Level of Achievement of Topical (Criterion 9) Outcomes 1-9:

The program provides the graduate with a thorough grounding and working knowledge of the chemical sciences, including:

1. General, organic, physical, and analytical chemistry.
2. Material and energy balances on chemical processes, including safety and environmental factors.
3. Thermodynamics of physical and chemical equilibria.
4. Heat, mass, and momentum transfer.
5. Chemical reaction engineering.
6. Continuous and staged separation operations.
7. Process dynamics and control.
8. Process design.
9. Modern experimental and computing techniques.

Assessment Instruments:

1. Fundamentals of Engineering Examination
2. American Chemical Society Organic Chemistry Examination
3. Average Course Grades

Assessment Results:

1. Fundamentals of Engineering Examination. 6 of 11 or 55% of the students in the Class of 2009 passed the FEE.

Time	Subject	Outcome	Questions	USMA ChE	National
AM	Chemistry	1	11	84	86
PM	Chemistry	1	6	56	65
PM	Mass/Energy Balances	2	9	70	74
PM	Safety, Health, Env.	2	3	58	60
AM	Thermodynamics	3	8	68	78
PM	Thermodynamics	3	6	53	68
AM	Fluid Mechanics	4	8	63	71
PM	Fluid Dynamics	4	6	29	54
PM	Heat Transfer	4	6	58	66
PM	Mass Transfer Operations	6	6	52	55
PM	Reaction Engineering	5	6	36	57
PM	Process Control	7	3	58	60
AM	Engineering Economics	8	10	69	76
PM	Process Design	8	6	50	61
AM	Computers	9	8	66	69
PM	Computer Usage & Chem. Engineering	9	3	61	68

2. American Chemical Society Organic Chemistry Examination. The students in the Class of 2009 correctly answered an average of 24 out of 70 questions, or 33.86% on the ACS Organic Chemistry Exam. This compares to the national average of 39.47±12.16, placing us in the 36th percentile.

3. Course Grades for Class of 2009 are shown below (n=13).

		ChE Topical Program Outcomes 1-9								
↓ Course		Advanced Chemistry	Material & Energy Bal.	Thermodynamics	Transport	Reaction Engineering	Separations	Dynamics & Control	Process Design	Experiment & Compute
		1	2	3	4	5	6	7	8	9
CH371	Intro. to Analytical Chem.	3.42								
CH383	Organic Chemistry I	3.49								
CH384	Organic Chemistry II	3.26								
CH481	Physical Chemistry I	3.03		3.03						
CH362	Mass & Energy Balances		3.39							
CH363	Separation Processes						3.54			
CH364	Chem. Reaction Eng.					3.62				
CH459	Chem. Eng. Laboratory									3.82
CH402	Chem. Eng. Process Des.								3.44	
ME311	Thermal-Fluid Systems I			3.64	3.64					
ME312	Thermal-Fluid Systems II			3.26	3.26					
ME480	Heat Transfer				3.51					
XE472	Dyn. Modeling & Control							3.33		
CH482	Physical Chemistry II									
Average Grade		**3.40**	**3.39**	**3.31**	**3.47**	**3.62**	**3.54**	**3.33**	**3.44**	**3.82**
Standard Deviation		0.87	0.58	0.91	0.71	0.47	0.55	0.77	0.60	0.29

Evaluation:

Level of achievement of Outcomes 1-9: 3-Acceptable.

Feedback to Program:

Additional review time was added in the CH400 course to cover FE review. The program needs to measure the affects of this change on the AY10 results. Sustain.

Level of Achievement of General (Criterion 3) Outcome 10:

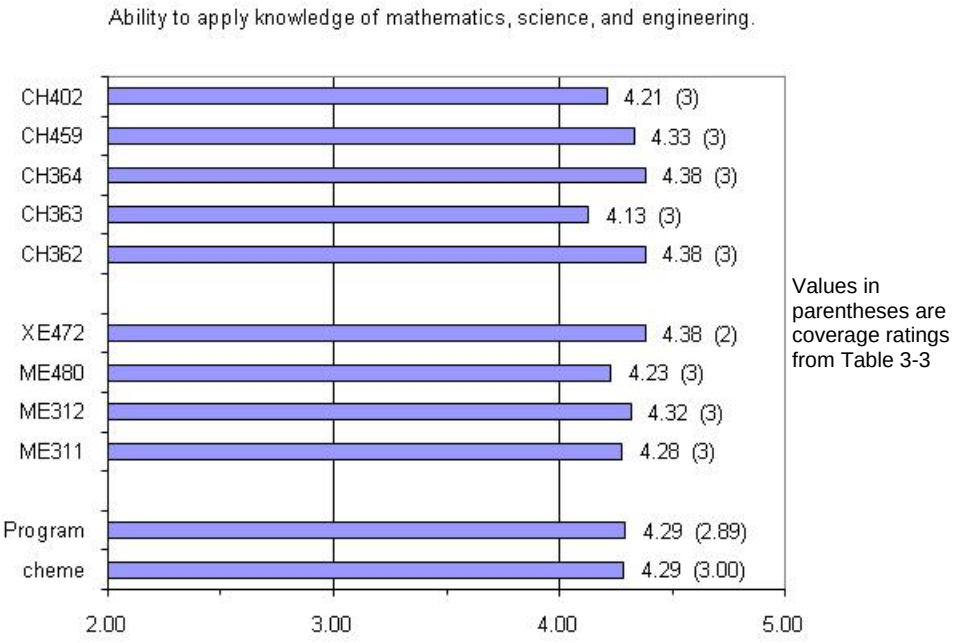
On completion of the chemical engineering program, our graduates will be able to apply knowledge of mathematics, science, and engineering.

Assessment Instruments:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators
2. Fundamentals of Engineering Examination
3. American Chemical Society Examination
4. End of Semester Student Surveys
5. Chemical Engineering Program Exit Survey
6. USMA First Class Academic Survey

Assessment Results:

