

Major Upgrade of the Presentation Education Assistance System (PEAS) and its Extensive Application to Educational Fields

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Abstract—This Innovative Practice Category Work-In-Progress Paper presents modifications of the existing Presentation Education Assistance System (PEAS) in order to expand application domain from STEM to STEAM based educational fields. In the previous study, the efficacy of the existing PEAS in assessing students' individual presentation skills was presented. In this study, the feasibility of evaluating students' critical thinking skills and group activities by the upgraded PEAS was examined. The study also aimed to confirm usefulness and acceptability of the upgraded PEAS in various academic disciplines including engineering and liberal arts. The results showed that the use of the upgraded PEAS enabled master's STEM students to improve their critical thinking skills. Also, the upgraded PEAS became capable of evaluating group presentations as well as individual speech in the group activity of liberal art students. Furthermore, the upgraded PEAS realized active classroom interaction by integrating with Learning Management System (LMS) using IMS LTI (Learning Tools Interoperability). From these results, effectiveness and acceptability of the upgraded PEAS for both individuals and student's groups in not only STEM but also STEAM based educational field were confirmed.

Keywords—*STEAM; Critical Thinking; Presentation Skills; Teamwork; Peer Evaluation; Smartphone; LTI*

I. INTRODUCTION

Modern professionals such as scientists, technologists, engineers, designers and so forth are required of not only professional expertise but also various skills to be successful in the global world. As declared in the "Criteria for Accrediting Engineering Programs" [1], communication skills development is one of the major goals of engineering education. In accordance with the ABET's criteria, Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) also designates the skills as a vital learning outcome of engineering education [2].

Communication skills generally refer to the abilities to convey information, ideas, and feelings effectively to others in verbal (oral and written) and non-verbal forms. In addition, the skills sometimes include abilities such as reflection, critical thinking, and teamwork [3]. Team skill is vital for engineers because many projects in the engineering fields are carried out in a group. In fact, graduates of 11 engineering majors rated

teamwork and communication as part of the top cluster of competence in pursuing professional practice [4]. In group work such as a project-based learning (PBL) activity, students can learn how to work with others towards a common academic goal and train their teamwork skills [5].

On the other hand, peer assessment is an innovative approach which gives students opportunities for learning and evaluation [6]. Moreover, it is a very important technique to engage students in active learning and to enhance their self-reflection [7-9]. Furthermore, it can be a positive learning experience for students to develop their higher-order thinking skills such as critical thinking skills [10]. Various systems supporting peer review activities are used in a broad range of disciplines [11]. These systems, however, are mostly for massive courses and they usually see peer assessment as a way to reduce instructors' workload. Here we propose our new system, upgraded PEAS (abbreviated as UPG PEAS in the following passage), to enhance the quality of students' active learning through peer evaluation as well as to facilitate instructors' course management by way of smartphones cooperating with LTI.

In our previous study [12], the enhancement of students' oral presentation skills, physical messages, and interaction, in particular, was shown. This study examines the effectiveness of the UPG PEAS in evaluating group activities in order to develop students' verbal, team, and critical thinking skills. Considering the growing recognition of the importance of integrating arts and science in education [13], the study also aimed to confirm efficacy and acceptability of the UPG PEAS in STEAM (Science, Technology, Engineering, Arts and Mathematics) based educational fields such as Technical Writing (TW) and College English (CE) courses. In TW course, the enhancement of students' verbal and critical thinking skills through article reviews was examined. In reviewing articles, students thought of how to explain their chosen articles logically and more comprehensible for the audience. They made oral presentations about their reviews and the audience gave feedback to the presenters using the UPG PEAS. In CE course, the students reviewed their assigned literary works in group and made group presentations. Through this group project, students learned teamwork, critical thinking, and oral skills. Their performances were peer-reviewed by the UPG PEAS.

II. COURSE DESCRIPTION

A. Technical Writing(TW)

TW is an elective course primarily for master's students of Graduate School of Engineering and Design at Hosei University. The aim of this course is to improve students' verbal English communication skill which is indispensable in thriving in the global engineering community [14]. The fifteen-week course consists of lectures, writing exercises, discussions, and presentations. In the course, the students learn skills in writing documents such as emails, CVs, memos as well as academic papers in English. At the end of the term, students are assigned to write an English abstract of their own research. Before writing their own abstracts, students read English articles related to their specializations, review the content and make presentations about the chosen article. The objective of these assignments is to familiarize students with academic writings in their fields and to train their critical thinking skills, such as analysis and evaluation, in accordance with Bloom's taxonomy. In reviewing the articles, the students contemplated on the following six guiding questions by Swales and Feak (2004) [15]: 1. Who is the audience of the journal? 2. What research question(s) is (are) being made? 3. What conclusions does the author draw from the research? 4. What kind of evidence is offered in support of the conclusions? 5. Are the author's conclusions valid? Why? 6. Does the research make an original contribution to the field? Why?

