

Thank you

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# Personality Convergence Using the Five Factor Model with Student Engineering Design Teams

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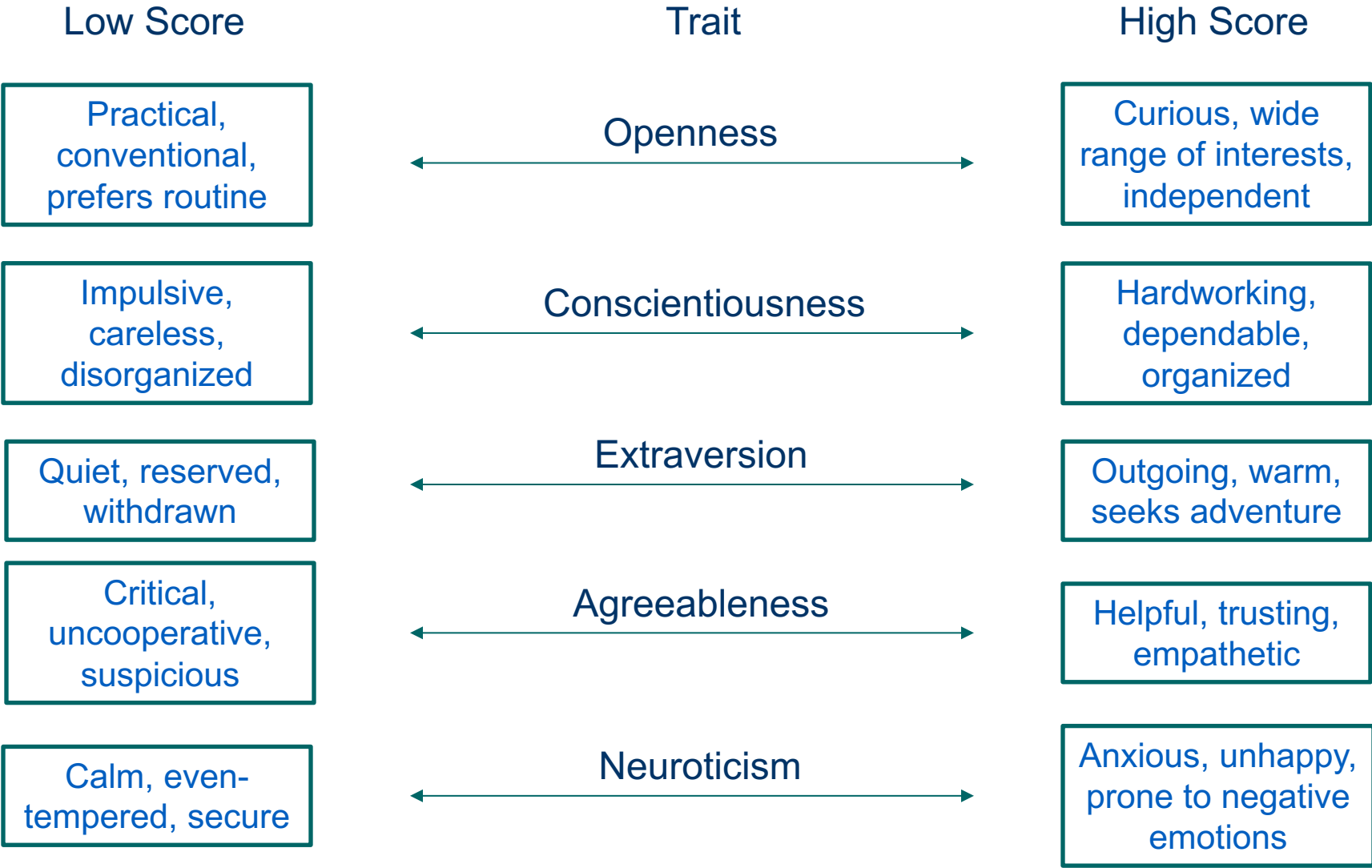
Department of Mechanical Engineering  
Clemson University

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- When are teams used?
  - Industry: create new processes, products, improve existing infrastructure
  - Academia: research teams, student teams
- Student Teams
  - Not meaningfully selected
    - Underperforming
    - Incompatible
- Senior level engineering student teams
  - Similar to novice engineering teams, used as a model for industry teams (Borrego, 2013)
- Understand teams better, improve to team selection

- The Five-Factor Model has emerged as a prominent measure for personality<sup>(Goldberg, 1992)</sup>
  - Model measures extraversion, agreeableness, conscientiousness, neuroticism, and openness
  - 50 Item International Personality Item Pool (IPIP) version of Big Five Markers survey
  - Each factor is measured on a scale of 0 to 50
- Limited research has been done using the Five Factor Model in team formation<sup>(Ogot, 2006)</sup>
- Model has been tested for use of evaluating peer's personalities<sup>(McCrae, 1997)</sup>

# Five Factor Definitions



1. Using the Five Factor Model, will student peer evaluations match self-evaluations?
  1. Will the individual converge to the peer ratings?
  2. Will the group ratings converge to the individual ratings?
2. Over time, will student peer evaluations change?
3. Over time, will student self evaluations change?