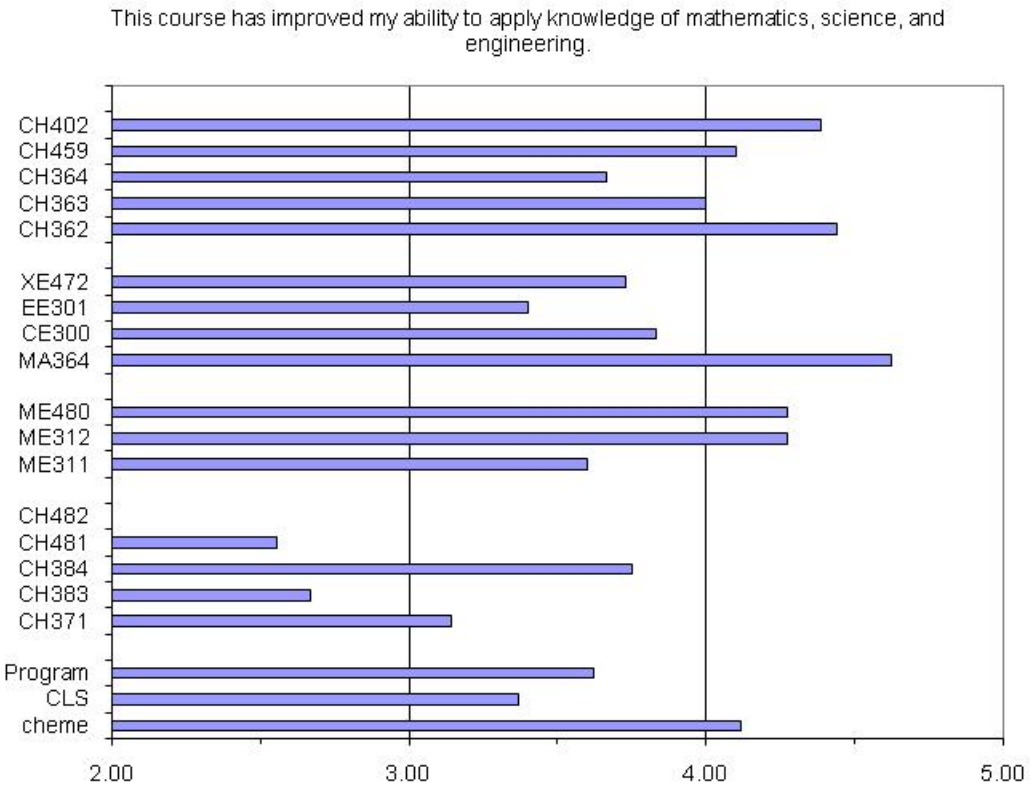
1. Chemical and Mechanical Engineering Course Work Embedded Indicators



2. Fundamentals of Engineering Examination (FEE). As reported above, 6 of 11 or 55% of the students in the Class of 2009 passed the FEE.

3. American Chemical Society Organic Chemistry Examination. The students in the Class of 2009 correctly answered an average of 24 out of 70 questions, or 33.86% on the ACS Organic Chemistry Exam. This compares to the national average of 39.47±12.16, placing us in the 36th percentile.

4. End of Semester Student Surveys



5. Chemical Engineering Program Exit Survey (n=13): 4.46/5.00.

6. USMA First Class Academic Survey

#	**Survey Item**	**Avg. Resp.**
73	Confident in ability to solve real-world technical problems	4.00
76	Discern scientific aspects of complex problems	4.25
77	Select and apply mathematical methods and algorithmic or computational techniques in the course of solving problems	4.50
80	Construct mathematical models to facilitate the understanding and solution of problems	4.50
	USMA Average (n=216)	4.34
	USMA Engineering Average Response (n=46)	4.34
	Chemical Engineering Average Response (n=4)	**4.31**

Evaluation:

Level of achievement of Outcome 10: 4-Very Good

Feedback to Program:

This would have been excellent if FE scores were higher. All course indicators and surveys were very good. Additional review time was added in the CH400 course to cover FE review. The program needs to measure the affects of this change on the AY10 results. Sustain.

Level of Achievement of General (Criterion 3) Outcomes 11:

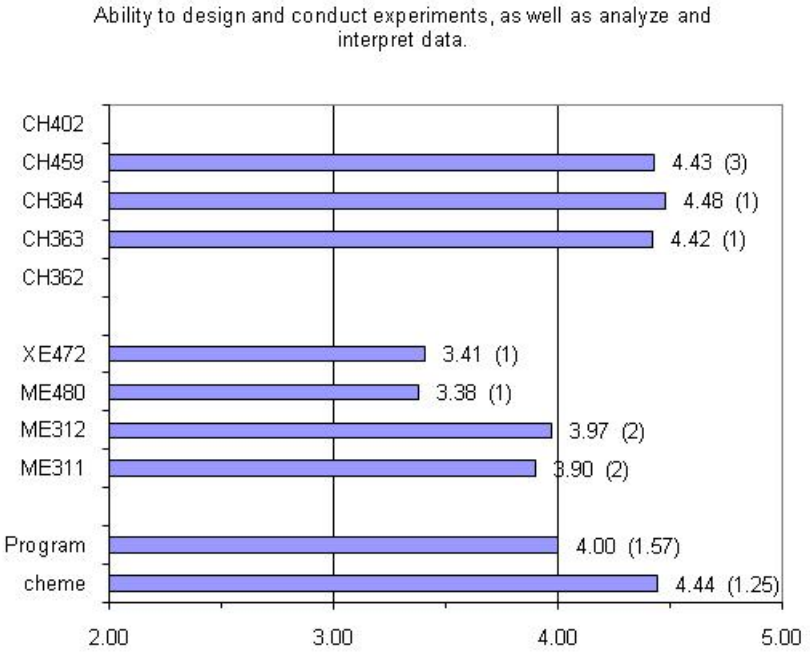
On completion of the chemical engineering program, our graduates will be able to design and conduct experiments, as well as analyze and interpret data.

Assessment Instruments:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators
2. End of Semester Student Surveys
3. Chemical Engineering Program Exit Survey
4. Course Grades in CH459

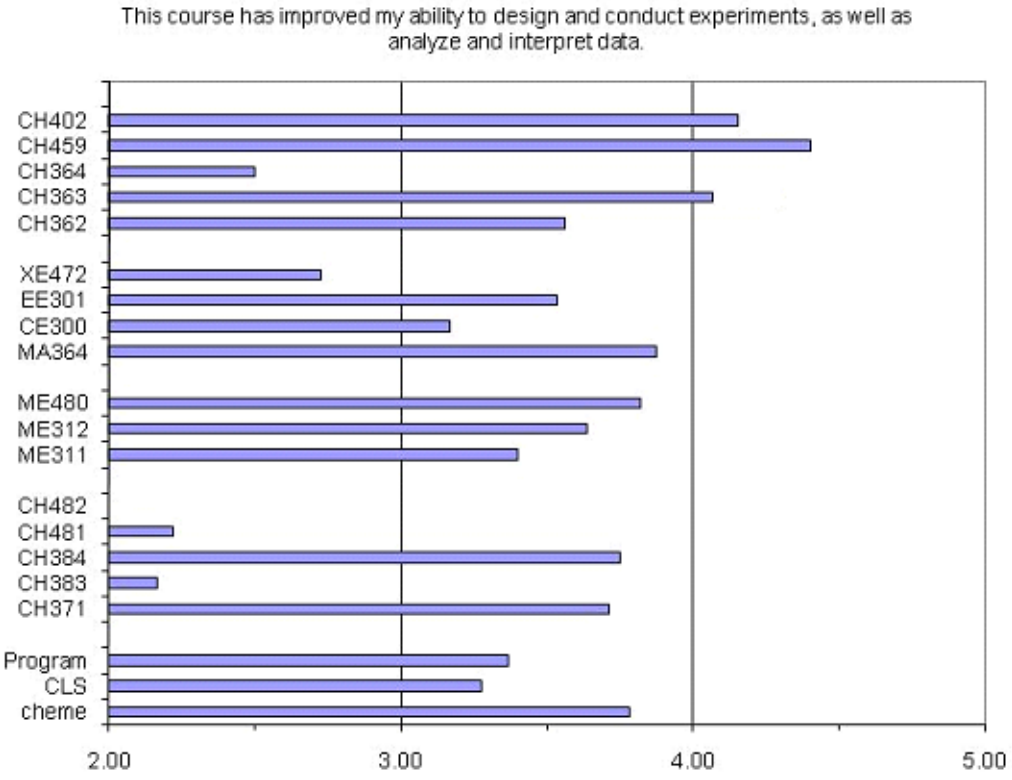
Assessment Results:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators



Values in parentheses are coverage ratings from Table 3-3

2. End of Semester Student Surveys



3. Chemical Engineering Program Exit Survey (n=13): 4.38/5.00.
4. The average course grade in CH459 Chemical Engineering Laboratory was 3.82±0.29 (n=13) with no failures.

Evaluation:

Level of achievement of Outcome 11: 4-Very Good

Feedback to Program:

Key indicators in the C&ME courses could be higher. Other course indicators and surveys were very good. Sustain.

Level of Achievement of General (Criterion 3) Outcomes 12:

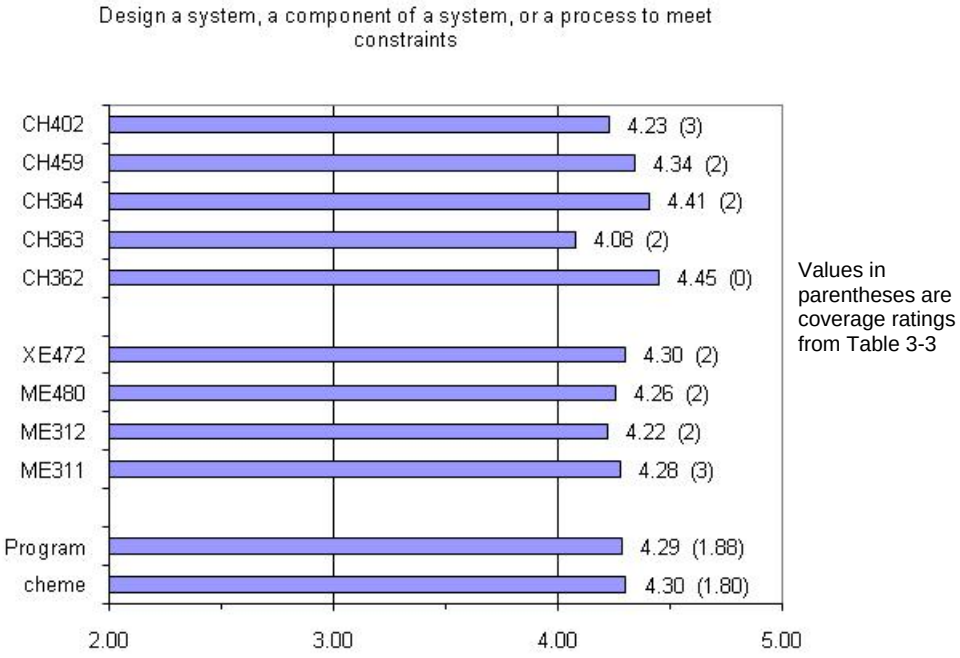
On completion of the chemical engineering program, our graduates will be able to design a system, component, or process to meet desired needs within economic, environmental, social, political, ethical, health and safety, manufacturing, and sustainability constraints.

Assessment Instruments:

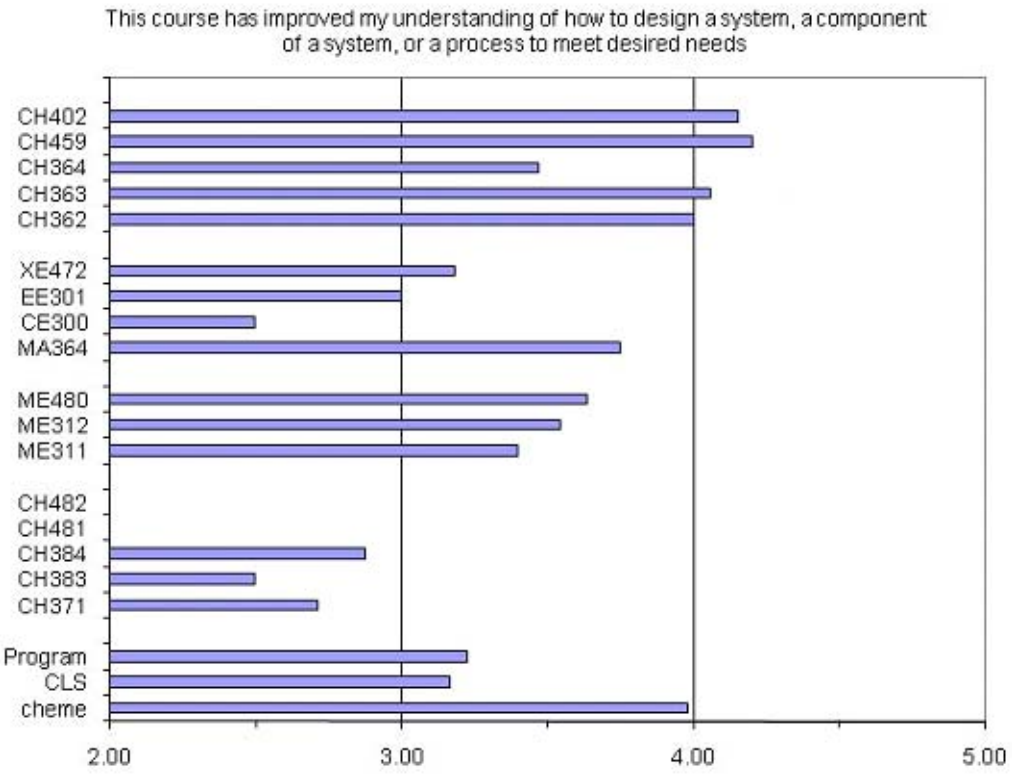
1. Chemical and Mechanical Engineering Course Work Embedded Indicators
2. End of Semester Student Surveys
3. Chemical Engineering Program Exit Survey
4. Course Grades in CH402

Assessment Results:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators



2. End of Semester Student Surveys



3. Chemical Engineering Program Exit Survey (n=13): 4.23/5.00.
4. The average course grade in CH402 Chemical Engineering Process Design was 3.44±0.60 (n=13) with no failures.

