Influence of Different Scoring Methods on the Results of Team Contribution Peer-Evaluations (2)

T. Furukawa,[1]. Matsuishi,[2]S. Matsumoto,[3]K. Takemata[4],
T. Yamakawa,[5]L. Rynearson[6]

[1~6]Kanazawa Institute of Technology, Kanazawa, Japan

furukawa@neptune.kanazawa-it.ac.jp[1]

Abstract

In engineering design classes managed with Project Based Learning techniques, students' activities are often assessed using peer-evaluation. However, when the peer-evaluation scoring method is different, the results sometimes change [1] [2]. We investigated team contributions of students by peer-evaluation with two scoring methods, namely the Bonus Distribution Method and the Five-Rating Evaluation Method, in 27 classes, with 1884 total examples from 942 university 1st and 2nd year students. We analyzed the examples and proposed ways of best using the results from the different peer-evaluation methods. It was found that 1. the differences in score between group members using the Bonus Method are generally much higher than in groups using the Five-Rating Evaluation Method, 2. the frequency distribution of evaluation points by the Five-Rating Method appears to have a normal distribution, 3. the Bonus Distribution Method is better to use in the middle of the term for giving advice to the team and the Five-rating method is better to use at the end of a term for final student evaluations.

1. Introduction

The Kanazawa Institute of Technology requires all university freshmen and sophomores to take classes named Engineering Design 1&2 [1] which teach "how to proceed with work as a professional engineer" using Project Based Learning (PBL) techniques. Peer-evaluations are used in these classes to help the instructor understand the out-of-class activities of each student so that they may better give advice to the team and to better evaluate each student's contributions to the team. However, different peer-evaluation methods yield different results. Thus, it was important to understand the effects of different peer-evaluations and how each type is best used.

Orland M.W. and Layton R.A. [3] used the actual activities of the team as the items evaluated and examined the reliability of the peer evaluation done with two kinds of worksheets. They pointed out the importance of the evaluation method to the peer evaluation system results. Steven G.N. and Denine A.N. try to distinguish the effects on team contributions caused by having students from several majors on a team. We did peer-evaluation of team contributions by using two kinds of scoring methods and compared and analyzed the results.

This research aims to clarify the relationship between the peer evaluation method and the results of peer-evaluation, to create awareness of the important of this for those preparing peer-evaluation sheets, as well as to investigate the best way to use the results of the evaluations.

2. Class management

Team roles, including a leader and a clerk, are established in each team and rotate weekly. Each team performs design activities from the selection of the project theme through presenting the solution, with PBL, over the course of a term.

Peer-evaluation about the contribution of students to their team's activities is carried out in the middle of a term (the fourth or fifth week) and at the end of a term (the ninth week) in order to give advice to the team and to evaluate each member's team contribution. We use two kinds of scoring methods for peer-evaluation. These are named the Bonus Distribution Method and the Five-Rating Method. In the Bonus Distribution Method each student divides up 1,000,000 yen according to each student's degree of contribution to the team. The Five-Rating-Method asks each student to evaluate all team members' team contributions to six team activities by five ratings {4}. It was modified for this research so that the total evaluation points of each member by this method would be 100, to allow comparison

with the Bonus Distribution Method. Further details of the students' evaluations and how the data was processed are presented in the report. The worksheets are shown in Table 1 and Table 2.

Table 1 Worksheet of Bonus Evaluation Method

Activities / Student's Name	A	B	C	D	E	Total
Expressed his/her opinions in the team						20
Listened to other opinions						20
Complete the job he/she shared on time						20
Contributed to the quality of team output						20
Managed team activities well						20
Total (k-yenÅj= Weight of Contribution						100

Table 2 Worksheet of Five-Rating Method

Activities / Students Name	A	B	C	D	E	Total
Show his own opinion						
Listens to others' opinions						
Completed the job they shared						
Contributed to the quality of team output						
Managed team activities well						
Managed well when problems occurred						
Total (= Weight of Contribution)						

3. Investigated data

We have investigated and analyzed the peer-evaluation data of 1884 individual results, from a total of 4 years, 27 classes, 163 teams, and 942 students. Table 3 shows the school year, the number of classes, the number of teams, the number of data points, and the method of peer-evaluation for all of the data used.

