

PEAR: Peer Evaluation & Assessment Resource

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Abstract

Effective teamwork is an important aspect of value creation in many organizations; appropriately, organizations are looking for potential employees who can work well in a team from the start. This has created the need to introduce activities to build collaboration and teamwork skills in many college curricula. Peer evaluation is one of the best ways to assess the group dynamics of a team project. However, there are a few tools available for facilitating peer evaluations and efficiently compiling meaningful information designed to assess one team member compared to the team as a whole. In this paper, we introduce the Peer Evaluation & Assessment Resource (PEAR), which is a web-based solution that was created to efficiently assess the teamwork skills of students through peer and self-evaluations. The PEAR application allows instructors to form teams from their student rosters and choose a rubric to assess their teamwork skills, abilities, and contributions. In addition to the rubrics built into the PEAR system, instructors can also create custom rubrics based on the Model of Domain Learning (MDL) to better suit their specific courses. Students can then use the web interface to evaluate both themselves and fellow team members. After students complete their evaluations, instructors are able to view the results through the system's reports and can formulate an individual grade for each student. More importantly, instructors also have the ability to send the students feedback and automatically include anonymous reviews from other team members. The reports show the instructor where the students' skills may be lacking. The preliminary results from a pilot study are discussed.

I. Introduction

In engineering and information technology programs, teamwork has become ubiquitous in response to the growing requirement for graduates to acquire teamwork skills and abilities during their undergraduate education. Increased amount of teamwork in technical programs has also raised the concern of whether individual students are achieving the expected technical and professional learning outcomes from teamwork. Peer evaluations are frequently used to evaluate the individual team members' contributions to the collective outcome of the team. Peer evaluations can positively impact student attitudes toward teamwork by allowing them to have partial control on their individual grade and providing them an outlet to express their dissatisfaction.⁹ Peer evaluations tend to reduce social loafing^{14,8}, which has a negative impact on team performance. In addition, because peer evaluation practice is an important element of 360-degree performance evaluations used by many organizations to evaluate job performance and provide feedback for continuous professional development, it is important to introduce students to peer evaluations.

Conducting paper-and-pencil peer evaluations is a labor-intensive process. The number of peer ratings can easily reach to levels that make paper-and-pencil peer evaluations impossible to implement in large classrooms. Although providing timely feedback to students is important to fully observe the benefits of peer evaluations, it is a time consuming process to generate meaningful feedback from paper-and-pencil peer evaluations. In addition, confidentiality is another concern for paper-and-pencil peer evaluations completed in the classroom. To address to the drawbacks of paper-and-pencil peer evaluations, we proposed a prototype web-based tool called Peer Evaluation and Assessment Resource (PEAR).⁷ Currently, PEAR is fully functional and has been beta-tested in several courses. In this paper, we present the beta-version of PEAR and introduce our preliminary results of a comparison of peer and self-evaluations conducted using PEAR.

In self-assessment, Boud and Falchikov² report that students with a higher overall grade give themselves a lower rating than their instructor would, while those with a lower overall grade would give themselves a higher rating. The exception to this is that when students know their grade is dependent on their rating, all students will give themselves higher grades. Friendships and peer pressure are also among concerns because they can cause students to give higher ratings to their team mates than what they would have given to a random student.

The primary advantages of peer evaluations to determine a portion of the grade are the reduction of social loafing and increase in students' productivity.^{14,4} These evaluations can also be used to find problems in teams and find ways to improve the team.^{5,11} These advantages help to show the overall objective of helping to increase students' knowledge, skills, and abilities to work in a group or team on a common project.

There is also evidence in the literature that self and peer evaluations are instrumental for undergraduate students to develop their teamwork and other professional skills.^{3,13} Boyd and Cowan⁹ report that self-assessment is an effective way for students to develop deep processing strategies despite the difficulties of using it. This is important because we want students to work well together now and eventually in the business setting; this is also what many companies and organizations are looking for when they hire our graduates.

