

Mid Semester Survey: An Alternate for the End of Semester Evaluation for Engineering Courses

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Abstract

Student Evaluation of Teaching is typically used as a measure of an instructor's performance and has been the focus of many previous studies. In this work, the end of semester Student Evaluation of Teaching (SET) indices was compared with Mid Semester Informal Evaluation (MIE) indices. For the comparison, the undergraduate student evaluation data of an instructor in the area of engineering were collected. These data were then compared statistically using student t-distribution at 95% confidence level. The results indicate that no significant difference exist between SET and MIE indices, suggesting that that a midterm survey data is reliable to predict the teaching performance of an instructor and student's satisfaction by instructor's teaching. Among 306 surveyed data, only 11% of the data are found to be statistically different. The difference between SET and MIE in the remaining 89% of the data is found to be statistically insignificant. Through this work, a strong co-relation between SET and MIE indices are observed.

Subject Headings: Student Evaluation of Teaching, Mid Semester Survey, Student Rating, Instructor Performance, Statistical Co-relation

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1.0 Introduction

Quality teaching is essential for growth and student retention in any engineering program. Instructors teaching performance, measured by Student Evaluation of Teaching (SET), is among many factors that affect the quality of education that student receives. In SET evaluation scheme, students respond to a number of questions through a numerical rating (i.e., 1 through 5) at the end of semester surveys. If an instructor receives higher student SET ratings, then it is generally assumed that students are satisfied with the instructor's pedagogical style and different aspects learning outcomes of the course.

The relationship between SET indices and instructors effectiveness and students performance has been studied by many researchers. SET is a valid measure of teaching performance (Brown 2008) and that there exists a strong positive relationship between SET and the student performance in that course [9]. Therefore, SET provides valuable information about an instructor's effectiveness; hence it is being used as a tool for assessment, tenure and promotion in many universities in the U.S. [7].

1.1 Mid-Semester Informal Evaluation (MIE).

In addition to classroom teaching performance by an instructor, the quality control mechanisms are becoming more important in higher educational institutions. Since SET evaluation takes place at the end of semester, student's feedback cannot be addressed immediately. To address students' feedback immediately, the Mid-Semester Informal Evaluation (MIE) provides a potential alternative. The benefits of MIE are described below:

- The MIE provides faster mechanisms to obtain feedback in order to apply corrective measures to address students concerns. Therefore, MIE will have immediate impact on the course.
- The MIE provides an additional "lowstakes" means of communication between students and instructor. When MIE this evaluation obtains response in an anonymous format, students will be more comfortable to communicate and comment than they would in person.
- Unlike end-of-semester SET evaluations, the MIE offers the opportunity to the instructor not only to make adjustments in teaching, but also to return to the class with thoughtful commentary on students' feedback and suggestions, their perspectives on the course and on teaching.
- The MIE also signals to students that their feedbacks are taken seriously and that instructors are dedicated to improve the course to enhance student learning.
- The MIE assist instructors to identify and address issues related to classroom dynamics that students might otherwise be reluctant to mention i.e., issues that arise when other students are disrupting class by arriving late, or surfing internet on their laptops. Even when students do not address these issues themselves, mid-semester is an excellent time to reinforce course policies and expectations related to these issues.

1.2. Mid-Semester Informal Evaluation Process.

The Mid-Semester Informal Evaluation can be obtained in a 3-step process: designing the evaluation questionnaire, administering the evaluations, and responding to student rating and comments after careful analysis of the survey data.

- The evaluation questionnaire generally contains questions about the major aspects of the course (e.g. lectures, discussions, assignments, group work). The open-ended question is often useful to obtain both a quantitative rating and comments.
- To obtain honest, unbiased and objective feedback, the evaluation form must be anonymous in terms of name and student's identification number. When distributing the evaluation questionnaires, the student should be

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thanked for their time and asked to be specific in their comments. The instructor should indicate that student's responses are evaluated and valued to enhance teaching performance.

- At the end of the semester, the instructor should revisit the midterm evaluations, along with the end-of-semester course evaluations, to examine if the changes in teaching style have any significant impact on students satisfaction on the course.

2.0 Previous Study

The previous study indicates that faculty members have been employing MIE process to improve courses before the end of the term [1]. It is generally believed that MIE provides an opportunity for an instructor to achieve higher SET index values. Several researchers have studied the importance of MIE [1, 6 and 8]. Few studies focused on the improvements of teaching ratings through MIE [3 and 5], while another study compared the end of the semester course evaluations with that of MIE [2].

A more recent study conducted in 2013 examined the effects on classroom instruction using a midterm student feedback survey [4]. The researchers gathered data from 122 students over two years for six classes. The results indicate that midterm student feedback offered valuable insight for faculty. When faculty make instructional changes based on MIE data, students' responses improved.