Table 3: Investigated data

		Bonus Method		Five-Rating Method		Total
		05	06	07	08	
Grade Level	Freshmen	4	5	3	2	14
	Sophomore	3	4	3	3	13
	Total	7	9	6	5	27
Number of teams	Freshmen	26	31	19	13	89
	Sophomore	16	23	18	17	74
	Total	42	54	37	30	163
Number of data points	Freshmen	287	365	216	154	1022
	Sophomore	211	259	194	198	862
	Total	498	624	410	352	1884
		1122		762		

4. Peer Evaluation Results

4.1 Individual evaluation points of the peer-evaluation

Figure 1 is an example of the individual peer-evaluation results from the Bonus Distribution Method, taken from a freshman class composed of computer engineering students in 2005 during the 9th week of the class. The evaluation results are generally in the 100 ± 25 range, though there is one student whose score differs greatly. Figure 2 is an example of evaluation results taken in 2008 from a freshman class composed of mechanical engineering students by the Five-Rating Method.

Though a difference isn't clear when figures 1 and 2 are compared, maximum and minimum points using the Bonus Distribution Method are a little bit greater than that of the Five-Rating Method. As mentioned before, data from the Five-Rating Method was modified so that the total of each person's evaluation point could be 100, to allow comparison with the Bonus Distribution Method. This was done by setting the mean score of the team to 100.