- Mechanical Engineering 4010
  - 26 teams of 6 students, 1 team of 5 students
  - One design project during one semester, 3 distinct stages
  - Course required for graduation
  - Same level students
- Creative Inquiry: NASA Micro-g NExT
  - 4 teams of 5 students
  - Cross-disciplinary
  - ~1 senior, ~1 junior, ~3 sophomores on each team
  - Longitudinal (2 semesters)
  - Design project based on NASA requirements
    - Under Ice Sampling Device
    - Sharp Edge Detection and Removal/Covering

- 50 Item IPIP version of Big Five Markers
  - Replicated and administered using google forms
  - Demographic information also collected
    - Which team?
    - If it's a peer evaluation, have you worked with them before?
      - If yes, social setting, class setting, project setting (curricular and extra-curricular)
    - Co-op (yes/no)
    - Gender
  - Survey has been independently tested for reliability of a diverse group ages 16 and up<sup>[5]</sup> but has not been on our specific engineering population
- Self and peer survey administered 4 times in Fall 2017 semester
  - ~25,000 data points total



They are the life of the party.

	1 - Very Inaccurate	2 - Moderately Inaccurate	3 - Neither Accurate Nor Inaccurate	4 - Moderately Accurate	5 - Very Accurate
Person 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Person 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Person 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Person 4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Person 5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