3.0 Research Objective

In this work, student midterm survey results in several engineering courses over 8 semesters (i.e., Spring 2009 through Fall 2012) in two different institutions are compared with those of SET for the same courses during these semesters. Based on student's numerical indices and feedback on mid-semester surveyed data, the instructor mentioned in this study changed his teaching style and addressed students concerns. After the end of semester evaluation, the instructor analyzed the data to examine if the student's feedback is significantly different than those of mid-semester.

The primary objectives of this work are to identify if there is any statistical correlation between the end of semester Student Evaluation of Teaching (SET) and Mid Semester Informal Evaluation (MIE) indices

3.0 Methodology

The end-of-semester formal course evaluation data for engineering courses were collected from University of Southern Indiana (USI) during Spring 2009 through Spring 2012 semesters and Georgia Southern University (GSU) for fall 2012 semester. The questionnaires for SET were designed by these institutions. The questionnaires uses for MIE and SET surveys were the same. These questions were divided into two categories. Questions 1 through 10 (USI) Questions 1 through 13 (GSU) are related to the performance of the instructor (as perceived by the students), and are listed under "Course Evaluation" category. Questions 11 through 14 (USI) and Questions 14 through 20 (GSU) are related to the level of student's satisfaction and confidence and are listed under "Self Evaluation" category in Table 1.

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Table 1: Course Evaluation Questionnaires used by University of Southern Indiana.

Part I: Course Evaluation	Part II: Self Evaluation
<ol style="list-style-type: none"> 1. The course materials used, such as visuals, texts, handouts, and on-line items, helped me to learn. 2. The instructor was well organized. 3. The assignments helped me increase my understanding of the course content. 4. The instructor clearly communicated the subject matter. 5. The instructor showed enthusiasm for the course. 6. The instructor was prepared for each class. 7. The instructor's teaching style was effective for me. 8. The instructor was accessible to me outside of class. 9. The instructor treated me with respect. 10. The instructor evaluated me fairly. 	<ol style="list-style-type: none"> 11. I was prepared for each class. 12. I believe I performed up to my potential in this course. 13. I learned a lot in this course. 14. I would recommend this instructor to other students considering this course.

For GSU, Questions 1 through 13 are listed under “Course Evaluation” category, while Questions 14 through 20 are listed under “Self Evaluation” category in Table 2.

Table 2: Course Evaluation Questionnaires used by Georgia Southern University.

Part I: Course Evaluation	Part II: Self Evaluation
<ol style="list-style-type: none"> 1. The degree to which important points were stressed in this course was 2. The instructor's preparation for this course was 3. The instructor's encouragement of class participation, discussion, questions was 4. Organization of the course material was 5. The clarity of the presentation of the course was 6. The degree to which tests and other graded activities reflected course content was 7. The instructor's availability to students was 8. The instructor's helpfulness to students was 9. The degree to which the class stayed focused on course objective was 10. The instructor's interest in the content (or material) of this course was 11. Overall, how would you rate this instructor? 12. What was your level of interest in this subject matter before taking the course? 13. What was your level of interest in this subject matter after taking this course? 	<ol style="list-style-type: none"> 14. How much effort did you put into learning the material covered in this course? 15. How much did you learn from this course? 16. To what degree were you intellectually challenged in this course? 17. How often did you seek outside help with this course? 18. How difficult was this course? 19. How was the workload of this course? 20. Overall, how would you rate this course?

For each question listed in Tables 1 and 2, students responded through numerical rating, ranging from 1 through 5 where 1 indicates student’s least satisfaction and 5 indicates student’s highest level of satisfaction. For example, in Question 6 (Table 1), students rated instructor’s preparation for teaching through digits 1, 2, 3, 4, or 5, where 1 indicates that the instructor was the least prepared and 5 indicates that the instructor was most prepared to teach the class.

The necessary data were gathered from two different institutions. The name of institution, discipline, and list of courses are provided in Table 3.

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Table 3: The Data Summary of Institution and Course Lists from which Student Evaluation of Teaching and Mid Semester Informal Evaluation Data were Obtained.

Name of institution and discipline	Course name and (number of semester courses were taught)		
University of Southern Indiana	<ul style="list-style-type: none"> • Water Resources & Hydrology, Engr. 429 (3) • Environmental Engineering, Engr. 428 (2) • Engineering Economics, Engr. 335 (6) 	<ul style="list-style-type: none"> • Introduction to Engineering, Engr. 107 I (2) • Applied Problem Solving, Engr. 104 (1) 	<ul style="list-style-type: none"> • Principles of Problem Solving, Engr. 103 (3) • Analytical Technique for Economic Evaluation, IM 651 (2)
Georgia Southern University	<ul style="list-style-type: none"> • Fluid Mechanics Lab, CENG 3232 (1) • Environmental Pollution, TCET 3141 (1) 		

Table 3 indicates that these courses provide 21 data points (i.e., 21 semesters) to calculate SET and MIE indices. The courses at USI were taught multiple semesters except Engr. 104 - Applied Problem Solving. The courses at GSU were taught only one time.