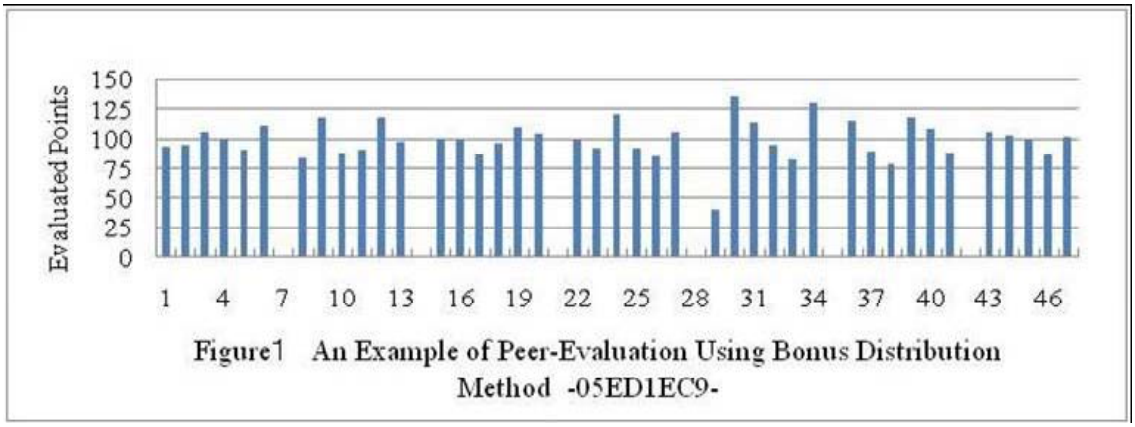

Figure1 An Example of Peer-Evaluation Using Bonus Distribution Method -05ED1EC9-

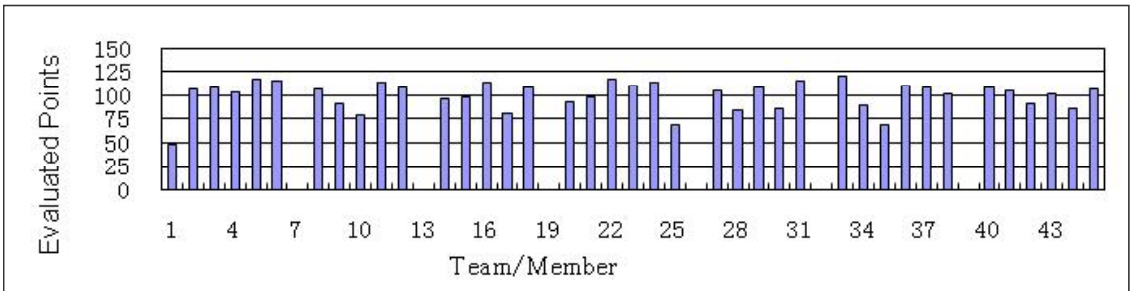

Figure 2 An Exampl of Peer-Evaluation Using Five-Rating Method(08PD1EM9)-Recalculated the Total Evaluation Points to Become 100-

4.2 The maximum and the minimum evaluation points in the class

We gathered the maximum and minimum evaluation values in each class. Figure 3 shows the results of 16 classes 32 times from the Bonus Distribution Method, and Figure 4 shows the results of 11 classes 22 times from the Five-Rating Method. When the results of evaluation using the Five-Rating Method are compared to the results from the Bonus Distribution Method, it is understood that the class maximum value is bigger for the Bonus Distribution Method.

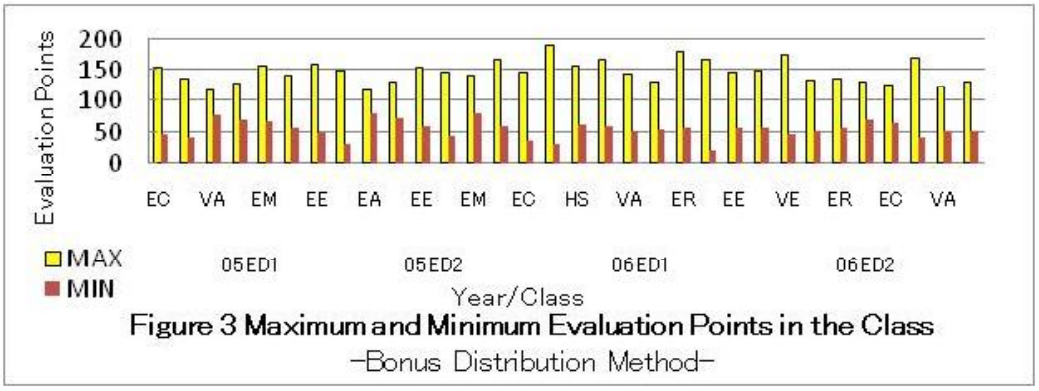

Figure 3 Maximum and Minimum Evaluation Points in the Class
–Bonus Distribution Method–

