watched the recorded video of the revised team presentations afterward and evaluated each individual performance in the team presentation based on the criteria shown in Table III.

Each participant checked their recorded video and the peer assessment result and wrote the second self-reflection report.

In the afternoon of the 2nd day, emulating the FIE postcard presentation session, the participants learned about the postcard presentation and prepared two postcard slides.

TABLE II. A TEAM PRESENTATION RUBRIC

Questions	Scale	Target
Q1. The presenters articulated the objective of the research proposal without any jargon.	☆☆☆☆	team
Q2. The presenters explained the reason why the proposed research will be feasible.	☆☆☆☆	team
Q3. The presenters explained what difference it makes if the proposed research succeed.	☆☆☆☆	team
Q4. The presenters explained what is new about the research proposal.	☆☆☆☆	team
Q5. The presenters prepared “overview” and “summary” slides.	☆☆☆☆	team
Q6. The presenters used effective slides with charts, photos, and graphs.	☆☆☆☆	team
Q7. The presenters stated in a loud, clear voice so that the speech was easy to follow.	☆☆☆☆	team
Q8. The presenters maintained great eye contact with the audience.	☆☆☆☆	team
Q9. The presenters stood in a stable posture with his/her back straight	☆☆☆☆	team
Q10. Transitions between the presenters were smooth and natural.	☆☆☆☆	team
Q11. Each speaker fulfilled one's role and contributed to the team presentation.	☆☆☆☆	team
Q12. The overall presentation was excellent.	☆☆☆☆	team
Q13.-Q16. Please write your comment to each speaker.	Written answer	Solo
Q17. What was the most significant point of the team presentation?	Written answer	team
Q18. What was the strength of the team presentation?	Written answer	team
Q19. What was the challenge of the team presentation?	Written answer	team

### B. Study 2- A Solo Postcard Presentation

After two months from the 1st team presentation, the postcard presentation session was held in July. Utilizing the experiences of the team presentations, each participant prepared two postcard slides, made a five-minute talk about his/her research (work), and answered questions from the audience. We intended to find out whether the participants, who reflected thoroughly on the team presentation, did well in their solo postcard presentation.

The teammates and the supervisors evaluated the presenters. Based on the rubric shown in Table IV (an excerpt from Table II related to physical messages), the supervisors assessed their performances according to the following criteria: Questions 1 to 3, ☆☆☆ for “strongly agree” (3 points), ☆☆ for “agree” (2 points), ☆ for “disagree” (1 point).

Also, the HR personnel in charge of the training program reviewed the 1st self-reflection reports using the same rubric shown in Table IV and evaluated if the participants answered explicitly to each question according to the following criteria.

Questions 1 to 3, ☆☆☆ for “the participant wrote explicitly about what needs to be reflected and the measures for improvements,” ☆☆ for “the participant wrote about what needs to be reflected,” ☆ for “the participant answered in an unspecific way.” For example, if a speaker writes about what needs to be reflected without the improvement measures for each question, he/she will get 6 points.

## VI. RESULTS

### A. Research question 1- Does the proposed method of combining a web-based peer assessment system with video self-reflection refine the participants’ presentation skills?

The improvement of the participants’ presentation skills was examined by comparing the scores of the two team presentations.

The bar graph in Fig. 1 shows the average scores of the first and the second team presentations evaluated by the participants using the rubric shown in Table II. The vertical axis stands for the average points of all participants, and the horizontal axis shows the question numbers. The blue bar

TABLE III. A SIMPLIFIED TEAM PRESENTATION RUBRIC USED BY THE SUPERVISORS

Questions	Scale
Q1. The presenters articulated the objective of the proposal without any jargon.	☆☆☆
Q2. The presenters stated in a loud, clear voice so that the speech was easy to follow.	☆☆☆
Q3. The presenters maintained great eye contact with the audience.	☆☆☆
Q4. The presenters stood in a stable posture with a straight back.	☆☆☆
Q5. The presenters fulfilled one’s role and contributed to the team presentation.	☆☆☆

TABLE IV. A POSTCARD PRESENTATION RUBRIC BY THE SUPERVISORS

Questions	Scale
Q1. The presenter maintained good eye contact with the audience.	☆☆☆
Q2. The presenter stated in a loud, clear voice so that the audience could easily follow.	☆☆☆
Q3. The presenter spoke in a stable posture with his/her back straight.	☆☆☆

indicates the 1st presentation, and the orange bar stands for the 2nd presentation.