3.1 Statistical Analysis.

- The Course Evaluation Questionnaires are divided into Part I: Course Evaluation and Part II: Self Evaluation. For USI, there are 10 questions (1 through 10) for Course Evaluation and five questions (11 through 15) for Self Evaluation. For GSU, there are 20 questions (1 through 13) for Course Evaluation and seven questions (14 through 20) for Self Evaluation. These Questionnaires were used to calculate both SET and MIE indices.
- The arithmetic average (i.e., average) were calculated based on student rating data for Course Evaluation and Self Evaluation. Then these averages were used to calculate grand average. Therefore, grand average indicates the arithmetic average of Course Evaluation and Self Evaluation. Finally, the grand average are calculated and compared between SET and MIE data.
- The arithmetic averages for the questions in Course Evaluation and Self Evaluation are calculated according to the following equations:

$$x_{m,j} = \frac{1}{N_m} \sum_{i=1}^{i=N_m} x_{i,j} \dots\dots\dots (1.a)$$

$$x_{f,j} = \frac{1}{N_f} \sum_{i=1}^{i=N_f} x_{i,j} \dots\dots\dots (1.b)$$

Where,

$x_{m,j}$ = arithmetic average of questions by student i for question j used to obtain Mid (m) Semester Informal Evaluation (MIE) index;

$x_{f,j}$ = arithmetic average of questions by student, i for question, j used to obtain formal (f) end of semester Student Evaluation of Teaching (SET) index;

$x_{i,j}$ = student rating for by student i for question j;

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N_m = Number of questions used to obtain Mid (m) Semester Informal Evaluation (MIE) index;

N_f = Number of questions used to obtain formal (f) end of semester Student Evaluation of Teaching (SET) index;
The Sum of Square Error for each question is calculated as:

$$ss_{m,j} = \sum_{i=1}^{i=N_m} (x_{m,j} - x_{i,j})^2 = \sum_{i=1}^{N_m} x_{i,j}^2 - \frac{\left(\sum_{i=1}^{N_m} x_{i,j}\right)^2}{N_m} \dots\dots\dots(2.a)$$

$$ss_{f,j} = \sum_{i=1}^{i=N_f} (x_{f,j} - x_{i,j})^2 = \sum_{i=1}^{N_f} x_{i,j}^2 - \frac{\left(\sum_{i=1}^{N_f} x_{i,j}\right)^2}{N_f} \dots\dots\dots(2.b)$$

Where,

$ss_{m,j}$ = Sum of Square Error for question j used to obtain Mid (m) Semester Informal Evaluation (MIE) index;
 $ss_{f,j}$ = Sum of Square Error for question j to obtain formal (f) end of semester Student Evaluation of Teaching (SET) index;

The data summary of averages of Course Evaluation and Self Evaluation; and Grand Average of Course and Self Evaluation is provided in Table 4.

Table 4. Data Summary of Averages of Course Evaluation and Self Evaluation; and Grand Average of Course and Self Evaluation

Semester Courses	Course Evaluation Average		Self Evaluation Average		Course and Self Evaluation Grand Average	
	MIE	SET	MIE	SET	MIE	SET
1	3.83	3.83	3.79	3.85	3.82	3.84
2	3.69	3.69	3.27	3.42	3.57	3.55
3	3.98	3.94	3.97	3.92	3.98	3.93
4	4.00	4.26	4.66	4.21	4.19	4.23
5	3.05	3.86	3.11	3.81	3.07	3.84
6	3.54	4.08	3.62	3.86	3.56	3.97
7	3.88	3.93	4.07	4.08	3.93	4.01
8	4.38	4.23	4.06	4.00	4.29	4.12
9	3.91	3.96	3.83	3.81	3.89	3.88
10	3.98	4.09	3.49	3.59	3.84	3.84
11	4.50	4.40	4.00	4.35	4.36	4.38
12	4.69	4.30	4.48	4.14	4.63	4.22
13	4.84	4.84	4.85	4.80	4.84	4.82
14	4.38	3.18	4.31	3.50	4.36	3.34
15	4.28	3.75	3.93	3.37	4.18	3.56
16	4.19	3.68	3.92	3.48	4.11	3.58
17	3.75	3.83	3.97	4.38	3.81	4.11
18	3.78	3.68	3.57	3.40	3.72	3.54
19	4.13	4.31	4.31	4.25	4.18	4.28
20	3.26	3.15	3.49	2.63	3.40	2.81
21	3.37	3.10	3.61	3.13	3.50	3.12

2014 ASEE Southeast Section Conference

A comparison of the averages of Course Evaluation and Self Evaluation is shown in Figures 1 and 2, respectively.