Their presentations will be videotaped and peer-reviewed using the UPG PEAS. After the 1st presentation, the students will check their videotapes and reflect on their performance in reference to the peer evaluation results by the students and the instructor. In the following week, they will deliver the improved version of their presentations.

B. College English (CE) Reading and Writing

CE Reading and Writing is a required course for freshmen and sophomores at Seikei University. The aim of this course is to develop student's reading and writing skills in English. The fifteen-week course consists of lectures, communicative activities, exercise (reading and writing), discussions, oral presentations, and examinations. At the end of the term, students will engage in a group project which is to review English literary works and present their analysis. First of all, students learn the organization of a story through lectures. Then, they will analyze the assigned book in a group according to the review criteria. After that, each group makes a presentation about their assigned book. The objective of this assignment is to familiarize students with English literary works and to train their oral and teamwork skills through the group project. Their presentations will be peer-reviewed based on ten criteria using UPG PEAS. After the presentation, the presenters will reflect on their performance in reference to the peer evaluation results.

III. MATERIALS AND METHOD

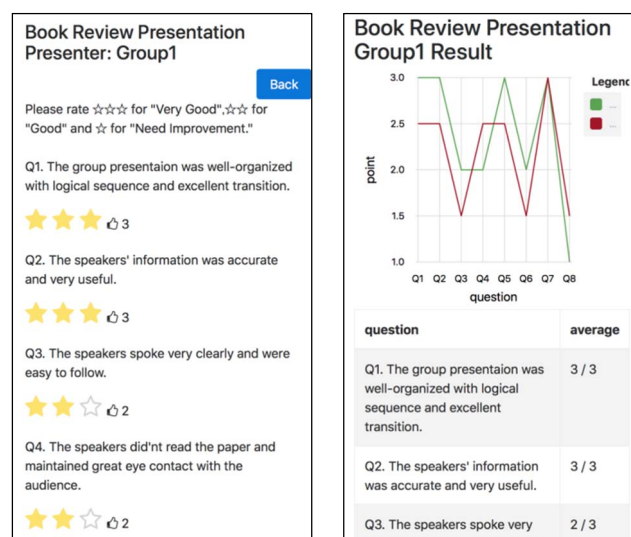
As for the materials, the UPG PEAS was developed to support multiple-point rating scales and group evaluation. In

addition, administrative work such as user and course registration was eliminated by conforming to IMS LTI, one of the global standards that integrates learning tools with LMS. The UPG PEAS coordinates with LMS by way of IMS LTI. An instructor and students can launch the UPG PEAS by clicking an item in the subject menu of the LMS. Then, the UPG PEAS obtains information from LMS. As a result, the workload of an instructor was much reduced. At the beginning of the term, the instructor needs to set parameters for UPG PEAS such as URL, key, secret in the contents of LMS when using the UPG PEAS. Table 1 shows a feature comparison between the 1st generation PEAS and the UPG PEAS. Figure 1 (a) and (b) are screenshots of student's smartphone while evaluating a group presentation by the UPG PEAS. The red line shows the average score of the whole groups and the green line shows the score of each group.

On the other hand, the methods used to examine TW course were solo presentations and peer evaluation which could promote the improvement of students' communication and critical thinking skills. In CE Reading and Writing course, group presentations and peer evaluation were applied to enhance students' communication and team skills.

Table 1. Feature Comparison for the PEASs

	The 1 st generation PEAS	the UPG PEAS
Numerical Rating Scale	Dichotomous Scale	Multiple Point Scales
Intended Evaluatee	Only individuals	Individuals and groups
Access Permission to the Results	The individual presenter only	Individual presenter and all presenters in the group
User and course registration	Manually	Obtained from LMS by IMS LTI
Requisite for question	To assess solo presentations	To assess solo and group presentations



(a) Review page

(b) Results page

Figure 1. Screenshots of Student's Smartphone

IV. PRESENT STUDIES

In conducting the study, four research questions were posed: 1. Does the UPG PEAS promote master's STEM students' critical thinking skills in reviewing journal articles? 2. Is it possible to use the UPG PEAS in analyzing a group activity? 3. Does the UPG PEAS facilitate instructor's classroom management in liberal arts class as well? 4. Is it possible to use the LTI compliant UPG PEAS in other institutions by integrating with various LMSs?