II. Peer Evaluation and Assessment Resource (PEAR)

PEAR was developed as part of a National Science Foundation (NSF) sponsored project. The objective is to design and implement an assessment framework for measuring and evaluating students' development in different professional skills. This objective is unique compared to the objectives of the existing peer evaluation software tools^{6,10} that are used to assess the individual contribution of each team member into team's collaborative output, which eventually aids to determine students' individual grade. In addition, PEAR aims to facilitate the assessment of students' teamwork knowledge, skills, and ability (KSA) development throughout their educational progress. The assessment items included in PEAR intend to measure the attitude, behavior, knowledge, or strategic abilities of students as perceived by their peers. According to the Model of Domain Learning (MDL), a learner becomes an expert in a domain by going through three progressive and incremental experience-based stages, i.e., acclimation, competency and proficiency¹. The MDL posits that the nature of domain knowledge, strategic processing abilities, interests, as well as their interactions, are different across the acclimation, competency, and proficiency stages. Within PEAR, evaluation items are categorized as knowledge, strategic processing, and interest, and are mapped against the MDL stages.

III. Description of PEAR System

In this section, we explain the peer assessment process within PEAR.

Instructor Dashboard

The PEAR instructor dashboard (Figure 1) is the starting point that an instructor will work from. The dashboard has three main sections: Instructor Assessments, Peer Evaluation Rubrics, and Self Evaluation Rubrics. Each section allows the instructor to create, modify, or delete the items in the respective section. By clicking the "gear" icon, the dashboard gives the instructor access to other functionalities including access to results and statistics of assessments and the ability to send students emails documenting feedback on their assessments. The dashboard also shows assessment completion status (i.e., how many students have completed a specific assessment) by filling the bar under "Completion" and turning it green (see Figure 1) when all students have completed that assessment.

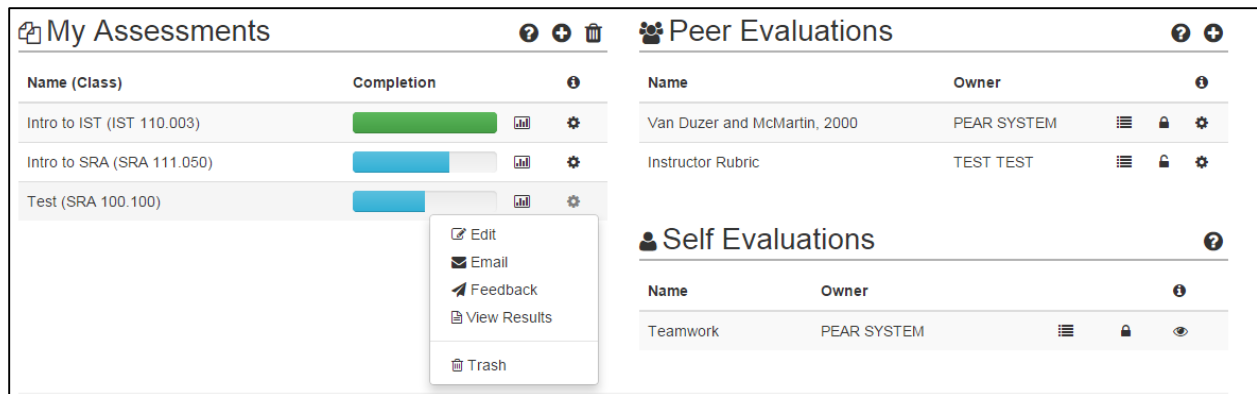


Figure 1. Instructor Dashboard

Creating a rubric

PEAR includes several peer evaluation rubrics from the literature. PEAR also allows instructors to create a custom rubric to better suit their course. Figure 2 illustrates the process of rubric creation in PEAR. An instructor starts by opening the tool from his/her dashboard screen. Once the tool is open, the instructor first enters a rubric name and description. Then, the instructor picks the professional skill area that the rubric will include (Figure 2-(a)). The number of questions in each rubric is given to avoid creating extremely long rubrics. Next, the instructor can pick the specific questions that they want to include in their rubric (Figure 2-(b)). PEAR includes a large set of questions that are mapped against the MDL-based assessment framework. Lastly, the instructor can review the rubric and create it if there are no problems (Figure-(c)).