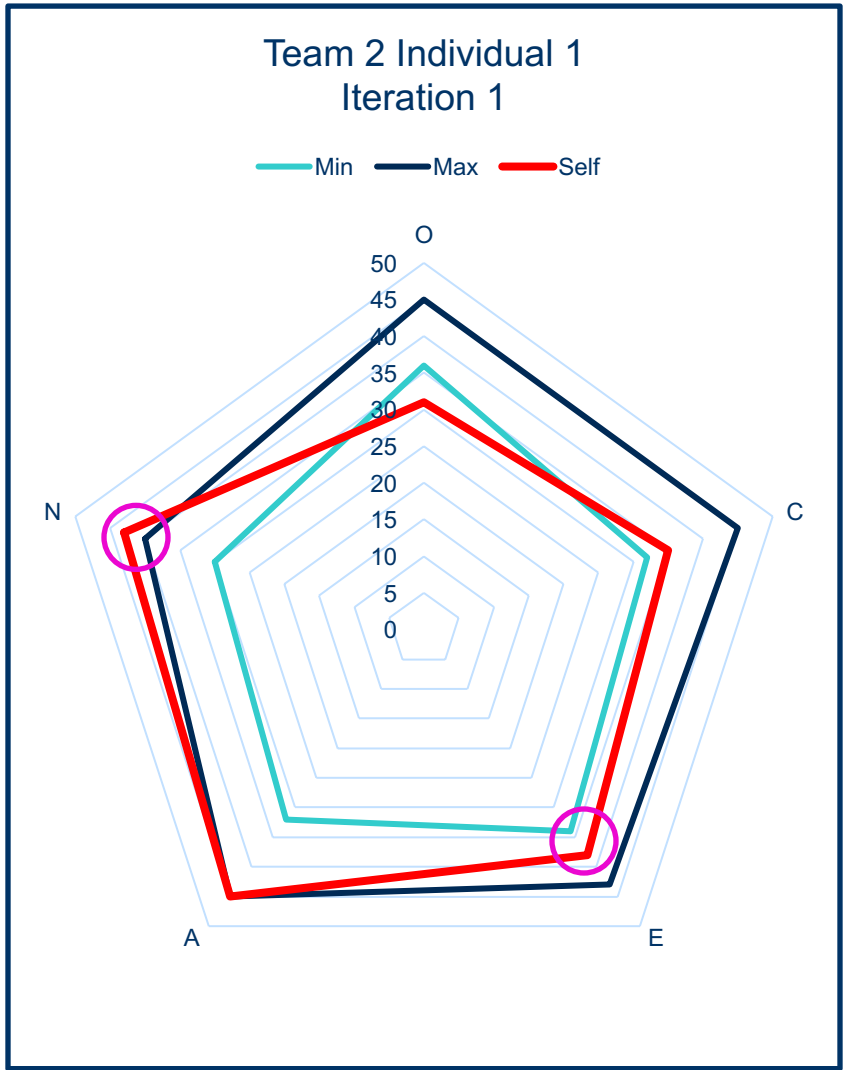
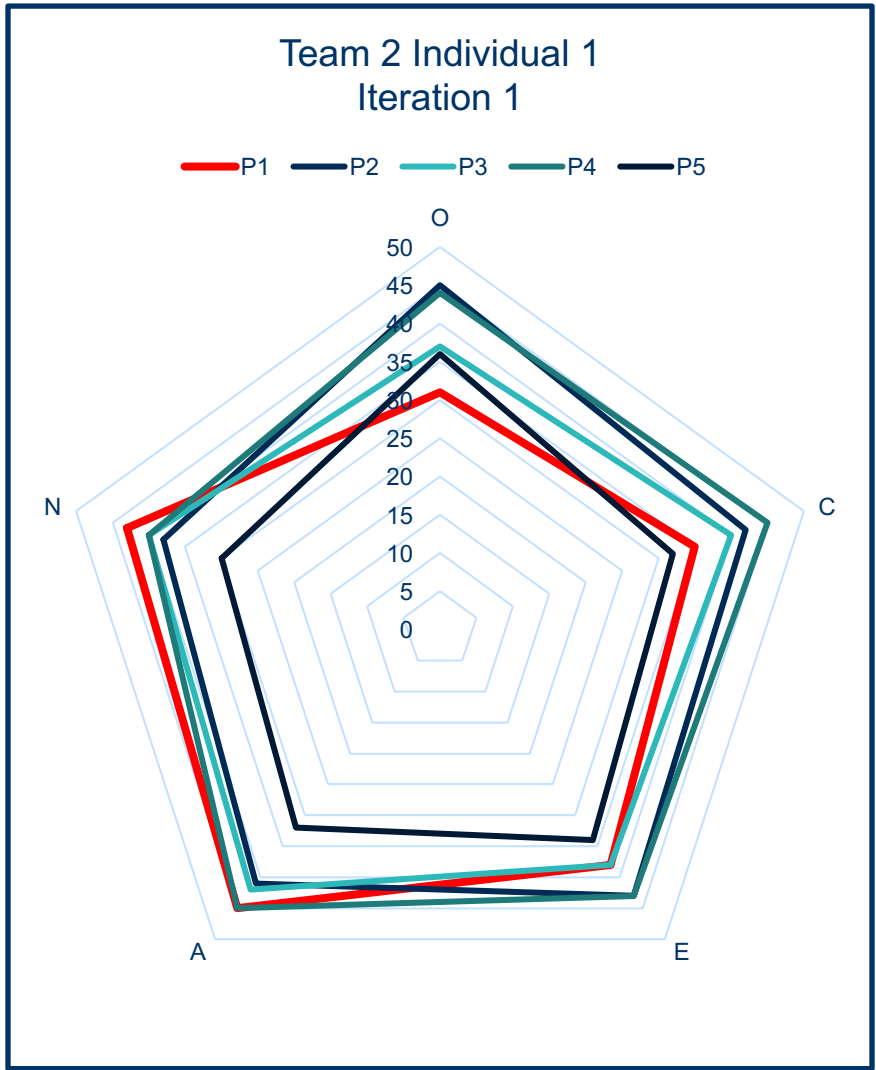
Peer Questionnaire Sample Question

Am the life of the party. \*

	1	2	3	4	5	
Very Inaccurate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very Accurate

Self Questionnaire Sample Question

- Measures: Extraversion
- Keyed: +
  - + keyed items: add the score (1-5)
  - - keyed items: add opposite of score on Likert scale (ex: answer of 1, add 5)