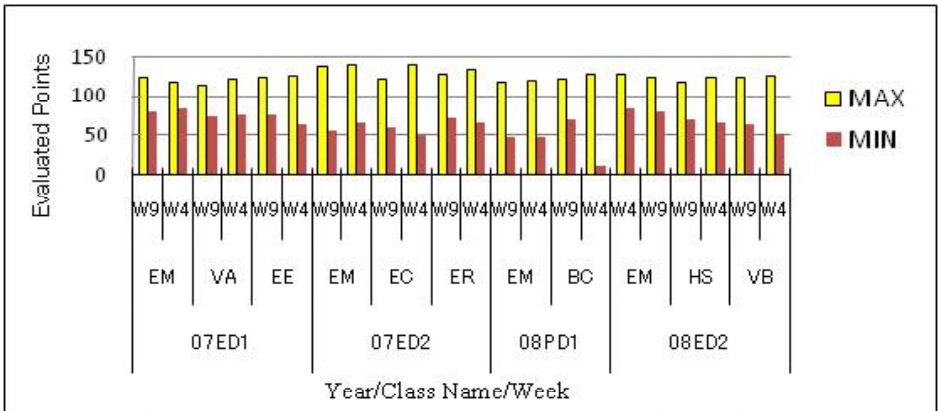

Figure 4 Maxmum and Minimum Evaluation Points In the Class- Five Rating Method -

4.3 The difference in maximum value and minimum value

The difference in evaluation maximum value and minimum value in each class was calculated for 54 times in 27 classes. That result is shown in figure 5. Data taken earlier in the study appears on the left. Therefore, the left side data of the figure are the results from the Bonus Distribution Method, and the right side data are the results from the Five-Rating Method. The mean value is 91 points with the Bonus Method, and 60 points with the Five-Rating Method. As for the mean value of the difference in maximum and minimum from the Bonus Distribution Method, it was found to be more than 1.5 times the mean difference from the results of the Five-Rating Method.

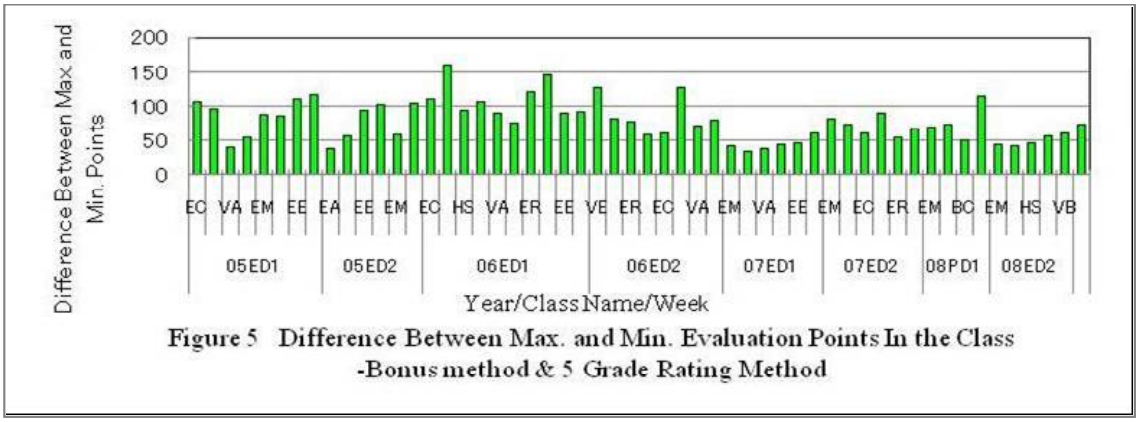

Figure 5 Difference Between Max. and Min. Evaluation Points In the Class
-Bonus method & 5 Grade Rating Method

4.4 The frequency distribution of the evaluation value

We divided the evaluation values into 9 ranges, that is, less than 65, 65 - 75, ____ and 125 – 135, and more than 135, and totaled the frequency of occurrence in every class. Figure 6 is an example from the 4 freshmen classes of 2005. Figure 7 shows similar result from 3 classes of sophomores in 2008. Though it disperses on the whole around the mean of 100, the dispersion is very large for each class unit for both figures, because the number of students is only 30-40 for each figure and that may be not enough to get good frequency distribution. The data of all the classes was totaled for each rating system. That result is shown in figure 8 and figure 9. The frequencies are biggest at the mean 100, and the frequency distribution almost disperses symmetrically before and after the mean. As shown in the table 1, the number of data points is 762 in case of the Five-Rating Method and 1122 in the case of the Bonus Method. It is big enough to get good frequency distribution.