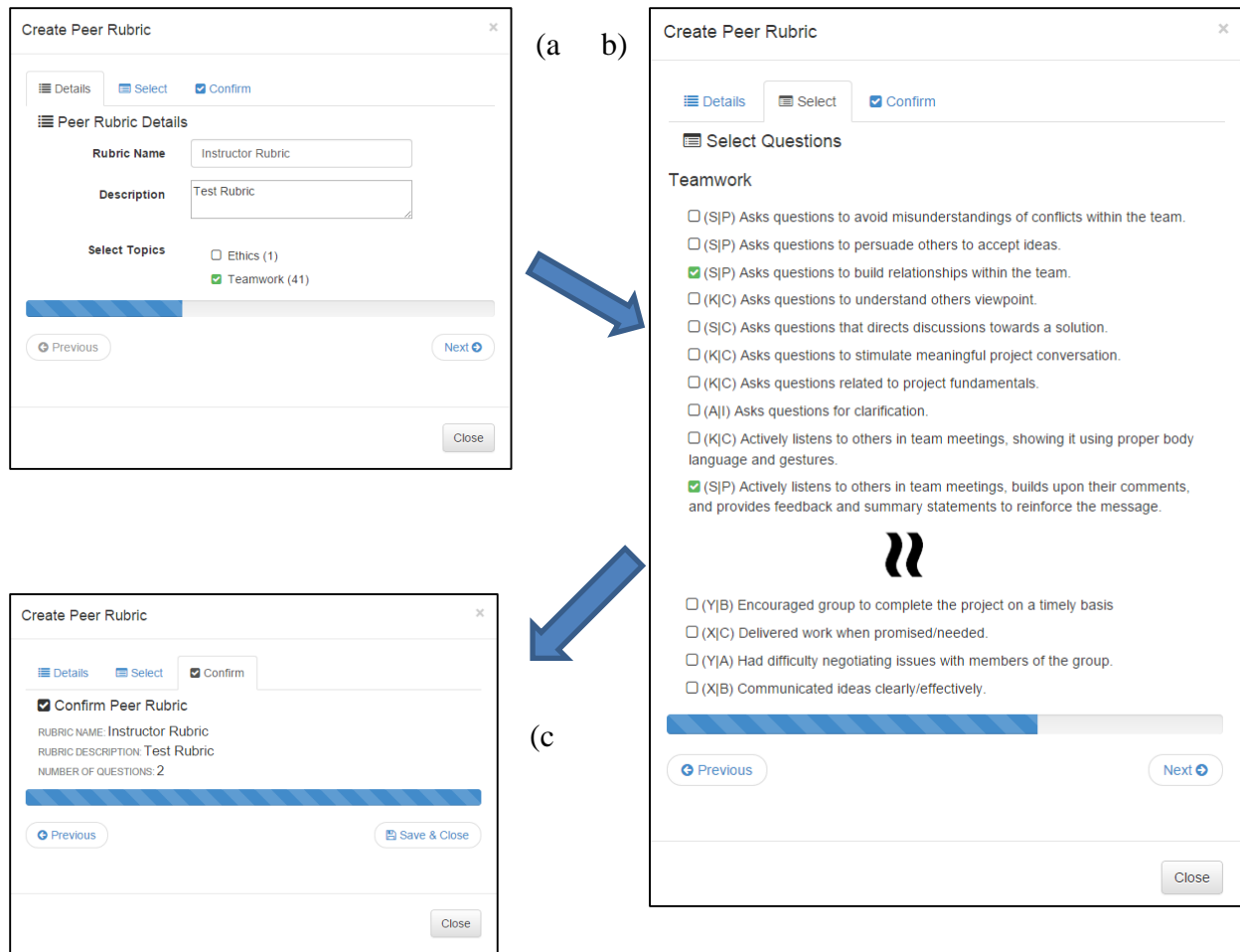


Figure 2. Process of using PEAR's tool to create a rubric

Creating an assessment

In PEAR, an assessment connects a rubric to a course. To create an assessment, an instructor first enters course information such as course title, number, section, semester, and year as shown Figure 3-(a). Next the instructor is able to pick a peer evaluation rubric and a self-evaluation rubric (Figure-(b)). Both the built-in rubrics and the ones created by the instructor will be available for use. After selecting the desired rubrics, the instructor will enter the student and team information for their course (Figure-(c)). PEAR allows copying from the instructor's class roster to simplify the process of entering their student's information. Lastly, the instructor can review the entered students' information to assure that there are no mistakes (Figure-(d)). If a student's information is not correct, the row can be removed and the instructor can go back and fix the incorrect information.