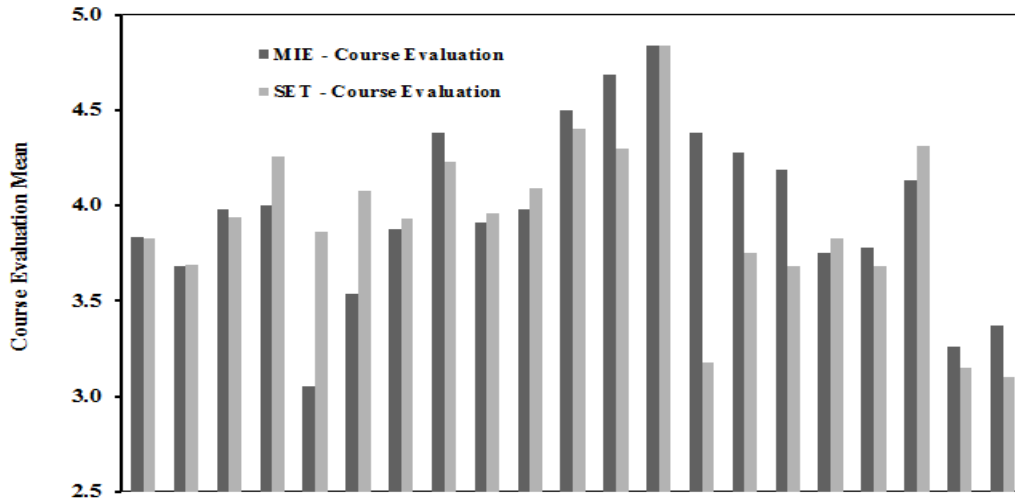


Figure 1. Comparison of Course Evaluation Data between End of Semester Student Evaluation of Teaching (SET) and Mid Semester Informal Evaluation (MIE)

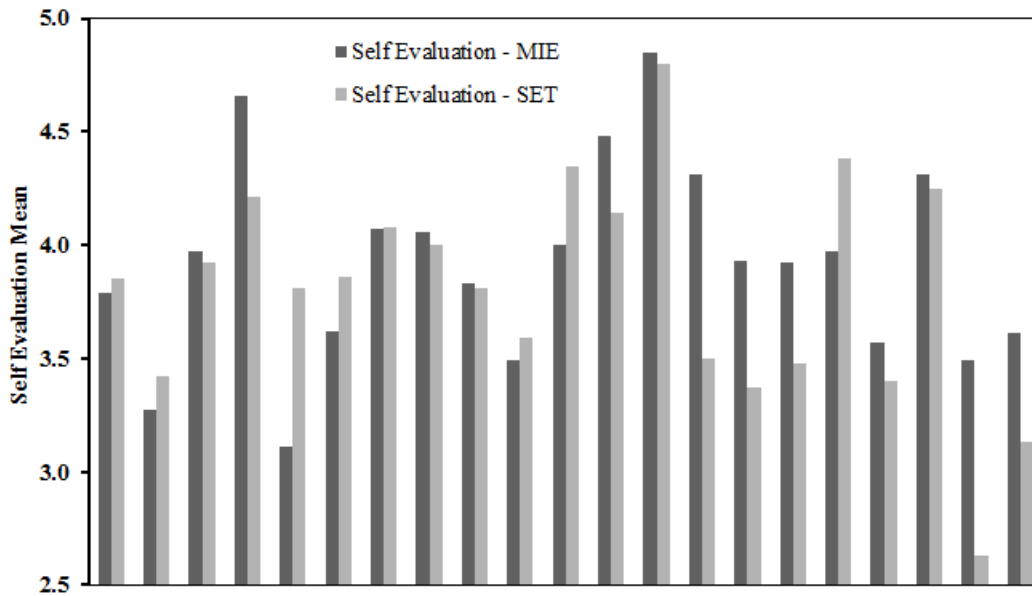


Figure 2. Comparison of Self Evaluation Data between End of Semester Student Evaluation of Teaching (SET) and Mid Semester Informal Evaluation (MIE)

A comparison of the grand averages of Course Evaluation and Self Evaluation is shown in Figure 3 below.