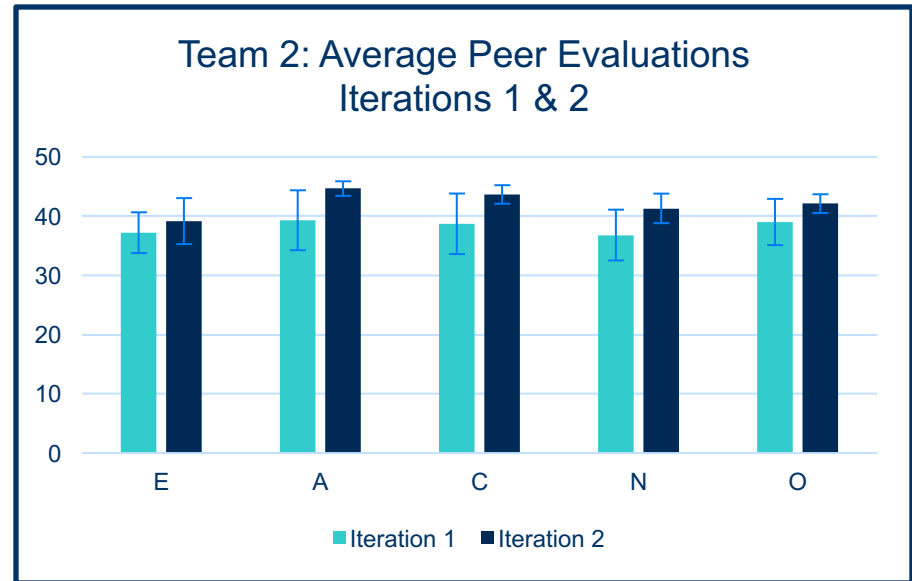
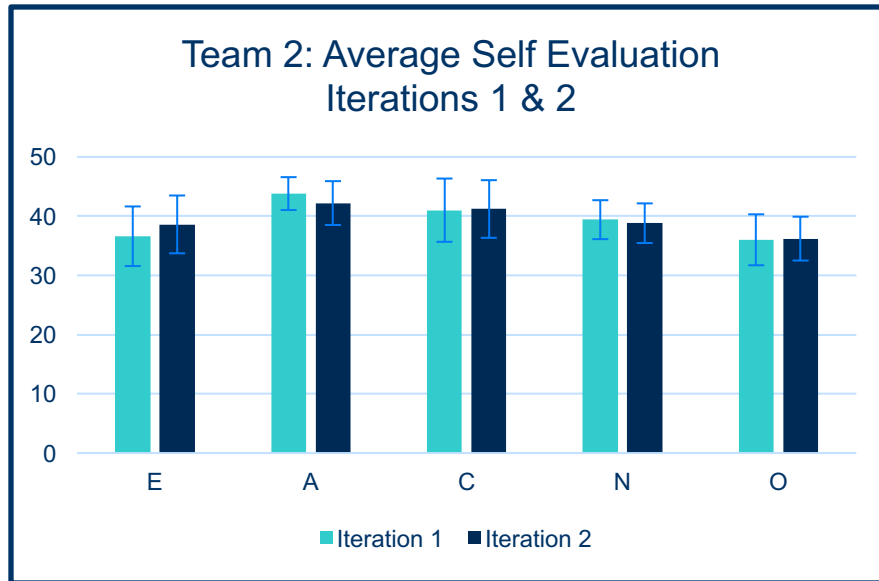
Team 1	Iteration 1			Iteration 2		
	Inside	Outside	Avg Range	Inside	Outside	Ave Range
P1	3	2	8.2	4	1	16
P2	3	2	12.4	3	2	11.4
P3	4	1	12	4	1	14.2
P4	2	3	14.4	2	3	19.6
P5	4	1	14.8	5	0	13.8

Team 2	Iteration 1			Iteration 2		
	Inside	Outside	Avg Range	Inside	Outside	Ave Range
P1	3	2	12.4	2	3	7.4
P2	2	3	11.4	2	3	7
P3	5	0	11.2	0	5	8.8
P4	3	2	10.6	1	4	5.8
P5	3	2	9.4	1	4	7.8

Team 3	Iteration 1			Iteration 2		
	Inside	Outside	Avg Range	Inside	Outside	Ave Range
P1	2	3	13.8	3	2	14.2
P2	4	1	13	2	3	12.4
P3	5	0	9.2	3	2	12.6
P4	1	4	11.4	0	5	11.6
P5	5	0	13	2	3	14

Team 4	Iteration 1			Iteration 2		
	Inside	Outside	Avg Range	Inside	Outside	Ave Range
P1	4	1	15.8	4	1	14.2
P2	5	0	13.8	5	0	14.6
P3	2	3	13	2	3	11.8
P4	3	2	14.4	4	1	17.2
P5	2	3	13.2	5	0	8.8

- Team 1
  - Inside: 1 factor increase, 1 no change
  - Avg Range: 2 factors decrease
- Team 2
  - Inside: 1 factor no change
  - Avg Range: 5 factors decrease
- Team 3
  - Avg Range: 1 factor decrease
- Team 4
  - Inside: 1 factor increase, 2 no change
  - Avg Range: 3 factors decrease