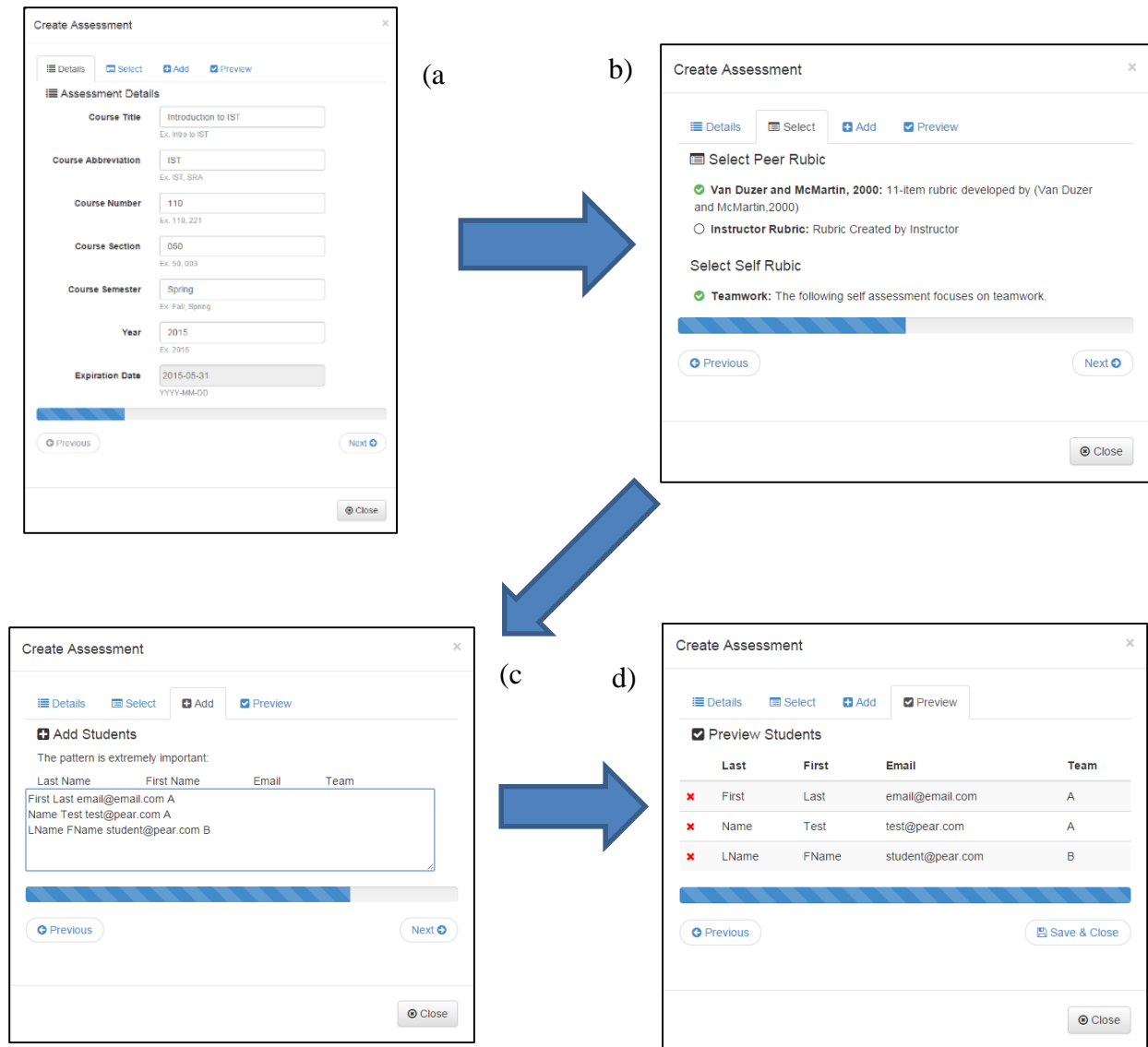


Figure 3. Process of using PEAR’s tool to create an assessment

Assessment Email

The assessment email tool allows instructors to send a custom message to their students for each assessment (Figure 4-(a)). Included in the email is a link the students can use to access the web form to complete the assessment. Instructors have the ability to send email to the entire class, specific groups, or specific students. A sample email that a student would receive is shown in Figure 4-(b).