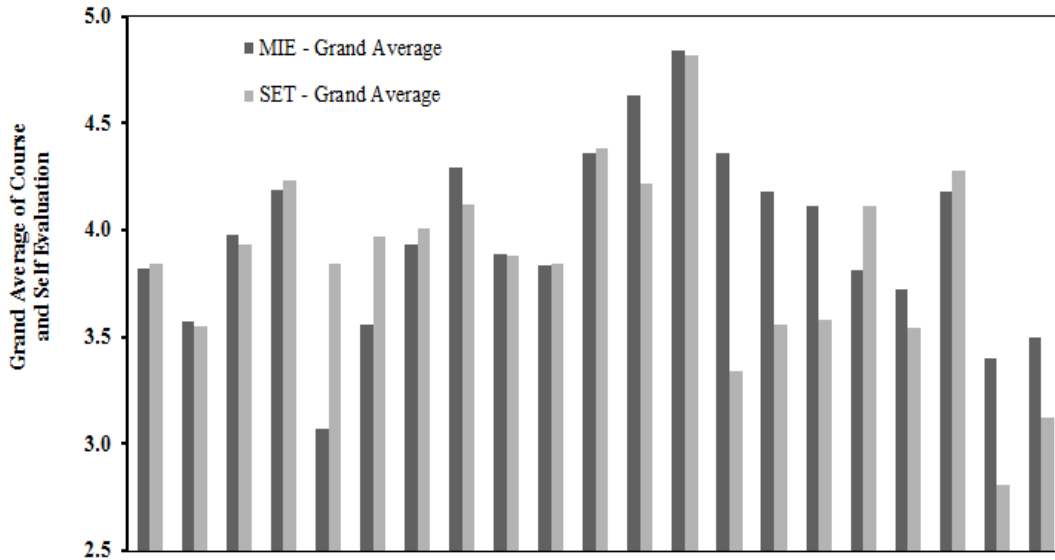


Figure 3. Comparison of Grand Averages between End of Semester Student Evaluation of Teaching (SET) and Mid Semester Informal Evaluation (MIE)

Figures 1, 2, and 3 indicate that Student Evaluation of Teaching (SET) and Mid Semester Informal Evaluation (MIE) are co-related.

3.2 Statistical Significance - Mid Semester Informal Evaluation vs. Student Evaluation of Teaching

To compare MIE and SET surveyed data, statistical significant test was conducted using student t-distribution. For this analysis, the mean index values of for MIE and SET are compared for course surveyed data collected from University Southern Indiana (USI).

For this analysis, first the course surveyed data from SET and MIE is selected, and number of question (N_m and N_f) is calculated. Then the arithmetic means (i.e., $x_{m,j}$ and $x_{f,j}$) and the Sum of Square Error ((i.e., $ss_{m,j}$ and $ss_{f,j}$) are calculated. The student-t statistic (t-test) for question j (t_j) is calculated using the following equation:

$$t_j = \frac{x_{m,j} - x_{f,j}}{\sqrt{\left(\frac{ss_{m,j} + ss_{f,j}}{df}\right)\left(\frac{1}{N_m} + \frac{1}{N_f}\right)}} \dots\dots\dots(3)$$

Where, $df = \text{degrees of freedom} = N_m + N_f - 2 \dots\dots\dots(4)$

The t-test is conducted at 95% confidence (i.e., 5% probability) level (two-tailed). Finally, $t_{critical}$ values are obtained and compared with the t-static values.

If the computed t-value (i.e., t_j) is below $t_{critical}$ value, then it can be concluded that the difference between the SET and MIE indices are statistically insignificant. The results of statistical significant test are provided in Tables 5.a, 5.b, 5.c and 5.d.

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Table 5.a: Data Summary of Statistical Significant Test using Student-t Distribution between Mid Semester Informal Evaluation and End of Semester Student Evaluation of Teaching - University of Southern Indiana

Course, Semester, Degrees of Freedom, d_f		Evaluation Survey Questionnaire														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Spring 2009	Engr. 429 ($df = 10$)	X_m	4.33	3.17	3.83	3.67	4.00	3.50	3.83	3.83	4.17	4.00	3.83	3.83	3.67	3.83
		X_f	4.50	2.83	4.33	3.33	4.67	2.83	3.17	3.67	4.67	4.33	4.00	4.00	4.20	3.20
		t_j	0.30	-0.39	0.77	-0.59	0.93	-0.87	-1.77	-0.41	0.73	0.45	0.38	0.25	0.82	-0.83
		$t_{critical}$	2.228													
	Engr. 107 ($df = 28$)	X_m	3.43	3.36	3.43	3.00	4.36	3.93	3.00	3.79	4.21	4.36	3.79	3.64	2.79	2.86
		X_f	3.69	3.62	3.44	2.62	4.37	4.19	2.81	3.62	4.19	4.31	4.00	4.00	3.13	2.53
		t_j	0.54	0.60	0.02	-0.80	0.04	0.85	-0.41	-0.35	-0.06	-0.15	0.66	1.13	0.75	-0.57
		$t_{critical}$	2.048													
	IM 651 ($df = 18$)	X_m	4.56	3.33	4.44	3.33	4.56	4.11	3.22	4.00	4.11	4.11	3.89	4.11	4.22	3.67
		X_f	4.18	3.55	4.18	3.45	4.45	3.82	3.27	3.91	4.27	4.27	4.3	4.2	3.8	3.4
		t_j	-1.24	0.56	-1.00	0.25	-0.44	-0.81	0.10	-0.22	0.49	0.48	1.22	0.36	-1.10	-0.65
		$t_{critical}$	2.101													
Fall 2009	Engr 103 ($df = 38$)	X_m	3.90	4.00	3.67	3.57	4.43	4.19	3.33	4.10	4.57	4.24	4.86	4.41	4.55	4.82
		X_f	4.32	4.21	4.26	3.84	4.58	4.53	3.95	4.11	4.47	4.32	4.35	4.12	4.18	4.18
		t_j	1.41	0.70	1.85	1.06	0.55	1.34	1.80	0.05	-0.40	0.28	-1.79	-1.11	-1.35	-2.50 ^a
		$t_{critical}$	1.96													
	Engr 335 ($df = 26$)	X_m	3.36	2.50	2.86	2.29	3.79	3.00	2.00	3.50	3.64	3.57	3.71	3.21	3.00	2.50
		X_f	4.07	3.50	4.23	3.21	4.23	3.50	3.43	4.00	4.29	4.21	4.00	3.85	3.92	3.46
		t_j	1.67	2.55 ^a	5.06 ^a	2.36 ^a	1.25	1.42	3.02 ^a	1.69	1.69	1.56	1.02	1.81	2.37 ^a	2.14 ^a
		$t_{critical}$	2.056													
Spring 2010	Engr 107 ($df = 17$)	X_m	3.60	2.90	3.30	3.10	4.00	3.50	3.00	3.50	4.40	4.10	4.27	3.60	3.40	3.20
		X_f	4.33	3.56	4.00	3.67	4.33	3.33	3.78	4.56	4.67	4.56	3.89	3.75	4.11	3.67
		t_j	1.52	1.60	1.68	1.15	0.92	-0.35	1.56	2.31	0.68	0.99	-1.96	0.31	1.51	0.81
		$t_{critical}$	2.110													
	Engr 335 ($df = 65$)	X_m	3.82	3.79	4.21	3.03	4.21	4.09	3.15	3.88	4.32	4.29	4.91	4.03	3.82	3.50
		X_f	4.18	3.82	4.21	3.06	4.18	4.03	3.36	3.97	4.27	4.18	4.45	4.27	4.03	3.58
		t_j	2.13 ^a	0.13	0.02	0.13	-0.15	-0.28	0.95	0.37	-0.26	-0.56	-2.77 ^a	1.25	0.94	0.29
		$t_{critical}$	1.96													