Evaluation:

Level of achievement of Outcome 12: 5-Excellent

Feedback to Program:

All key indicators and surveys are excellent. Sustain.

Level of Achievement of General (Criterion 3) Outcomes 13:

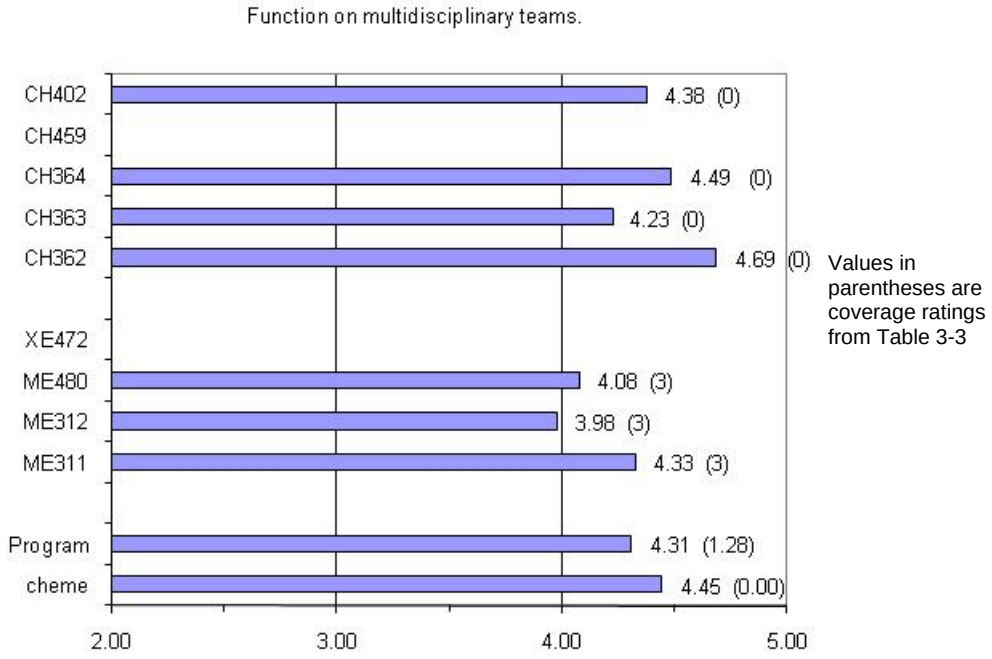
On completion of the chemical engineering program, our graduates will be able to function on multidisciplinary teams.

Assessment Instruments:

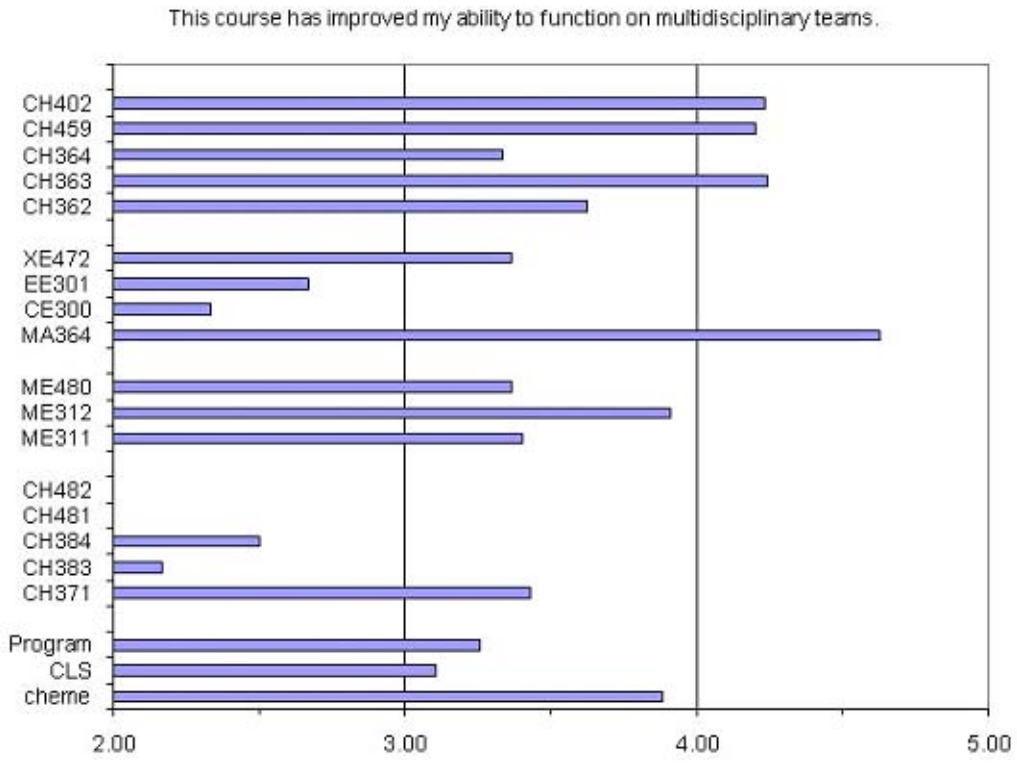
1. Chemical and Mechanical Engineering Course Work Embedded Indicators
2. End of Semester Student Surveys
3. Chemical Engineering Program Exit Survey
4. USMA First Class Academic Survey

Assessment Results:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators



2. End of Semester Student Surveys



3. Chemical Engineering Program Exit Survey (n=13): 4.58/5.00.
4. USMA First Class Academic Survey

#	**Survey Item**	**Avg. Resp.**
68	Confident in ability to apply theories of behavior to leadership situations	4.00
69	Confident in ability to influence behavioral changes in others toward accomplishment of mission	4.25
72	Confident in ability to lead in technologically complex Army	4.25
	USMA Average (n=216)	4.08
	USMA Engineering Average (n=46)	4.36
	Chemical Engineering Average Response (n=4)	**4.00**

Evaluation:

Level of achievement of Outcome 13: 4-Very Good.

Feedback to Program:

Key indicators are very good, but some survey results are a little low. Sustain.