a)

Send Email (SRA 111.050)

Recipient Group (Select One):
Entire Roster Uncompleted Students **Select Teams** Select Students

Specify Team: Tea Selected Teams: Team: 1 ✖

Team: 1
Team: 2

FILE EDIT Insert View Format Table Tools

Please use the following link to complete your assessment for SRA 111.050

All course related information will be included in the email.

Note: Emails will start sending in background.

Close Send Email

b)

PEAR

Dear Steven Magluilo:

Please use the following link to complete your assessment for SRA 111.050

<http://ist.bk.psu.edu/pear/score.php?data=QXNzZXNzbWVudEIEPTEvNCZTdHVkZW50SUQ9Mjg%3D>

Your receiving this email on behalf of your enrollment in SRA 111
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Figure 4. The PEAR tool to send an email with example student email

Completing an Assessment

Once a student receives the email sent by the instructor, they can follow the link to complete the assessment. When the student opens the emailed link, they are brought to the assessment page shown in Figure 5. The assessment rubric includes three parts: the self-assessment survey (Figure 5-(a)), peer assessment survey (Figure 5-(b)), and comments section (Figure-(c)). The self- assessment survey allows the student to evaluate their own performance and gives the instructors the ability to see how each student can improve. The self-assessment survey mainly intends to measure student interest and self-efficacy. The peer assessment survey allows students to rate their teammates' performance and allows both the instructor and the student to see how their performance was and what they could do better. Similar to the peer assessment survey, the comments section allows for students to give customized messages about each of their teammates. For both of the surveys, the student can give a score from 0 – 100 for each question by moving the slider along the bar to correspond with the labels above the slider.

a) Welcome Steven Maglulio,

Self Assessment

1. How seriously will you take this assessment?
Not at all Somewhat Very

2. For your intended professional career, how important is it to have teamwork knowledge, skills, and abilities?
Not at all Somewhat Very

⋮

b) **Peer Assessment**

1. Failed to do an equal share of the work.
Strong Disagree Disagree Neutral Agree Strongly Agree

Steven Maglulio (me) Steven Mags

2. Kept an open mind was willing to consider other's ideas
Strong Disagree Disagree Neutral Agree Strongly Agree

Steven Maglulio (me) Steven Mags

⋮

c) **Comment on your Team Members**

Steven Mags

Submit

Figure 5. A sample student web form to complete the assessment survey

Reviewing the results

From the dashboard instructors can see the results of each assessment as long as at least one student has completed the assessment. As shown in Figure 6, the results page is broken up into six sections; the self-student summary (a), peer student summary (b), self-assessment summary (c), peer question summary (d), peer student score breakdown (e), and the comments section (f). For the first four sections (a-d), the average, minimum, and maximum score for each rubric item are shown. The fifth section allows instructors to see how each student was rated by others compared to the score the student gave themselves. This is done by letting the instructor pick an individual student and then showing the average score given by that student's teammates and the score they gave themselves. The instructor is also able to see the comments associated to each student. Lastly, the instructor has the ability to download the assessment results to a Microsoft Excel file.