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Table 5.b: Data Summary of Statistical Significant Test using Student-t Distribution between Mid Semester Informal Evaluation and End of Semester Student Evaluation of Teaching - University of Southern Indiana

Course, Semester, Degrees of Freedom, df		Evaluation Survey Questionnaire														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Fall 2010	Engr 428 (df = 5)	X_m	4.25	3.75	4.25	4.25	5.00	4.25	4.25	4.25	4.75	4.75	4.00	4.00	4.50	3.75
		X_f	4.67	3.00	4.33	4.00	4.33	4.33	4.00	4.00	4.67	5.00	4.00	4.00	4.00	4.00
		t_j	0.93	-0.92	0.18	-0.38	-1.95	0.18	-0.85	-0.31	-0.18	0.85	NA	0.00	-1.46	0.85
		$t_{critical}$	2.571													
	Engr 335 (df = 20)	X_m	3.83	3.62	3.85	2.92	4.46	4.08	2.85	4.08	4.77	4.69	3.92	4.08	3.77	3.54
		X_f	3.44	3.22	3.78	3.44	4.78	4.11	3.22	4.00	4.78	4.78	3.78	4.22	3.78	3.44
		t_j	-0.91	-0.98	-0.14	1.53	1.24	0.10	0.75	-0.21	0.06	0.43	-0.38	0.45	0.03	-0.25
		$t_{critical}$	2.086													
	Engr 103 (df = 30)	X_m	4.00	3.94	3.94	3.06	4.35	4.18	3.35	4.29	4.41	4.24	3.59	3.47	3.24	3.65
		X_f	4.36	4.00	4.21	3.50	4.57	4.14	3.50	4.14	4.21	4.29	3.93	3.64	3.43	3.36
		t_j	1.48	0.21	0.80	1.19	0.89	-0.13	0.33	-0.52	-0.66	0.16	0.98	0.47	0.51	-0.65
		$t_{critical}$	1.960													
Spring 2011	Engr 429 (df = 12)	X_m	4.43	4.14	4.14	4.14	4.86	4.43	4.29	4.71	5.00	4.86	3.86	4.14	3.71	4.29
		X_f	4.29	3.86	4.29	4.14	4.86	4.71	4.00	4.29	4.86	4.71	4.20	4.20	4.40	4.60
		t_j	-0.32	-0.48	0.36	-0.01	0.01	0.99	-0.65	-1.01	-0.90	-0.60	0.76	0.16	1.67	0.99
		$t_{critical}$	2.179													
	Engr 335 (df = 31)	X_m	4.63	4.88	4.71	4.06	4.88	4.82	4.29	4.71	5.00	4.88	4.19	4.44	4.56	4.75
		X_f	4.63	4.19	4.27	3.88	4.56	3.94	3.81	4.31	4.88	4.53	4.00	4.00	4.19	4.38
		t_j	0.03	-3.09 ^a	-1.73	-0.53	-2.12 ^a	-3.20 ^a	-1.54	-1.73	-1.41	-2.26 ^a	-0.87	-1.55	-1.59	-1.69
		$t_{critical}$	1.960													
	IM 651 (df = 8)	X_m	5.00	4.80	4.80	4.60	5.00	5.00	5.00	4.60	4.60	5.00	4.60	4.80	5.00	5.00
		X_f	5.00	4.80	5.00	4.40	5.00	5.00	4.60	4.60	5.00	5.00	4.60	5.00	4.80	4.80
		t_j	NA	0.00	1.00	-0.39	NA	NA	-1.45	0.00	1.00	NA	0.00	1.00	-0.89	-0.89
		$t_{critical}$	2.306													

