

# A Preliminary Investigation of the Effectiveness of Peer Ratings in Engineering Design Teams

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## Objectives

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- Assess the use of a peer evaluation form
- Determine if there were correlations between self- and peer-evaluations with final course grade
- Determine if there are differences between ratings given to non-minority and minority students.

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## Why Use Collaborative Learning?

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- Creates a learning environment that makes students more confident
- Students retain and acquire information easier
- Leads to higher-level thinking skills

*Johnson et al. (1998)*

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## Concerns About Team Projects

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1. How to evaluate and hold each team member accountable.
2. Equitable grading is threatened when one or more members contribute little to the project.
3. Team members agree to give inflated ratings.
4. Bias or prejudice in assigning ratings.

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# Courses Evaluated

- EGR 107 Introduction to Engineering Design (spring 2012)
- ECE 485/EGR 487 Senior Design Exhibit I (spring 2011)
- ECE 486/EGR 488 Senior Design Exhibit II (fall 2011)

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# Demographic Data

Course	# of Students	# of Males	# of Females	# of Non-minorities	# of Minorities
EGR 107	22	21 (95%)	1 (5%)	15 (68%)	7 (32%)
ECE 485 EGR 487	19	17 (89%)	2 (11%)	10 (53%)	9 (47%)
ECE 486 EGR 488	19	17 (89%)	2 (11%)	10 (53%)	9 (47%)

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# Team Composition

Course	# of Teams	Mixed Gender	All Non-minority	All minority	Minority & Non-minority
EGR 107	1,2-person 4,3-person 2,4-person	1	1	1	5
ECE 485 EGR 487	5,3-person 1,4-person	2	1	1	4
ECE 486 EGR 488	5,3-person 1,4-person	2	1	1	4

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## # of Peer Evaluations Performed

- In EGR 107, teams evaluated **twice**.
- ECE 485/EGR 487, teams evaluated **once**.
- ECE 486/EGR 488, teams evaluated **once**.

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# Qualitative and Quantitative Rating Scales

- Excellent: **100**
- Very good: 87.5
- Satisfactory: 75.0
- Ordinary: 62.5
- Marginal: **50.0**
- Deficient: 37.5
- Unsatisfactory: 25.0
- Superficial: 12.5
- No show: **0**

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## Example Spreadsheet

Team # Group Grade					Ind. Avg/Team Avg	SQRT(Ind. Avg/Team Avg)			
>>>>	89.3								
	Rating 1	Rating 2	Rating 3	Rating 4	Ind. Avg	Team Avg.	Adj. Factor - Alternative 1	Adj. Factor - Alternative 2	Ind. Grade
Student 1	75	75	62.5	87.5	75.0	82.0	0.91	0.96	85.4
Student 2	87.5	100	100	75	90.6	82.0	1.10	1.05	93.9
Student 3	62.5	75	62.5	62.5	65.6	82.0	0.80	0.89	79.9
Student 4	100	100	100	87.5	96.9	82.0	1.18	1.09	97.0

$$\text{Adjustment Factor 1} = \frac{75}{82} = 0.9146$$

$$\text{Adjustment Factor 2} = \sqrt{0.9146} = 0.956$$

$$\text{Final Grade} = 89.3 \times 0.956 = 85.4$$

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# Data Reduction/Analysis

1. Non-parametric statistical analyses performed on peer ratings using Minitab.
2. Spearman ranked correlation analyses performed between average student peer rating and final grade; and between self-rating and final grade.
3. Wilcoxon ranked sum tests performed on peer ratings.
4. Excel used to organize peer ratings and compute averages.

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## Correlations between Peer Ratings and Final Grades

Course	Comparison	n	$\alpha$	$r_s$ Calculated	$r_s$ Table
EGR 107	Final Grade and Peer-evaluation PDR	22	0.05	<b>0.573</b>	0.359
ECE 486 EGR 488	Final Grade and Peer-evaluation CDR	19	0.05	<b>0.599</b>	0.388

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## Correlations between Peer and Self Evaluations

Course	Comparison	n	$\alpha$	$r_s$ Calculated	$r_s$ Table
ECE 485 EGR 487	Peer- and Self- evaluation PDR	19	0.05	0.465	0.388
ECE 486 EGR 488	Peer- and Self- evaluation CDR	19	0.05	0.435	0.388

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## Hitchhikers

- Individuals that are not responsible team members.
- Students receiving an unfavorable rating below **75**.
- **Three** Hitchhikers in EGR 107.
- **Five** Hitchhikers in ECE485/EGR 487.
- **No** Hitchhikers in ECE 486/EGR 488.