Level of Achievement of General (Criterion 3) Outcomes 14:

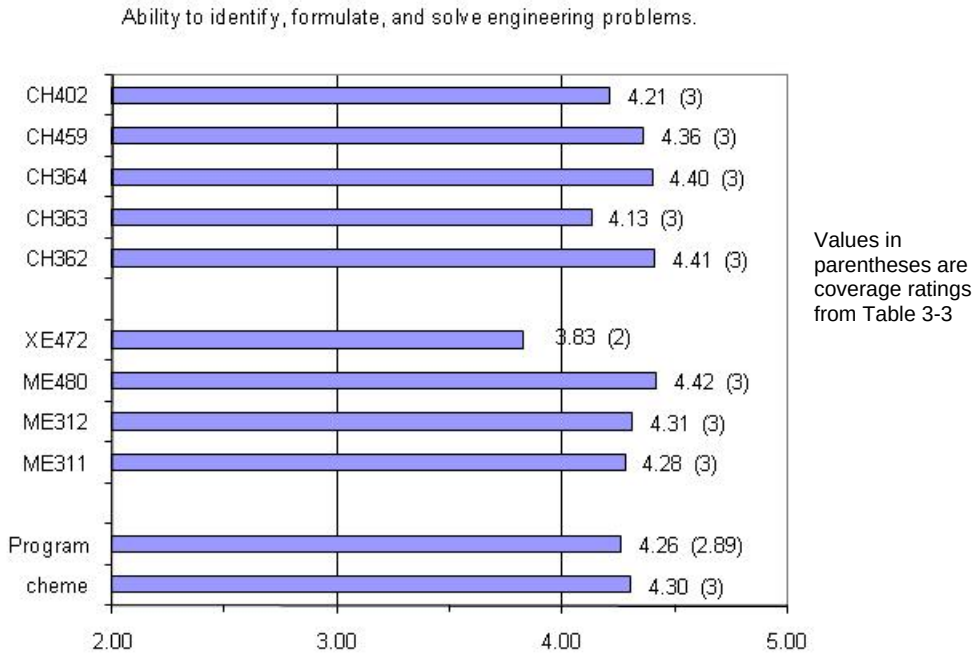
On completion of the chemical engineering program, our graduates will be able to identify, formulate, and solve engineering problems.

Assessment Instruments:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators
2. Fundamentals of Engineering Examination
3. American Chemical Society Examination
4. End of Semester Student Surveys
5. Chemical Engineering Program Exit Survey
6. USMA First Class Academic Survey

Assessment Results:

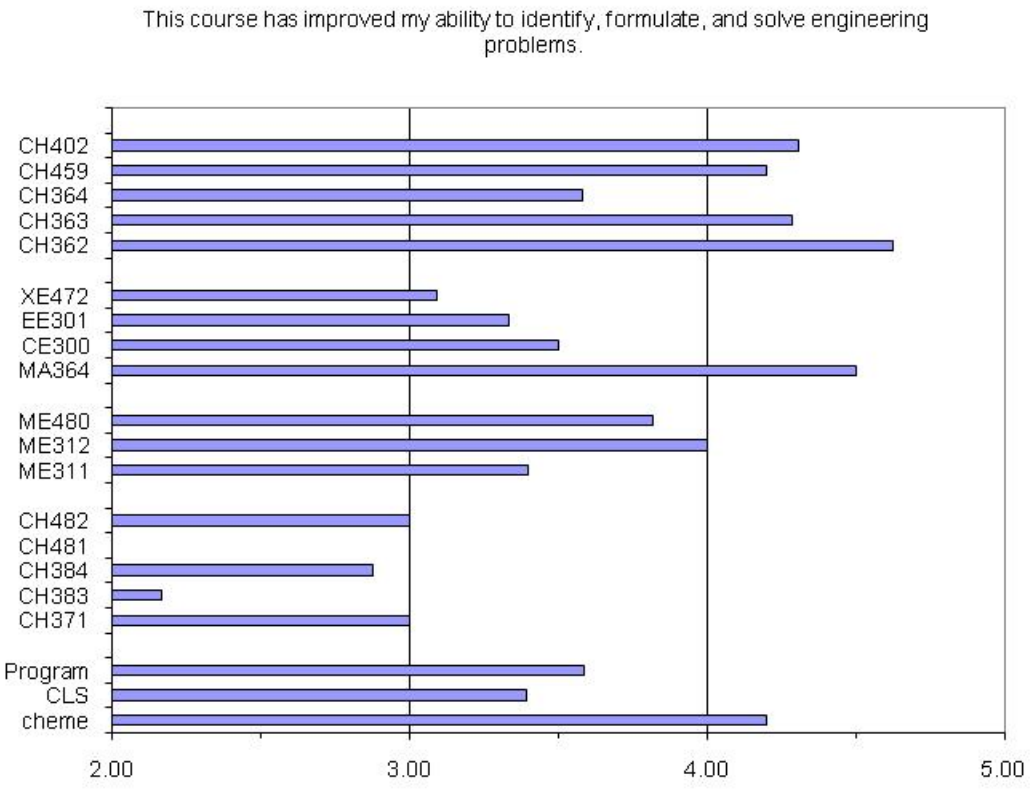
1. Chemical and Mechanical Engineering Course Work Embedded Indicators



2. Fundamentals of Engineering Examination (FEE). As reported above, 6 of 11 or 55% of the students in the Class of 2009 passed the FEE.

3. American Chemical Society Organic Chemistry Examination. The students in the Class of 2007 correctly answered an average of 24 out of 70 questions, or 33.86% on the ACS Organic Chemistry Exam. This compares to the national average of 39.47±12.16, placing us in the 36th percentile.

4. End of Semester Student Surveys



5. Chemical Engineering Program Exit Survey (n=13): 4.31/5.00.

6. USMA First Class Academic Survey

#	Survey Item	Avg. Resp.
73	Confident in ability to solve real-world technical problems	4.00
77	Select and apply mathematical methods and algorithmic or computational techniques in the course of solving problems	4.50
80	Construct mathematical models to facilitate the understanding and solution of problems	4.50
	USMA Average (n=216)	4.33
	USMA Engineering Average (n=46)	4.36
	Chemical Engineering Average Response (n=4)	**4.33**

Evaluation:

Level of achievement of Outcome 14: 3-Acceptable

Feedback to Program:

FE scores could show improvement after addition of review in CH400. Program will monitor progress. Other key indicators and surveys are very good. Sustain.