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Table 5.c: Data Summary of Statistical Significant Test using Student-t Distribution between Mid Semester Informal Evaluation and End of Semester Student Evaluation of Teaching - University of Southern Indiana

Course, Semester,		Evaluation Survey Questionnaire														
Degrees of Freedom, d_f		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Fall 2011	Engr 428 ($d_f = 6$)	X_m	4.50	4.00	4.50	3.75	4.75	4.25	4.00	4.50	4.75	4.75	4.00	4.25	4.25	4.75
		X_f	3.25	2.75	3.25	2.50	3.75	2.25	2.25	4.00	3.75	4.00	4.25	4.25	3.25	2.25
		t_j	-1.37	-1.31	-1.37	-1.18	-1.30	-2.30	-2.10	-0.90	-1.30	-1.40	0.50	0.00	-1.01	-3.25 ^a
		$t_{critical}$	2.447													
	Engr 335 (df = 31)	X_m	4.00	4.00	4.39	3.72	4.67	4.44	3.72	4.56	4.67	4.61	4.06	3.89	3.83	3.94
		X_f	3.53	3.40	3.73	3.13	4.33	3.93	3.07	4.20	4.13	4.07	3.80	3.33	3.20	3.13
		t_j	-1.09	-1.41	-2.15 ^a	-1.26	-1.56	-1.53	-1.43	-1.28	-1.79	-1.92	-1.02	-1.81	-1.63	-1.82
		$t_{critical}$	1.960													
	Engr 103 ($d_f = 26$)	X_m	4.63	4.13	4.13	3.50	4.50	4.31	3.50	4.00	4.56	4.63	3.88	3.75	4.06	4.00
		X_f	3.58	3.75	3.67	3.00	3.92	3.92	2.83	3.92	4.17	4.08	4.00	3.42	3.58	2.92
		t_j	-2.72 ^a	-1.00	-1.32	-1.06	-1.97	-1.27	-1.39	NA	-1.30	-1.74	0.41	-0.97	-1.35	-2.45 ^a
		$t_{critical}$	2.056													
Spring 2012	Engr 429 ($d_f = 21$)	X_m	3.88	3.13	3.13	3.75	4.00	3.50	3.63	4.13	4.13	4.25	3.88	3.75	4.13	4.13
		X_f	3.80	3.67	3.47	3.33	4.07	3.87	3.33	4.47	3.93	4.33	4.47	4.33	4.47	4.27
		t_j	-0.16	1.05	0.68	-0.80	0.14	0.75	-0.58	0.88	-0.33	0.18	2.08 ^a	1.67	1.09	0.40
		$t_{critical}$	2.080													
	Engr 335 ($d_f = 33$)	X_m	3.44	3.82	4.06	2.65	4.29	4.00	2.88	3.76	4.47	4.41	3.94	3.76	3.53	3.06
		X_f	3.78	3.39	3.78	2.61	4.28	3.83	2.39	3.94	4.44	4.33	3.94	3.65	3.47	2.53
		t_j	1.09	-1.40	-0.95	-0.12	-0.06	-0.57	-1.30	N/A	-0.12	-0.28	-0.01	-0.37	-0.18	-1.23
		$t_{critical}$	1.960													
	Engr 104 ($d_f = 13$)	X_m	4.00	3.75	4.63	3.88	4.25	4.13	3.63	4.13	4.63	4.25	4.13	4.13	4.50	4.50
		X_f	4.43	4.00	4.71	4.00	4.43	4.00	3.71	4.71	4.43	4.71	4.14	4.29	4.43	4.14
		t_j	1.04	0.55	0.31	0.26	0.45	-0.32	0.15	1.39	-0.54	1.06	0.04	0.34	-0.19	-0.93
		$t_{critical}$	2.160													

Table 5.d: Data Summary of Statistical Significant Test using Student-t Distribution between Mid Semester Informal Evaluation and End of Semester Student Evaluation of Teaching - Georgia Southern University