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## Peer Review and Self-Assessment Comparisons

Course	Comparison	n	$\alpha$	p-value
EGR 107	PDR Peer vs CDR Peer	17	0.05	0.6175
EGR 107	PDR Self vs CDR Peer	17	0.05	0.3096
ECE 485 EGR 487	PDR Peer vs CDR Peer	19	0.05	0.1444
ECE 486 EGR 488	PDR Self vs CDR Self	19	0.05	0.2933

**No significant differences**

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## Effects of Ethnicity on Student Ratings: EGR 107 PDR

Comparison	n	Rating	p-value
<b>By non-minorities</b>	<b>36</b>	<b>84.38</b>	<b>0.04</b>
<b>By minorities</b>	<b>10</b>	<b>96.25</b>	
To non-minorities	39	86.54	0.74
To minorities	12	87.50	
By non-minorities to non-minorities	24	82.81	0.80
By non-minorities to minorities	12	87.50	
By minorities to non-minorities	9	94.79	-----
By minorities to minorities	0	0	

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## Effects of Ethnicity on Student Ratings: EGR 107 CDR

Comparison	n	Rating	p-value
By non-minorities	31	88.71	0.36
By minorities	9	94.44	
To non-minorities	39	92.50	0.05
To minorities	9	80.56	
By non-minorities to non-minorities	21	90.28	0.09
By non-minorities to minorities	9	80.56	
By minorities to non-minorities	9	94.44	-----
By minorities to minorities	0	0	

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## Effects of Ethnicity on Student Ratings: ECE485/EGR487

Comparison	n	Rating	p-value
By non-minorities	22	79.55	0.13
By minorities	21	84.52	
To non-minorities	22	85.50	0.12
To minorities	20	77.50	
By non-minorities to non-minorities	12	83.33	0.14
By non-minorities to minorities	10	75.00	
By minorities to non-minorities	10	87.50	0.60
By minorities to minorities	10	80.00	

**No statistically significant differences**

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# Effects of Ethnicity on Student Ratings: CE486/EGR488

Comparison	n	Rating	p-value
By non-minorities	22	85.23	0.80
By minorities	21	87.50	
To non-minorities	22	89.20	0.18
To minorities	20	81.25	
By non-minorities to non-minorities	12	90.63	0.14
By non-minorities to minorities	10	78.75	
By minorities to non-minorities	10	91.25	0.31
By minorities to minorities	10	83.75	

**No statistically significant differences**

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## Conclusions I

1. Based on Spearman rank correlation coefficients, there were significant correlations between
  - a. Final grades and peer evaluations for the PDR in EGR 107
  - b. Final grades and peer evaluations for the CDR in ECE 486/EGR 488
2. Statistically, no significant correlation between peer reviews and self-reviews for both the PDR and CDR in EGR 107.
3. Strong correlations between peer reviews and self-review for both PDR and CDR for senior design courses at 0.05 level of significance.

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## Conclusions II

4. Three students in EGR 107 and five students in ECE 485/EGR 487 appear to be "Hitchhikers" since they received unfavorable ratings below 75.
5. A comparison of peer and self-assessment of the PDR and CDR in each course indicated that students do not rate themselves differently given a second opportunity.
6. In EGR 107 for the PDR, there was a significant difference in ratings given **by** non-minority and those given **by** minority students.

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## Conclusions III

7. In EGR 107 for the CDR, there was a significant difference in ratings given **to** non-minority and those given **to** minority students.
8. In both senior design courses, there was no significant differences in ratings given by or given to non-minorities and minorities.
9. Our results are different from those of Ohland and Finelli who found **no differences** in peer ratings based on race/ethnicity.

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## **Author's Comments**

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Considering using Layton and Ohland's expanded peer rating form in future sections of our freshman and senior design courses.

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## **Thank you!**

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**Are there any questions?**

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