A. Study 1- Technical Writing (TW)

The present study was administered between April 2017 and July 2017 in the Graduate School of Engineering and Design at Hosei University. Six master's course engineering students participated in the experiment. Two ten-minute experimental presentation sessions utilizing the UPG PEAS were carried out. After these sessions, the students wrote their self-reflection reports in reference to the peer evaluation results by the UPG PEAS.

In making the presentation, the speaker needs to consider the following peer evaluation criteria shown in Table 2. The criteria consist of two two-point scale questions (Q1, Q2) and seven three-point scale questions (Q3-Q9). Students rate their presentations as follows: Q1 and Q2 ☆☆☆ for "yes," ☆ for "no," Q3 through Q9, ☆☆☆ for "very good," ☆☆☆ for "good," ☆ for "need improvement." Besides the nine numerical scale questions, there is another question asking students to write their comments to the presenter about the presentation.

Table 2. Peer Evaluation criteria for the Article Review

Question	Scale
Q1. Did the speaker refer to the title, author's name and the name of the journal article?	☆☆
Q2. Did the speaker mention who are the readers of the journal article?	☆☆
Q3 Did the speaker clearly state the purpose and significance of the journal article?	☆☆☆
Q4. Did the speaker clarify the research questions thoroughly?	☆☆☆
Q5. Did the speaker give full explanation on how the experiment was conducted?	☆☆☆
Q6. Did the speaker clearly state the result of the study?	☆☆☆
Q7. Did the speaker provide relevant explanation on how the author drew conclusion from the findings?	☆☆☆
Q8. Was the speaker's review of the study valid and quite convincing?	☆☆☆
Q9. Was the speaker's assessment about the article's contribution to the research field fair and valid?	☆☆☆

B. Study 2- College English (CE) Reading and Writing

The present study was administered between September 2017 and January 2018 to the liberal arts students of Seiki University. Twenty-four freshmen divided into six groups participated in the experiment. Each group reviewed their assigned books in terms of general information, plot, character, settings and added their critical commentary. The assigned books include literary masterpieces such as "The Old

Man and the Sea", "Christmas Carol", "Romeo and Juliet", "The Phantom of Opera", "The Great Gatsby" and "Forrest Gump." After the instructor's lecture and four group work sessions, each group made a 12-minute book review presentation utilizing the UPG PEAS. In the presentation, each member took a turn and explained their assigned parts. The students wrote their self-reflection reports after their presentations in reference to the peer evaluation results of the UPG PEAS.

The peer evaluation criteria for the presentation shown in Table 3 consists of three-point scale questions (Q1-8) and written questions (Q9-14). Students provide their feedback to each speaker about his/her solo speech (Q9-12). In addition, the last two questions (Q13-14) ask students to comment on the strength and the challenge of the group. For Q1 through 8, the students rated ☆☆☆ for "very good," ☆☆☆ for "good," ☆ for "need improvement." Whereas, Table 4 was used for the

Table 3. Peer Evaluation criteria for the Book Review Presentation

Question	Scale	Target
Q1. Was the group presentation well-organized with logical sequence and excellent transitions?	☆☆☆	Group
Q2. Was the group presentation accurate with very useful information on the subject? ,	☆☆☆	Group
Q3 Did the speakers articulate clearly and were easy to follow?	☆☆☆	Group
Q4. Did the speakers maintain great eye contact with the audience?	☆☆☆	Group
Q5. Was the group well-rehearsed and did it manage their time effectively?	☆☆☆	Group
Q6. Did the group use great visuals effectively?	☆☆☆	Group
Q7. Did the speakers make great contribution to the group presentation?	☆☆☆	Group
Q8. How do you rate overall group presentation?	☆☆☆	Group
Q9-12. Please write your comment to Student 1 - 4	Written answer	Solo
Q13. The strength of the group presentation was...	Written answer	Group
Q14. The challenge of the group presentation was....	Written answer	Group

Table 4. An example of Peer Evaluation for the Group Work

Evaluate your group members in terms of the following criteria. 3- Excellent 2- Good 1- Fair	Std1	Std2	Std3	Std4
Seriously engaged in the task and knew what needed to be done.	3	2	2	2
Participated in group meetings with needed materials and was ready to work.	3	3	3	1
Always listened to others' point of view and showed respect.	3	2	2	2
Had good knowledge about one's assignment and role.	3	2	2	2
Always shared his/her idea with other members and contributed to the project.	3	3	2	2
Total Score	15/15	12/15	11/15	9/15

assessment of teamwork skills. As a trial step, we used the UPG PEAS only for assessing the presentation. The evaluation of group presentation, as well as solo speech, became possible by using the UPG PEAS. In this study, however, the numerical evaluation was adopted only for assessing the group performance so as not to overwhelm students with too many rating items. In this experiment, we adopted the onymous style in the peer evaluation. Thus, the presenter can see reviewers' names on the PEAS display. The book review project was graded by the presentation and teamwork skills.