As the graph shows, the average scores of the 2nd presentation improved compared to the 1st presentation for each question. The calculation results of the t-test showed that the difference is statistically significant ( $t(18) = 2.10, p < .001$ , The P-value was less than 0.05). The results showed that all the teams improved their scores for each question in the second presentation.

Fig. 2 shows the average improvement of each presenter’s presentation skills in the team presentations. For better objectivity, the supervisors watched the recorded video of the two team presentations and evaluated each speaker’s progress by the rubric shown in Table III. In Fig.2, the average improvement of researchers was 5.1 points, and that of administrative staff was 4.5 points. The average improvement for overall participants was 4.9 points.

As the average improvement score shows, the participants scored nearly 1.0 for each evaluation criterion, which stands for “some improvement” (1.0 points × 5 criteria = 5.0 points). Fig.3 shows the average improvement of each participant’s presentation skills by job grades also evaluated by the supervisors.

As previously mentioned, the institution has ten job grades, and Grades 7 through 10 participated in the program this time. Grade 7 got 4.0 points, 5.3 points for Grade 8, 4.6 points for Grade 9, and 5.3 points for Grade 10. Grades 8 and 10 improved considerably, while Grade 7 improved little.

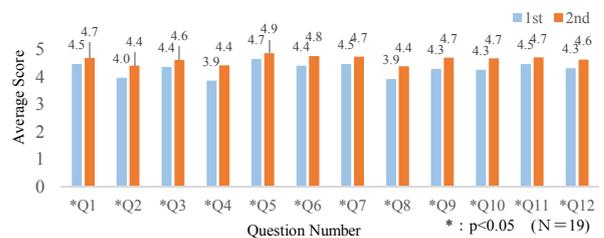


Fig. 1. The Average Team Presentation Scores by Questions

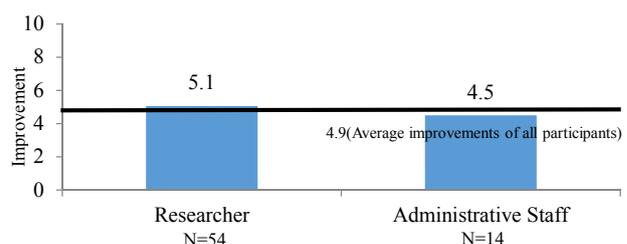


Fig. 2. The Average improvement of each presenter’s presentation skills by job types

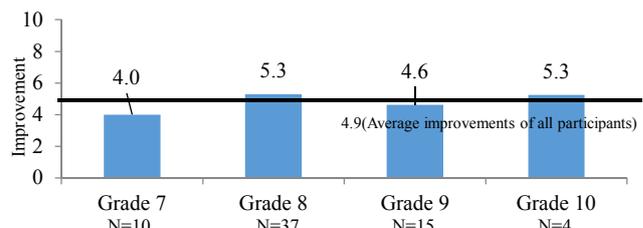


Fig. 3. The Average improvement of each presenter’s presentation skills by job grades

*B. Research Question 2 - How does the participant's self-reflection relate to each participant's improvement in the team presentations and the subsequent solo postcard presentation results?*

In experimenting, we intended to investigate how each participant's reflective activities relate to the team presentations' improvement and the subsequent solo postcard presentation. To explore the relationship between postcard presentation (PP) and self-reflection (SR) in depth, we analyzed the results by job types and job grades.

- Team Presentation Improvement and Self-reflection (Job Types)

Tables V and VII show the distribution of the researchers and the administrative staff respectively by SR scores and improvements (IMP). Using the peer assessment result and the recorded video, the participant wrote the self-reflection report within a week from the 1<sup>st</sup> team presentation.