- Self Evaluation Iterations 1 & 2
  - Not enough evidence to show the data are statistically different
- Peer Evaluation Iterations 1 & 2
  - A, C, N, O are statistically different with a 95% confidence interval
- Self Evaluation Iteration 1 & Peer Evaluation Iteration 1
  - A is statistically different with a 95% confidence interval
- Self Evaluation Iteration 2 & Peer Evaluation Iteration 2
  - O is statistically different with a 95% confidence interval

- Non-Response Bias
- Number of teams and different team compositions
- Limited to mechanical engineering population at Clemson University
  - Might not be applicable outside of specific population
- Limited by team selection
  - Have to take into account if students have worked together on a group project previously

- Why do we care about this?
  - To look at how teams evolve
    - Using evolution we can meaningfully select teams
    - By meaningfully selecting teams we can introduce new learning objectives about teamwork
  - Use in industry
    - Step towards looking at performance
- How is this related to engineering?
  - Engineers learning about engineers can lead to better recommendations about team performance

Questions?

Borrego, M., Karlin, J., McNair, L. D., Beddoes, K., 2013 “Team Effectiveness Theory from Industrial and Organizational Psychology Applied to Engineering Student Project Teams: A Research Review,” *Journal of Engineering Education*, **102** (4), pp. 472-512.

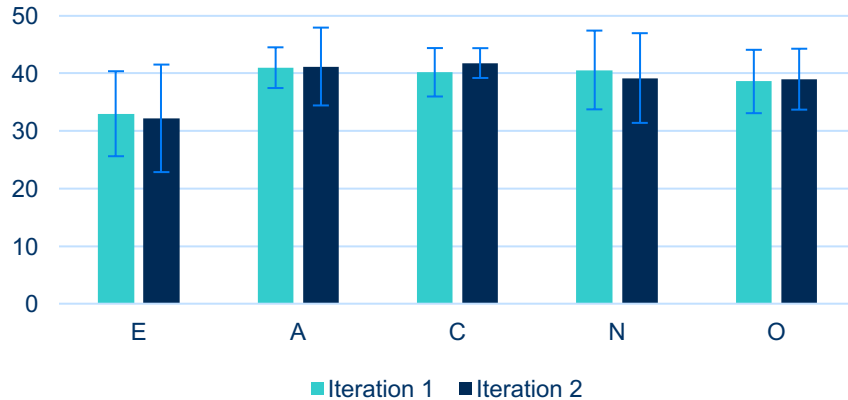
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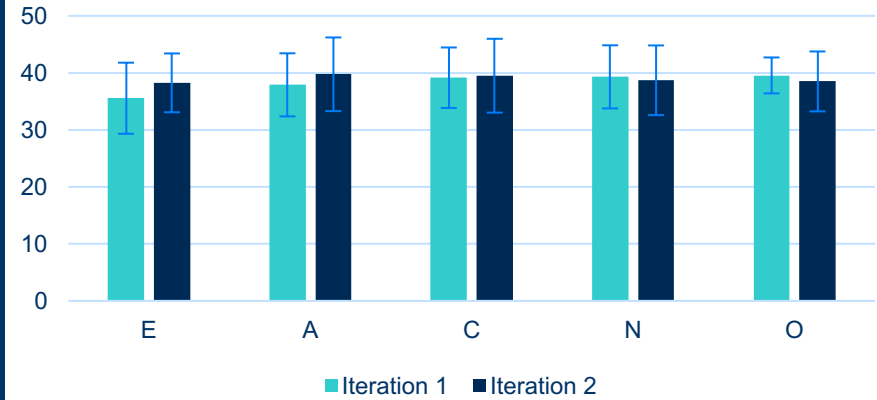
McCrae, R. R., Costa, P. T., 1987, “Validation of the Five-Factor Model of Personality Across Instruments and Observers,” *Journal of Personality and Social Psychology*, **52**(1), pp.81-90.



Team 1: Average Self Evaluation  
Iterations 1 & 2



Team 1: Average Peer Evaluations  
Iterations 1 & 2



- Self Evaluation Iterations 1 & 2
  - Not enough evidence to show the data are statistically different
- Peer Evaluation Iterations 1 & 2
  - Not enough evidence to show the data are statistically different
- Self Evaluation Iteration 1 & Peer Evaluation Iteration 1
  - Not enough evidence to show the data are statistically different
- Self Evaluation Iteration 2 & Peer Evaluation Iteration 2
  - Not enough evidence to show the data are statistically different