V. PRELIMINARY RESULTS

A. Results of Research Question 1

The line chart in Figure 2 shows the average scores (Q1-Q9) of the two article review presentations. The blue bar stands for the 1st and the red bar indicates the 2nd presentation. The improved average scores of the 2nd presentation show that the quality of the students' analyses and commentary of their chosen articles became better by reflecting upon their 1st presentations. The suggestions given by their peers and the instructor seemed to help the presenters reexamine their chosen articles and present their ideas in a more persuasive way.

B. Results of Research Question 2

The 1st generation PEAS has been used only for evaluating individual presentations. As shown in Table 3, the UPG PEAS realized the evaluation of group presentations as well as each group member's speech. In addition, the UPG PEAS was mostly welcomed even by the liberal art students, especially for its utility and promptness. Table 5 shows the number of students' feedback against the UPG PEAS.

Twenty four students wrote their comments on the UPG PEAS in the final reflection (multiple answers were allowed). Out of the 30 feedbacks, 12 were related to its usability and 18 were about motivational effects. Typical answers regarding PEAS's usability were as follows: "PEAS was faster and easier than handwriting.", "With PEAS, I could understand how our group presentation was seen through objective eyes.",

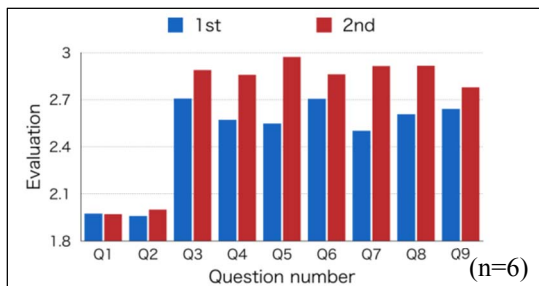


Figure 2. Average scores of the 1st and 2nd Article Review

Table 5. Number of Students' Feedback about the UPG PEAS

	Favor	Disfavor
Motivational Effect	13	5
Usability	11	1

(n=24)

"I could instantaneously identify our strength and weakness by the PEAS' graph.", "I had to answer the question quickly because there was a time limit."

On the other hand, comments about motivational effects were as follows: "Using PEAS, I could see how audience evaluated our group presentation as well as my solo speech, and that inspired me a lot.", "I noticed from the comments that I have good pronunciation and amiable face. Now I feel more confident about making presentations.", "In evaluating other groups with PEAS, I had to be very attentive and engaged in the presentation.", "I like anonymous feedback. I can be more direct and honest." Negative feedbacks related to motivational factors are mostly about the inconvenience of signed comments.

C. Results of Research Question 3

Although peer evaluation in group presentations has been applied to the CE Reading and Writing course since 2015, the instructor was unable to disclose peer evaluation results due to the time-consuming handling procedure of paper-based forms. The introduction of the UPG PEAS significantly reduced the instructor's workloads and enabled the instructor to try new things. For example, the winning group of the book review presentation was awarded on the spot. Without the instantaneous calculation of the UPG PEAS, this kind of active interaction was not feasible. The UPG PEAS not only motivated students but also inspired the instructor to explore new ways of teaching.

D. Results of Research Question 4

The UPG PEAS works with three major LMSs such as Moodle, Sakai, and Canvas by way of an LTI connection. The efficacy of the LTI compliant UPG PEAS in another institution was confirmed by the experiment conducted at the CE Reading and Writing class at Seikei University.

VI. CONCLUSION

Communication skill is recognized as an essential ability for becoming a competent professional in the modern world. To comply with the demands of academia and industry, the efficacy of UPG PEAS in developing student's critical thinking skill and communication skills has been investigated.

From the research, the effectiveness of UPG PEAS in enhancing master's engineering students' critical thinking skills in reviewing journal articles has been shown. In addition, the UPG PEAS became capable of evaluating group presentations as well as individual speech in the book review group project. Moreover, the timeliness of UPG PEAS facilitated classroom management and promoted active interaction. This inspired the instructor to explore the new method of teaching. Furthermore, the UPG PEAS was favored even by the liberal arts students. From these results, the effectiveness and acceptability of the UPG PEAS for both individuals and student's groups in various educational disciplines have been confirmed. In other words, flexible and versatile application of UPG PEAS in STEAM based educational fields was shown. For further study, the effectiveness of UPG PEAS in evaluating a PBL activity in engineering fields will be tested.

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