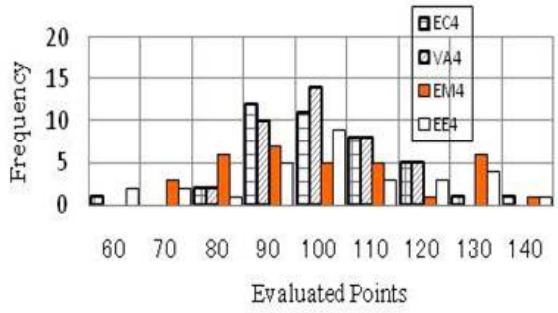

Figure 6 Histogram of Evaluation Points In the Class 05ED1 - Bonus Mthod -

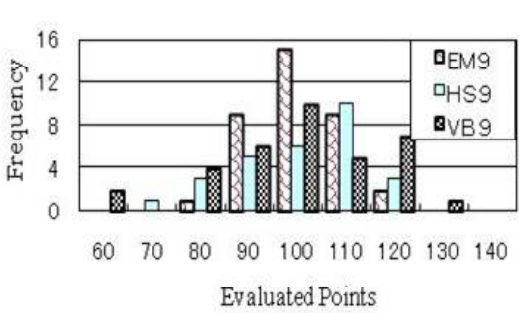

Figure 7 Histogram of Evaluation Points In the Class 08ED2 - 5 Grade Rating Method -

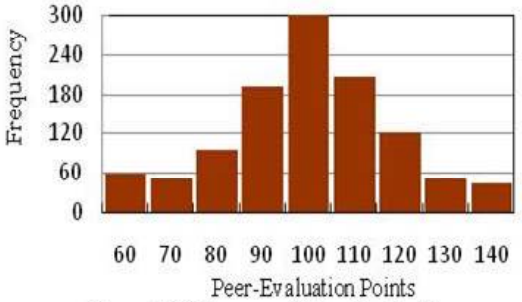

Figure 8 Histogram of Peer-Evaluation - Bonus Distribution Method -

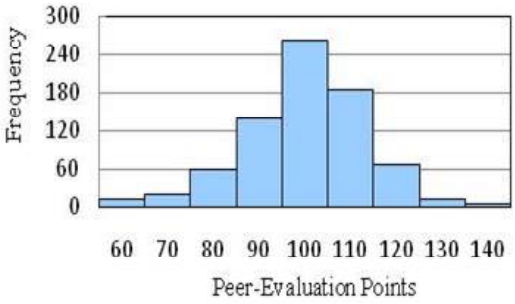

Figure 9 Histogram of Evaluation Points - 5 Grade Rating Method -

4.5 Probability density

All example data was put in order in a probability density figure, and shown in figure 10. The normal distribution function was shown in the same figure. The frequency distribution of the evaluation points of the Five-Rating Method is shown to be in a normal distribution in the same figure and it could be said to be a comparatively proper evaluation. In contrast to this, the evaluation points from the Bonus Distribution Method are close to a normal distribution in the neighborhood of the mean, but become bigger than a normal distribution when the evaluation points are outside ±20 points from the mean. We think this shows that there can be extreme evaluations when the Bonus Distribution Method is used.

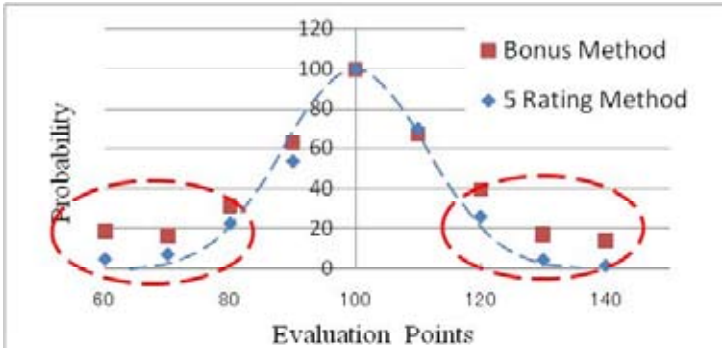

Figure 10 Probability Distribution

5. Summary

Peer-evaluation of member contributions to the team were carried out by two methods in classes where students engaged in team activities, and the characteristics of the results were analyzed. The problems inside a team are shown more clearly by the Bonus Distribution Method, as more extreme evaluations tend to occur when using this method. Therefore, this method is better to do in the middle of the term for the purposes of quickly understanding problems in the team and giving advice to correct those problems. The Five-Rating Method is more suitable for use at the end of the term and for the purposes of grading, because its frequency distribution is similar to a normal distribution and could be said to be a comparatively proper evaluation.

References

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