The columns stand for each participant's improvement between the two team presentations in terms of speaker's eye contact, posture, and voice, which were assessed by the supervisors using the rubric in Table IV. The rows stand for the SR scores evaluated by the HR staff as to the depth of the self-reflection using the same Table IV.

Table VI indicates the ratio of the researchers in each quadrant. Each quadrant is classified according to the two values of IMP and SR. The IMP scores "greater than or equal to 3 points" are "big improvement," while "not greater than 3" are counted as "little improvement." The correlation coefficients between the SR and the improvements of the two team presentations were 0.114 for researchers, and 0.094 for the administrative staff.

Subsequently, we paid attention to the difference between the two job types. As shown in Table VI and VIII, 72.2% of the researchers and 57.1% of the administrative staff made big improvements between the two team presentations. Regarding the team presentations, the researchers improved better than administrative staff. On the other hand, 85.7% of administrative staff got higher scores in the SR, while only 55.5% of researchers did. The results showed that administrative staff was more committed to self-reflective activities.

- Postcard Presentation and Self-reflection (Job Types)

The PP session was held two months later from the first SR report. Sixty-six participants talked about their research (work) in the presence of other teammates and the supervisors. The supervisors assessed their performances by the criteria shown in Table IV. In the following Tables IX through XII, the columns stand for the PP scores assessed by the supervisors. The rows stand for the SR scores evaluated by the HR staff using the same table.

Tables IX and XI show the distribution of the two scores by job types. In these tables, we were unable to find a positive correlation between the first SR report and the PP results. The participants who reflected deeply in the report did not necessarily perform well in the PP session held in July.

Tables X and XII indicate the ratio of the two scores in each quadrant by job types. Each quadrant is classified according to the two values of PP and SR: the 1<sup>st</sup> quadrant represents "greater than or equal to 6 points" for both PP and

TABLE V. THE RELATION BETWEEN IMP AND SR (RESEARCHER)

		Score of Self-Reflection (SR)							Sub Total
		3	4	5	6	7	8	9	
Score of Improvements (IMP)	6								0
	5			1	2	1			4
	4		2	3	4	1		1	11
	3	2	6	3	10	1	1	1	24
	2	1	1	2	6				10
	1			2	1	1			5
	0								0
Sub Total		3	10	11	23	4	1	2	54

TABLE VI. THE RATIO IN EACH QUADRANT (RESEARCHER)

		SR			Sub Total	
		Low (SR<5)	High (SR≥5)			
IMP	Big (IMP≥3)	II	17(31.5%)	I	22(40.7%)	39(72.2%)
	Little (IMP<3)	III	7(13.0%)	IV	8(14.8%)	15(27.8%)
	Sub Total		24(44.5%)		27(55.5%)	51(100.0%)

TABLE VII. THE RELATION BETWEEN IMP & SR (ADMINISTRATIVE STAFF)

		Score of Self-Reflection (SR)							Sub Total
		3	4	5	6	7	8	9	
Score of Improvements (IMP)	6								0
	5								0
	4						1		1
	3				4	1	1	1	7
	2		1	1		2			4
	1				2				2
	0								0
Sub Total		0	1	1	6	3	2	1	14

TABLE VIII. THE RATIO IN EACH QUADRANT (ADMINISTRATIVE STAFF)

		SR			Sub Total	
		Low (SR<5)	High (SR≥5)			
IMP	Big (IMP≥3)	II	0(0.0%)	I	8(57.1%)	8(57.1%)
	Little (IMP<3)	III	2(14.3%)	IV	4(28.6%)	6(42.9%)
	Sub Total		2(14.3%)		12(85.7%)	14(100.0%)

SR, the 2<sup>nd</sup> quadrant for "not greater than 5 points" for SR and "greater than or equal to 6 points" for PP, the 3<sup>rd</sup> quadrant for "not greater than 5" for both PP and SR, and the 4<sup>th</sup> quadrant for "not greater than 5" for PP and "greater than or equal to 6 points" for SR.

In both job types, the ratio of the 1st quadrant is the largest. The ratio of the administrative staff in the 1st quadrant was higher than that of the researchers (the researcher is 37.3%, and administrative staff is 53.3%). In Table X, 70.6% of the researchers scored high in PP and that 37.3% of them scored high for both PP and SR.