Course, Semester,		Evaluation Survey Questionnaire																				
Degrees of Freedom, d_f		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Fall 2012	TCET 3141 ($d_f = 29$)	X_m	3.31	2.94	3.19	2.69	3.44	4.06	3.19	3.56	3.56	4.25	3.19	3.44	3.81	4.13	3.50	3.50	4.31	3.50	2.25	2.38
		X_f	3.33	2.60	3.20	2.53	3.60	4.53	2.27	2.73	2.33	3.00	2.33	2.20	2.60	2.73	2.33	2.79	3.60	2.27	2.93	2.33
		t_j	0.06	-1.24	0.04	-0.46	0.50	1.48	-3.31 ^a	-3.02 ^a	-3.40 ^a	-3.48 ^a	-2.52 ^a	-3.48 ^a	-2.80 ^a	-5.11 ^a	-3.34 ^a	-2.41 ^a	-1.86	-3.70 ^a	1.66	-0.11
		$t_{critical}$	1.96																			
	CENG 3232 ($d_f = 27$)	X_m	3.54	3.58	3.38	2.85	3.04	3.58	3.65	3.69	3.54	3.73	3.35	3.35	3.81	3.92	3.77	3.68	3.77	3.62	2.92	3.38
		X_f	3.07	3.11	3.00	2.77	2.96	3.44	3.36	3.36	3.04	3.39	3.07	3.18	3.15	3.00	2.93	3.19	3.26	3.11	2.93	3.15
t_j		-2.51 ^a	-2.52 ^a	-2.08 ^a	-0.37	-0.53	-0.66	-1.59	-1.68	-1.70	-1.38	-0.95	-0.64	-2.60 ^a	-3.54 ^a	-3.29 ^a	-2.26 ^a	-2.35 ^a	-2.10 ^a	0.01	-0.82	
$t_{critical}$	2.052																					

2014 ASEE Southeast Section Conference

In the aforementioned tables (i.e., Tables 3.a, 3.b, and 3.c), there are 19 semester courses, and each semester course are surveyed through 14 questions. In the Table 3.d, there are 2 semester courses, and each semester course is surveyed through 20 questions. Based on these tables, there are 306 data sets for which statistical significant tests are conducted. Among these data, $t_{critical} \leq t_j$ is observed for 35 data set (indicate by “a” in Tables 5.a, 5.b, 5.c and 5.d), as summarized below in Table 6.

Table 6. Comparison of Semester Courses and Evaluation Questionnaire for which
Test values of t (i.e., $t_j \geq t_{critical}$)

Institution	Semester – Course	Evaluation Questionnaire no.	t_j	$t_{critical}$
University of Southern Indiana	Fall 2009 – Engr. 103	14	-2.50	1.96
	Fall 2009 – Engr. 335	2	2.55	2.056
		3	5.06	
		7	3.02	
		13	2.37	
		14	2.14	
	Spring 2010 – Engr. 335	1	2.13	1.96
		11	-2.77	
	Spring 2011 – Engr. 335	2	-3.09	1.96
		5	-2.12	
7		-3.20		
10		-2.26		
Fall 2011 – Engr. 428	14	-3.25	2.447	
Fall 2011 – Engr. 335	3	-2.15	1.96	
Fall 2011 – Engr. 103	14	-2.45	2.056	
Spring 2012 – Engr. 429	11	2.08	2.080	
Georgia Southern University	Fall 2012 – TCET 3141	7	-3.31	1.96
		8	-3.02	
		9	-3.40	
		10	-3.48	
		11	-2.52	
		12	-3.48	
		13	-2.80	
		14	-5.11	
		15	-3.34	
		16	-2.41	
	18	-3.70		
	Fall 2012 – CENG 3232	1	-2.51	2.052
		2	-2.52	
		3	-2.08	
		13	-2.60	
		14	-3.54	
		15	-3.29	
		16	-2.26	
17		-2.35		
18	-2.10			

Table 6 indicates courses and evaluation questionnaires, where the difference between SET and MIE is statistically significant. Therefore, only 11% (i.e., $35/306 = 11\%$) of the aforementioned data are statistically different. The difference between SET and MIE indices for 89% of these data are statistically insignificant.

Summary and Conclusion

- This work gathers surveyed data for 21 semester courses from University of Southern Indiana (USI) and Georgia Southern University (GSU). For USI data, each semester course is surveyed through 14 questions, generating 266 data sets for SET and MIE comparisons. For GSU data, each semester course is surveyed through 20 questions, generating 40 data sets for SET and MIE comparisons. The statistical significant test is conducted at 5% probability level (two-tailed) using student t-distribution.
- Among 306 surveyed data, only 35 data sets are found to be significantly different from each other. This represents that only 11% of the surveyed data are statistically different.
- Among 306 surveyed data, no significant difference is found in 271 data sets. This represents that 89% of the surveyed data are statistically the same.
- The results obtained from this study indicate that there is a strong statistical correlation between the end of semester Student Evaluation of Teaching (SET) and Mid Semester Informal Evaluation (MIE) indices. Therefore, the Mid Semester Informal Evaluation (MIE) survey data is a reliable predictor of the end of semester Student Evaluation of Teaching (SET) survey data. The MIE can be used to predict the teaching performance of an instructor and student satisfaction of an engineering class.
- Based on the aforementioned analysis, it can be concluded that student's perception of an instructor's performance of teaching does not change significantly after mid semester.

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