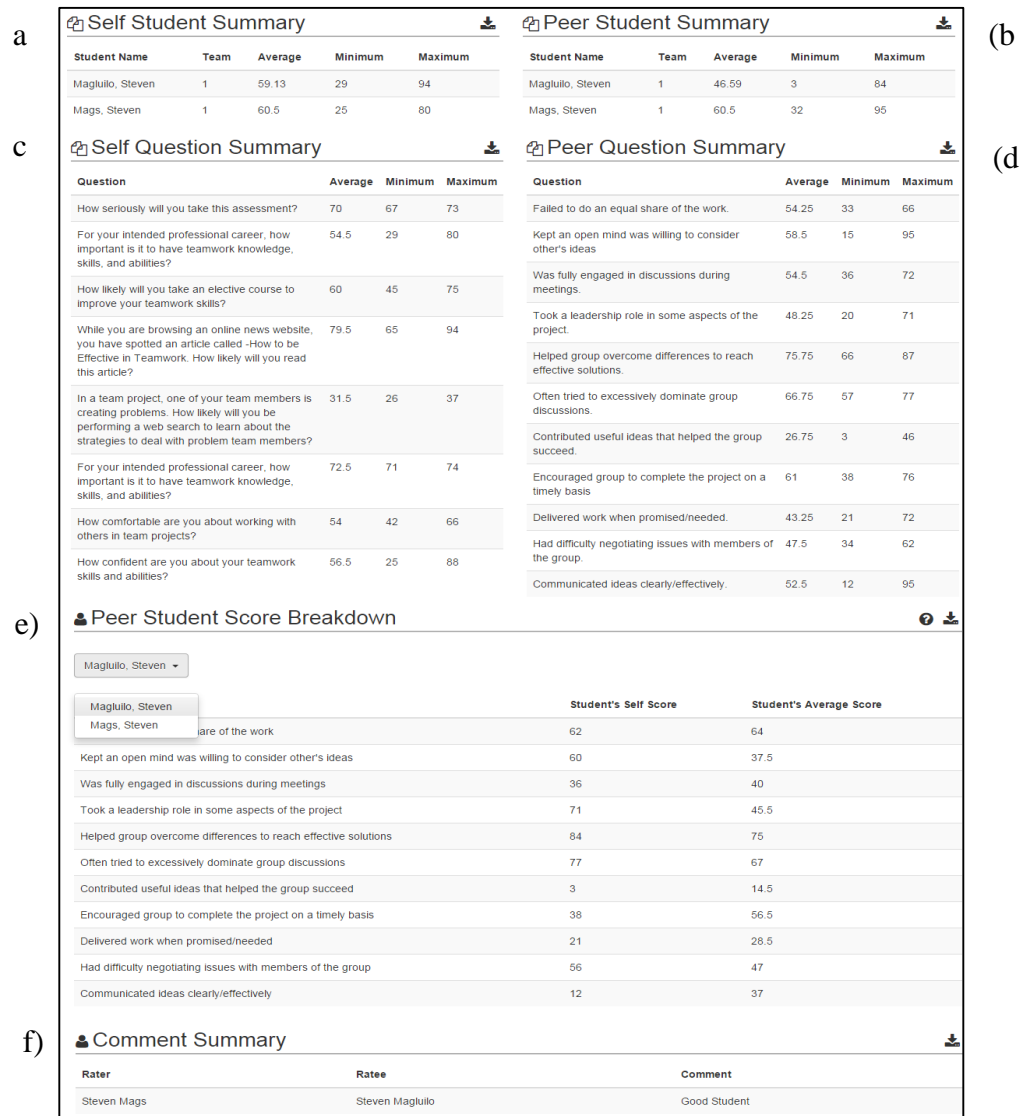


Figure 6. Assessment results page

Assessment Feedback

The assessment feedback tool allows instructors to send a custom message to their students for each assessment (Figure 7-(a)). Included in the email is the feedback for the assessment. Using the feedback the student can see how their teammates rated them compared to how they rated themselves, and more importantly the student can see how they can improve their skills to work better in the future. A sample email that a student would receive is shown in Figure 7-(b).

a)

Send Student Feedback (SRA 111.050) x

Personal Message

File ▾ Edit ▾ Insert ▾ View ▾ Format ▾ Table ▾ Tools ▾

← → **B** *I* [List Icons]

Thank you for completing the assessment survey for SRA 111.050

All course related information will be included in the email.

Note: Upon submit, emails will start sending in background. x

Close [Send Feedback](#)

b)

PEAR

Dear Steven Maglulo:

Thank you for completing the assessment survey for SRA 111.050

The following is your feedback for SRA 111

Your Rating	Avg. Rating	Question
62	64	Failed to do an equal share of the work.
60	37.5	Kept an open mind was willing to consider other's ideas
36	40	Was fully engaged in discussions during meetings.
71	45.5	Took a leadership role in some aspects of the project.
84	75	Helped group overcome differences to reach effective solutions.
77	67	Often tried to excessively dominate group discussions.
3	14.5	Contributed useful ideas that helped the group succeed.
38	56.5	Encouraged group to complete the project on a timely basis
21	28.5	Delivered work when promised/needed.
56	47	Had difficulty negotiating issues with members of the group.
12	37	Communicated ideas clearly/effectively.