On the other hand, 29.4% of the researchers and 33.3% of the administrative staff scored relatively low (not higher than 5 points) in their PPs. Considering that researchers have more opportunities to deliver presentations than administrative staff, the difference between these rates is small (only 3.9%).

It can be inferred from the results that researchers tend to think that they are already skillful and become less committed to making better presentations as they gain experiences.

- Postcard Presentation and Self-reflection (Job Grades)

Tables XIII through XVI describe the relationship between SR and PP, which indicates the ratio of the participants in each quadrant by four job grades. Except for Grade 7, not less than half of presenters in Grades 8 through 10 reflected thoroughly (greater than or equal to 6 points in SR) on their 1st team presentation.

TABLE IX. THE RELATION BETWEEN PP AND SR (RESEARCHER)

		Score of Self-Reflection (SR)							Sub Total
		3	4	5	6	7	8	9	
Score of Postcard Presentation (PP)	9			1	2		1		4
	8		1		1				2
	7		1	4	4	1			10
	6	2	7	1	8	2			20
	5		1	3	6	1		1	12
	4	1		2					3
	3								0
	Sub Total	3	10	11	21	4	1	1	51

TABLE X. THE RATIO IN EACH QUADRANT (RESEARCHER)

		SR			Sub Total	
		Low (SR<6)	High (SR≥6)			
PP	High (PP≥6)	II	17(33.3%)	1	19(37.3%)	36(70.6%)
	Low (PP<6)	III	7(13.7%)	IV	8(15.7%)	15(29.4%)
	Sub Total		24(47.0%)		27(53.0%)	51(100.0%)

TABLE XI. THE RELATION BETWEEN PP AND SR (ADMINISTRATIVE STAFF)

		Score of Self-Reflection (SR)							Sub Total
		3	4	5	6	7	8	9	
Score of Postcard Presentation (PP)	9			1		1			2
	8				1				1
	7							1	1
	6		1		1	2	1	1	6
	5				2		1		3
	4				2				2
	3								0
	Sub Total	0	1	1	6	3	2	2	15

TABLE XII. THE RATIO IN EACH QUADRANT (ADMINISTRATIVE STAFF)

		SR			Sub Total	
		Low (SR<6)	High (SR≥6)			
PP	High (PP≥6)	II	2(13.3%)	I	8(53.3%)	10(66.6%)
	Low (PP<6)	III	0(0.0%)	IV	5(33.3%)	5(33.3%)
	Sub Total		2(13.3%)		13(86.6%)	15(99.9%)

However, the correlation coefficient between the two scores was low (Grade 7 was -0.066, Grade 8 was 0.108, Grade 9 was 0.100, Grade 10 was -0.577).

In the light of job grades, notably, 70% of the participants in Grade 7 scored low (not greater than 5 points) in their SR, while the participants in other grades got better results (Grade 8 is 32%, Grade 9 is 33%, and Grade 10 is 50%). As shown in Table X, the same tendency can be seen among the researchers' group, whose 47% scored low in SR. As can be seen from Tables XIII through XVI, the participants scored low (not greater than 5 points) in PP, Grade 7 is 30.0%, Grade 8 is 29.7%, Grade 9 is 40.0%, and Grade 10 is 0.0%.

Although the participants in Grade 7 are ranked highest in the job grade, there is no significant difference between other grades in the PP scores. Instead, the high scoring ratio in Grade 10 (100%) was greater than that of Grade 7 (70%). It is thought that the participants in Grade 7 are confident about their PPs and do not realize the necessity for elaborate self-reflection.