Level of Achievement of General (Criterion 3) Outcomes 15:

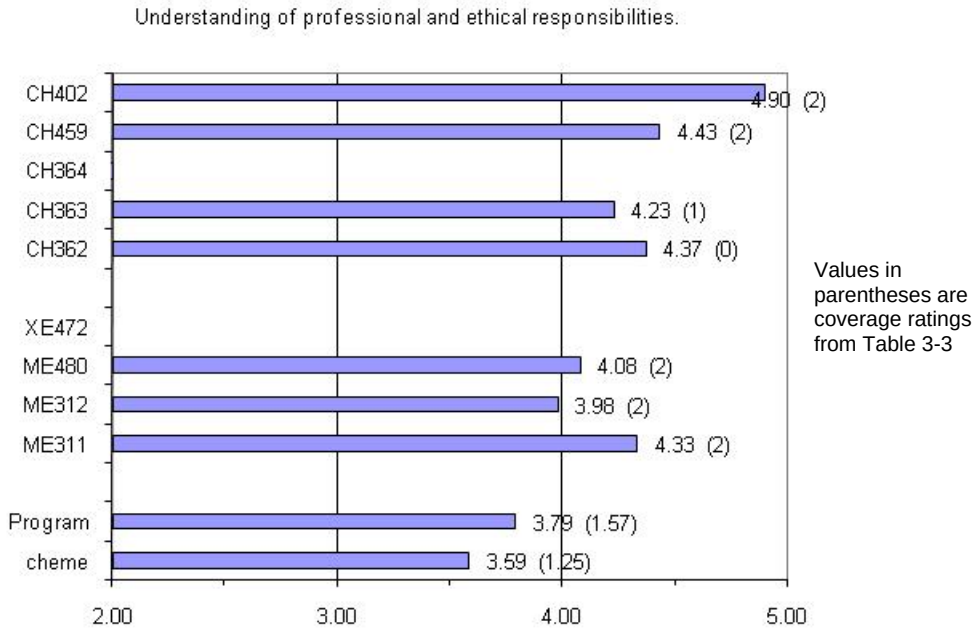
On completion of the chemical engineering program, our graduates will be able to understand professional and ethical responsibilities.

Assessment Instruments:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators
2. Fundamentals of Engineering Examination
3. End of Semester Student Surveys
4. Chemical Engineering Program Exit Survey
5. Completion of Professional Military Ethics Education
6. USMA First Class Academic Survey

Assessment Results:

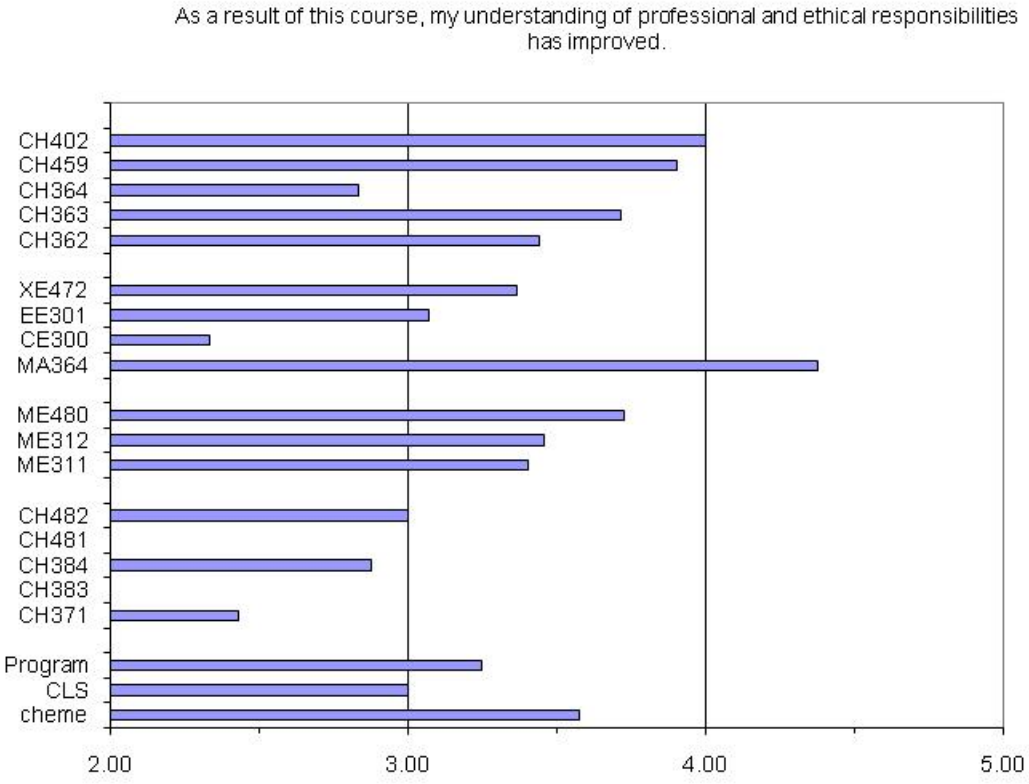
1. Chemical and Mechanical Engineering Course Work Embedded Indicators



2. Fundamentals of Engineering Examination

Time	Subject	Outcome	Questions	USMA %	National %
AM	Ethics and Business Practices	15	8	66	80

3. End of Semester Student Surveys



4. Chemical Engineering Program Exit Survey (n=13): 4.62/5.00.
5. All students successfully completed Professional Military Ethics Education.
6. USMA First Class Academic Survey

#	Survey Item	Avg. Resp.
85	Understand the ethical dimensions of military leadership	4.33
	USMA Average (n=216)	4.47
	USMA Engineering Average (n=46)	4.48
	Chemical Engineering Average Response (n=4)	**4.33**

Evaluation:

Level of achievement of Outcome 15: 3-Acceptable

Feedback to Program:

As with other outcomes related to the exam, FE scores could show improvement after addition of review in CH400. Program will monitor progress. Other key indicators and surveys are very good. Sustain.

Level of Achievement of General (Criterion 3) Outcomes 16:

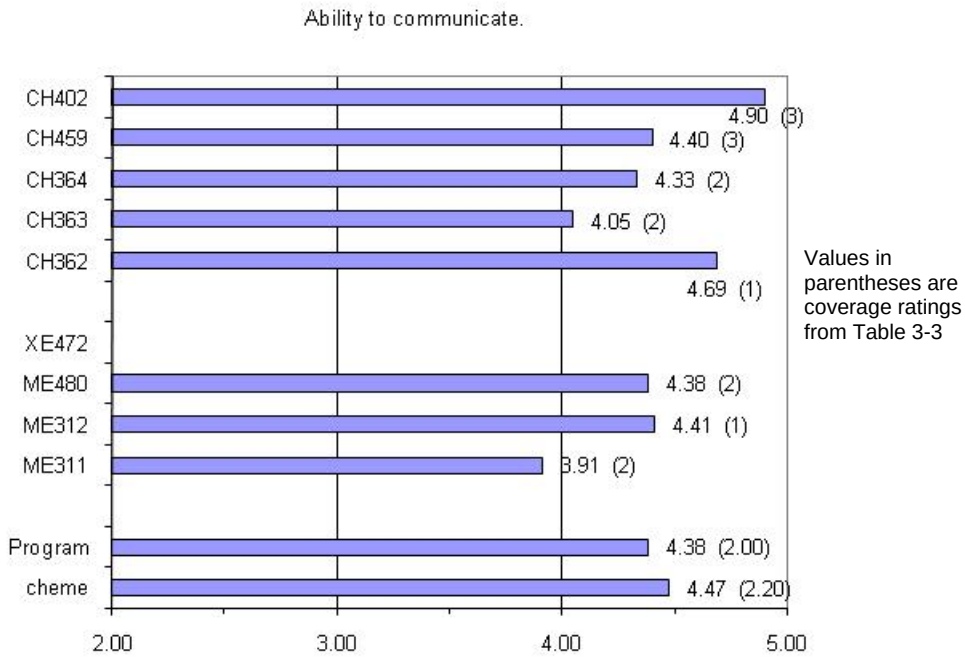
On completion of the chemical engineering program, our graduates will be able to communicate effectively, either orally or in written form.