Your receiving this email on behalf of your enrollment in SRA 111
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Figure 7. Student feedback tool with example feedback email

IV. A Case Study

In this section, we present a case study, which was used to beta-test PEAR in a multi-disciplinary entrepreneurship course. In this case study, the eleven-item rubric developed by Van Duzer and McMartin¹² was used within the PEAR software. We used a five point Likert-type scale from (1)-“Strongly Disagree” to (5)-“Strongly Agree” for each rubric question.

In the class, 22 students completed three group projects throughout the semester. At the end of the projects, students rated their project members as well as themselves. In each project, student teams included a different set of students as much as possible. In total, 2615 ratings were collected for the three group projects. Since some students did not complete peer evaluations or skipped questions, twelve ratings were collected for each combination of student and question on the average. Table 1 summarizes the mean ratings, grouped by peer rating and self-rating, for each rubric question. In the table, the peer rating column presents the average rating that the students assigned to other students (212 ratings per question on the average). The self-rating column indicates the average rating that the students assigned themselves (58 ratings per question on the average). The *p*-value column indicates the significance of the pairwise *t*-test comparing the peer rating average with the self-rating for each student (a total of 66 cases).

Table 1. A comparison of peer and self-ratings in the case study.

No	Questions ¹²	Peer Rating	Self Rating	<i>p</i> -value
1	Communicated ideas clearly/effectively.	4.22	4.61	0.004
2	Contributed useful ideas that helped the group succeed.	4.25	4.65	0.007
3	Delivered work when promised/needed.	4.21	4.58	0.032
4	Encouraged group to complete the project on a timely basis	4.16	4.58	0.011
5	Failed to do an equal share of the work (Reverse).	2.65	1.68	0.007
6	Had difficulty negotiating issues with members of the group (Reverse).	2.71	2.12	0.066
7	Helped group overcome differences to reach effective solutions.	4.16	4.52	0.008
8	Kept an open mind was willing to consider other’s ideas	4.49	4.65	0.315
9	Often tried to excessively dominate group discussions (Reverse).	2.70	2.42	0.160
10	Took a leadership role in some aspects of the project.	3.94	4.40	0.005
11	Was fully engaged in discussions during meetings.	4.25	4.67	0.003

Overall, the students tended to rate themselves higher than how their teammates rated them. This observation is expected due to fact that students tend to increase their ratings as much as possible when the course grade depends on peer ratings. In PEAR, therefore, student peer and self-ratings are reported separately. In addition, the average ratings were very high, excluding questions 5, 6, 9, and 11. We observed several pitfalls that we are planning to fix in the next release of PEAR as follows:

- Some students scored all questions, including the reversed ones, with the same rating, most likely very high (We excluded such suspicious cases from the analysis in Table 1). In other words, these students did not read the questions carefully and were not deliberate in their ratings. The questions with reversed ratings were helpful to identify such cases. We are planning to use the total time that students take to complete the assessment as another indicator of rating reliability.
- Several students avoided answering some questions although they completed peer evaluations. In some cases, such skipped questions were the ones that students were rated low by their peers. Available sample size is not sufficient to draw a conclusion about this observation, however.
- Some students were more deliberate and critical in their ratings than others. Currently, all student ratings are weighted equally in PEAR. In the next release, we plan to use statistical techniques to identify students with more deliberate peer evaluations and weight their opinion accordingly.

V. Conclusions

Peer Evaluation and Assessment Resource (PEAR) is a promising online tool to facilitate the self and peer evaluation processes. As shown in the case study, instructors can effectively perform peer evaluations that involve numerous ratings. Currently, PEAR is in its beta-testing phase. We are attempting to improve PEAR by addressing the pitfalls that we identified in this paper. After a rigorous beta testing phase, data will be collected to evaluate the reliability of PEAR instruments.

Acknowledgment

This work is partially supported by the National Science Foundation (NSF) under Award Numbers DUE-1141001. Any opinions, findings, conclusions, and/or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of the NSF.

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