### C. Research question 3- Is it possible to apply the proposed method to an employee training program in industry?

The proposed method was applied to the employee training program for the research institution. The authors confirmed the potency of the method in an in-house corporate training program with some modifications to get the maximum effect. This time, the authors adapted teaching materials and contents to the institution's needs: modifying

TABLE XIII. THE RATIO BETWEEN PP & SR IN EACH QUADRANT (GRADE 7)

		SR			Sub total	
		Low (SR<6)	High (SR≥6)			
PP	High (PP≥6)	II	5(50.0%)	I	2(20.0%)	7(70.0%)
	Low (PP<6)	III	2(20.0%)	IV	1(10.0%)	3(30.0%)
	Sub total		7(70.0%)		3(30.0%)	10(100.0%)

TABLE XIV. THE RATIO BETWEEN PP & SR IN EACH QUADRANT (GRADE 8)

		SR			Sub Total	
		Low (SR<6)	High (SR≥6)			
PP	High (PP≥6)	II	9(24.3%)	I	17(46.0%)	26(70.3%)
	Low (PP<6)	III	3(8.1%)	IV	8(21.6%)	11(29.7%)
	Sub Total		12(32.4%)		25(67.6%)	37(100.0%)

TABLE XV. THE RATIO BETWEEN PP & SR IN EACH QUADRANT (GRADE 9)

		SR			Sub Total	
		Low (SR<6)	High (SR≥6)			
PP	High (PP≥6)	II	3(20.0%)	I	6(40.0%)	9(60.0%)
	Low (PP<6)	III	2(13.3%)	IV	4(26.7%)	6(40.0%)
	Sub Total		5(33.3%)		10(66.7%)	15(100.0%)

TABLE XVI. THE RATIO BETWEEN PP & SR IN EACH QUADRANT (GRADE 10)

		SR			Sub Total	
		Low (SR<6)	High (SR≥6)			
PP	High (PP≥6)	II	2(50.0%)	I	2(50.0%)	4(100.0%)
	Low (PP<6)	III	0(0.0%)	IV	0(0.0%)	0(0.0%)
	Sub Total		2(50.0%)		2(50.0%)	4(100.0%)

one-semester contents into a two-day program, and implementing a postcard presentation to comply with the research institution's needs. Besides these modifications, there are two significant adaptations the authors think necessary: to boost participants' motivation and to build a capable team to conduct the training program.

First, comparing with the students who autonomously take the Presentation Skills course to enhance their presentation skills, the employees were generally less motivated because of the required training program. Some of them seemed to think that they already have sufficient presentation skills. Since there was no extrinsic incentive, such as pay rise or promotion, they felt as if they were forced to attend the program. The institution could have given a preliminary task that might inspire the participants. Alternatively, the institution could have built an incentive scheme for attending the program.

Second, excellent teamwork between the visiting instructor and the HR personnel is the key to a successful implementation of the program. In the university Presentation Skills course, the instructor designs the curriculum, facilitates the class with the help of TAs who know well about the course, and evaluates the students by herself using a coherent rubric. In the training program, the instructor taught and facilitated the program, while the HR staff took care of the PP and the assessment of SR. Although we did not have much time to prepare, we should have discussed in detail the rubric design of the SR and the assessment of the PP before implementing the program. Thus careful preparation and close collaboration between the instructor and the HR staff are vital in maximizing the effect.

## VII. DISCUSSION

Even under challenging conditions stated in RQ3 due to insufficient coordination, the authors confirmed the potency of the proposed method at the corporate institution's employee training program by the improved scores of the participants' presentation skills. In contrast to homogeneous students in higher education, the training program participants were diverse in terms of academic backgrounds, specializations, job

types, and ages. The method effectively extends even to the heterogeneous groups and proves beneficial for both homogeneous and heterogeneous audiences. Furthermore, we found that the method applies successfully by tailoring to the needs of the industry.

On the other hand, the study also raised a question about the efficacy of self-reflection among the participants. The importance of reflection has been documented in previous works [5-8]. Harlem and Belski [21], who emphasized the significance of reflection in engineering education, argued that expert engineers differ from novice engineers in the way they see a reflection. The expert perceives reflection as a continuous process of solving problems, while the novice only reflects when they make a mistake. Thus, researchers and engineers are supposed to be more reflective as they gain experiences. Nevertheless, the results at the institution were different. To dig deep into the results, the authors focused on the composition of each job grade.

As previously mentioned, Grade 7 is the mid-level position, and some of the participants in Grade 7 are expected to play a leading role in a small-scale research group or an administration team. Grades 8 through 10 are entry-level positions. Most of the participants in these grades were hired as new graduates. They were classified into each grade, depending on their academic credentials.