Assessment Instruments:

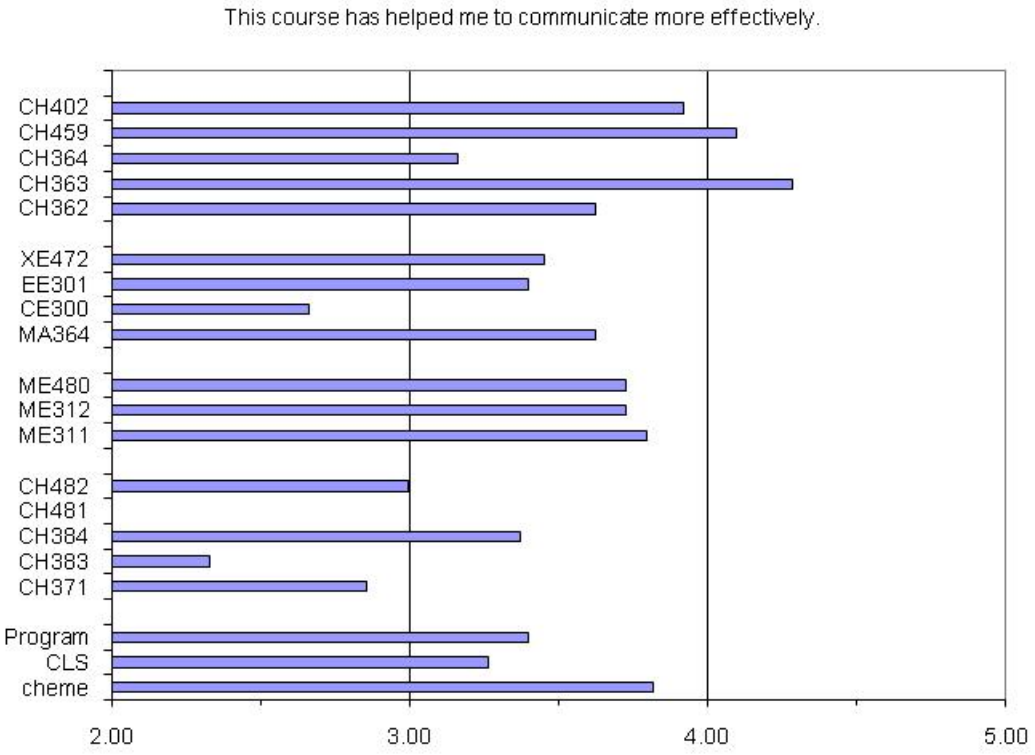
1. Chemical and Mechanical Engineering Course Work Embedded Indicators
2. End of Semester Student Surveys
3. Course Grades in CH459
4. Chemical Engineering Program Exit Survey
5. USMA First Class Academic Survey

Assessment Results:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators



2. End of Semester Student Surveys



3. The average course grade in CH459 Chemical Engineering Laboratory was 3.82±0.29 (n=13) with no failures.
4. Chemical Engineering Program Exit Survey (n=13): 4.62/5.00.
5. USMA First Class Academic Survey

#	**Survey Item**	**Avg. Resp.**
56	Confident in ability to write in coherent, well-organized manner	4.25
57	Confident in ability to speak in coherent, well-organized manner	4.25
58	Confident in ability to communicate as a leader in the Army	4.25
	USMA Average (n=216)	4.23
	USMA Engineering Average (n=46)	4.21
	Chemical Engineering Average Response (n=4)	**4.25**

Evaluation:

Level of achievement of Outcome 16: 5-Excellent

Feedback to Program:

All scores and indicators are high. Sustain.

Level of Achievement of General (Criterion 3) Outcomes 17:

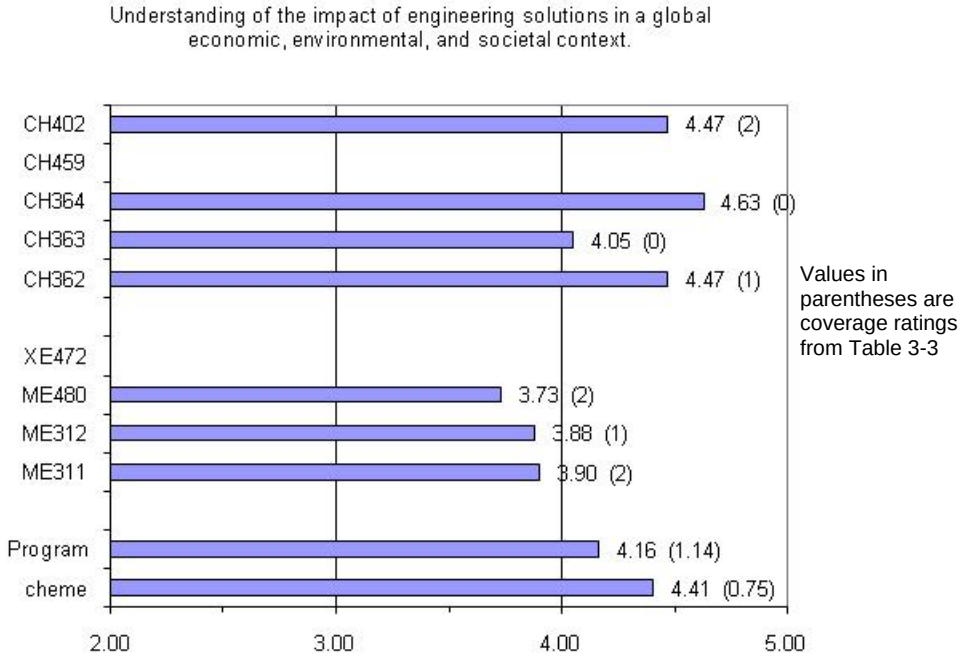
On completion of the chemical engineering program, our graduates will be able to understand the impact of engineering solutions in a global economic, environmental, and societal context.