According to Tables X and XII, 53% of researchers, 86.6% of the administrative staff, scored high in the SR. Furthermore, Table XIII shows that the least reflective was the participants in Grade 7, who ranked highest among the four job grades. Only 30% of Grade 7 got a high score in the SR. In this case, the depth of reflection did not link with the working experiences. The authors thought of two possible reasons for the results.

First, personnel relocation, which is a common practice in Japanese firms, occurs periodically even in the institutions. Even researchers need to change their research topics in line with the displacement. In a sense, their career as a researcher will be interrupted by the displacement, and they are deprived of opportunities to reflect on their work to become a real expert in one specialized field as in the USA and Europe. In the morning lecture, we learned about the Heilmeyer's questions [18] commonly used to review and reflect on research projects in the USA. The questions, however, seemed to be new to most of the researchers. As a next step, we need to find out how they review and reflect on their projects.

Second, there is a custom to educate new employees thoroughly in the workplace in Japan. In the institution, young employees with a short career receive training and guidance from their superiors, which leads to self-reflection. However, as they build their careers, they lose occasions for training and guidance. Furthermore, since the employees seldom give and receive constructive criticism from their peers in daily work, they tend to lose opportunities to look at themselves objectively. For example, on the second day of the training program, the authors asked if the participants have someone, other than supervisors, to peer review their research paper or reports. More than 50% of them answered that they do not have someone who could review and give feedback on their work. The authors suppose that they are not provided with opportunities to be reflective as a professional.

A reflective activity is not an easy task to do it alone. Employees need support and advice from their peers and

superiors to look at themselves. Thus, the training program offered participants a great chance to be evaluated by and evaluate others, and reflect on themselves by referring to the feedback from others. Also, we think that experiences and memories with their peers would be even more remembered and engraved in each participant's mind. This hypothesis comes from an observation of the improvement in the team presentations and the subsequent solo postcard presentation.

For example, as shown in Tables VI and X, 72.2% of the researchers made significant improvements (IMP) in the team presentations, and 70.6% of them got high scores in the PP held two months later. A weak correlation between IMP and PP was found in the researchers ( $r=0.346$ ,  $N=50$ ,  $r>|0.278|$ ). It can be thought that the researchers realized the crucial role of physical messages in the team presentations and used them in their solo postcard presentations despite the time lag and the different types of presentations. The previous presentation experiences might have long been remembered in their minds.

## VIII. CONCLUSION

Communication skills are one of the crucial elements in becoming a competent professional in the modern world, which is recognized by both academia and industry. To comply with their demands, the authors have investigated the efficacy of the presentation education method utilizing peer assessment and video self-reflection. By the method, we were able to confirm the progress of the employees' presentation skills at the institution with a diverse population. From the results, we conclude that the method can be applied to higher education as well as industry with modifications.

To get the most out of the method when applied in industry, special considerations for the participants' motivations and careful preparation before the implementation are essential. Through this study, we found that the depth of self-reflection does not necessarily relate to the presentation performances. In contrast to what we observed from the homogenous students at higher education [16-17], it was challenging to find a relationship between the reflective activities and the presentation performances at the institution. This finding may be attributable to the diverse employees who differ in backgrounds, motivations, previous experiences in presentations, and reflective activities, which needs to be further studied in future work. At the same time, we should devise a procedure that may promote employees' self-reflection.

Although this study is a starting point for the application in industry, nearly 70% of the participants benefited from the method and improved their presentations. These results verify the potency of the method in industry. In the future, the authors intend to explore how to inspire employees to enhance their presentation skills further and engage in reflective activities, which lead to their self-improvement and the development of the organization itself.

## ACKNOWLEDGMENT

The authors are grateful to Toyota Central R&D Labs., Inc. and Research Center for Computing and Multimedia Studies of Hosei University for the valuable contribution. Also, we appreciate Mr. Soichiro Fujii, who was the major developer of PEAS. The authors affiliated to Hosei University are funded by Toyota Central R&D Labs., Inc.

## REFERENCES

- [1] 2018-2019 Criteria for Accrediting Engineering Programs, Engineering Accreditation Commission, ABET, Baltimore, MD, USA.
- [2] 2010-2011 A Survey on sectoral attainment goals in engineering education commissioned by Ministry of Education, Culture, Sports, Science and Technology (MEXT), Chiba University, Tokyo, Japan, 2012.
- [3] J. Requena-Carrión, F. Alonso-Atienza, A. Guerrero-Curieses, and A. B. Rodriguez-González, "A student-centered collaborative learning for developing communication skills in engineering education," IEEE EDUCON Education Engineering 2010-The Future of Global Learning Engineering Education, Madrid, SPAIN, 2010, pp.783-786.
- [4] M. J. Riemer, "Communication skills for the 21st century engineer," Global J. of Engng. Educ., vol. 11, no. 1, Australia, 2007, pp.89-100.
- [5] J. Dewey, How we think, New York, D.C. Heath & Co., Publishers, 1910.
- [6] D.A.Schön, The Reflective Practitioner: How Professionals Think in Action, New York: Basic Books, 1983.
- [7] L.Mortari, "Reflectivity in research practice: an overview of different perspective," International Journal of Qualitative Method, 2015:1-9.
- [8] R.Pausch, The Last Lecture, New York: Hyperion, 2008.
- [9] V. Todd, and J.C. Hudson, "Using graded peer evaluation to improve students' writing skills, critical thinking ability, and a comprehension of material in a principle of public relations course," Journal of College Teaching and Learning, vol.4 no.10, Colorado, October 2007, pp.39-46.
- [10] C.M.Wigal, "The use of peer evaluations to measure student performance and critical thinking ability," 37th ASEE/IEEE Frontiers in Education Conference, Milwaukee, WI, 2007, S3B-7-S3B-12.
- [11] S.Trahasch, "From peer assessment towards collaborative learning," Proc. 34th ASEE/IEEE Frontiers in Education Conference, vol.1, Savannah, GA, 2004, F3F-16-20.
- [12] M.Dziedzic, P.R. Janissek, and A.P. Bender, "Assessment by peers – an effective learning technique," Proc. 38th ASEE/IEEE Frontiers in Education Conference, Saratoga Springs, NY, 2008, T2F-1-T2F-5.
- [13] F. Dochy, M. Segers and D. Sluijsmans, "The use of self-, peer and co assessment in higher education: A review," Studies in Higher Education, vol.24, issue 3, 1999, pp.331-350.
- [14] S. Cassidy, "Developing employability skills: peer assessment in higher education," Education and Training, vol.48, no.7, 2006, pp.508-517.
- [15] A. Danielewicz-Betz and T. Kawaguchi, "Preparing engineering students for global workplace communication: changing the Japanese mindsets," International Journal of Engineering Pedagogy, vol. 4, no. 1, 2014, pp. 55-68.
- [16] J. Toyoshima, S. Fujii, and Y. Tokiwa, "Development of a mobile-friendly classroom support system to improve students' presentation skills," Frontiers in Education (FIE), 2016 IEEE, Erie, PA, USA. DOI:9/FIE.2016.7757542
- [17] J. Toyoshima, S. Fujii, and Y. Tokiwa, "Major upgrade of the presentation education assistance system (PEAS) and its extensive application to educational fields," Frontiers in Education (FIE), 2018 IEEE, San Jose, CA, USA, DOI:10.1109/FIE.2018.8658645
- [18] G.H.Heilmeier, "The Heilmeier Catechism" [Online], Available: <https://www.darpa.mil/work-with-us/heilmeier-catechism>
- [19] D. Harrington and C. LeBeau, Speaking of Speech, new ed., Tokyo, MacMillan Language House, 2009.
- [20] H.D.Brown, Language Assessment: Principles and Classroom Practices, New York, Pearson Education, Inc., 2004.
- [21] J.Harlem and I.Belski, "Educating a reflective engineer: learning from engineering experts," Proceedings of the 24<sup>th</sup> Annual Conference of the AAEE2013, Queensland, Australia, 2013, PP4CT,1-9.