Assessment Instruments:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators
2. Fundamentals of Engineering Examination
3. End of Semester Student Surveys
4. Chemical Engineering Program Exit Survey
5. USMA First Class Academic Survey

Assessment Results:

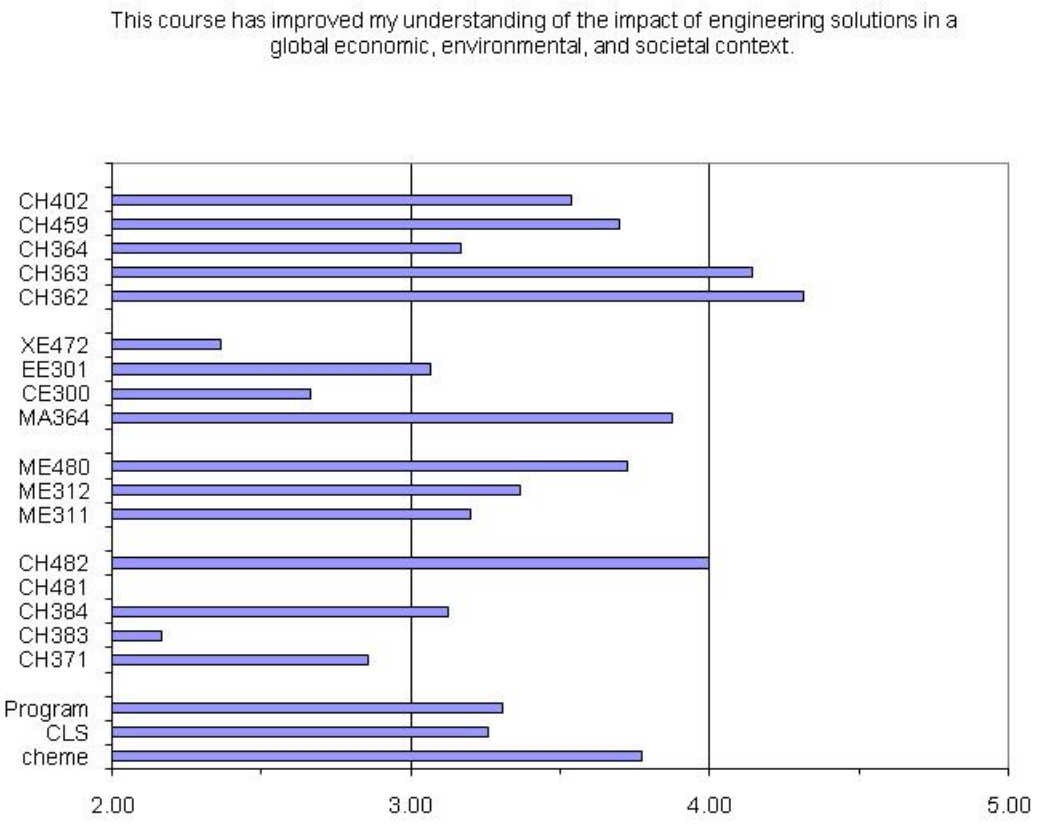
1. Chemical and Mechanical Engineering Course Work Embedded Indicators



2. Fundamentals of Engineering Examination

Time	Subject	Outcome	Questions	USMA %	National %
AM	Engineering Economics	8	10	69	76
PM	Process Design	8	6	50	61

3. End of Semester Student Surveys



4. Chemical Engineering Program Exit Survey (n=13): 4.54/5.00.

5. USMA First Class Academic Survey

#	**Survey Item**	**Avg. Resp.**
62	Confident in ability to analyze contemporary and historical events from different cultural perspectives	4.25
63	Confident in ability to apply understanding of culture to real-world encounters	4.00
64	Confident in ability to understand diversity among people	4.25
65	Confident in ability to view world from the perspective of someone in another culture	4.00
	USMA Average Response (n=216)	4.16
	USMA Engineering Average Response (n=46)	4.33
	Chemical Engineering Average Response (n=4)	**4.13**

Evaluation:

Level of achievement of Outcome 17: 4-Very Good

Feedback to Program:

FE scores were acceptable here. Program will monitor progress after implementation of review in CH400. Other key indicators and surveys are very good. Sustain.

Level of Achievement of General (Criterion 3) Outcomes 18:

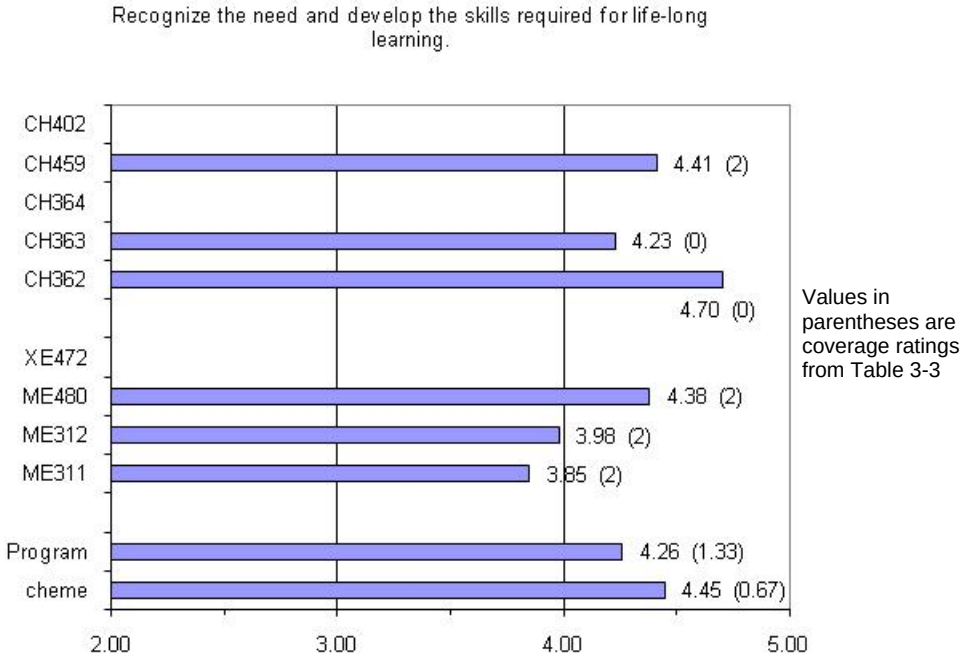
On completion of the chemical engineering program, our graduates will be able to recognize the need and develop the skills required for life-long learning.

Assessment Instruments:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators
2. Fundamentals of Engineering Examination
3. End of Semester Student Surveys
4. Chemical Engineering Program Exit Survey
5. USMA First Class Academic Survey
6. Percent of students taking Fundamentals of Engineering Examination.

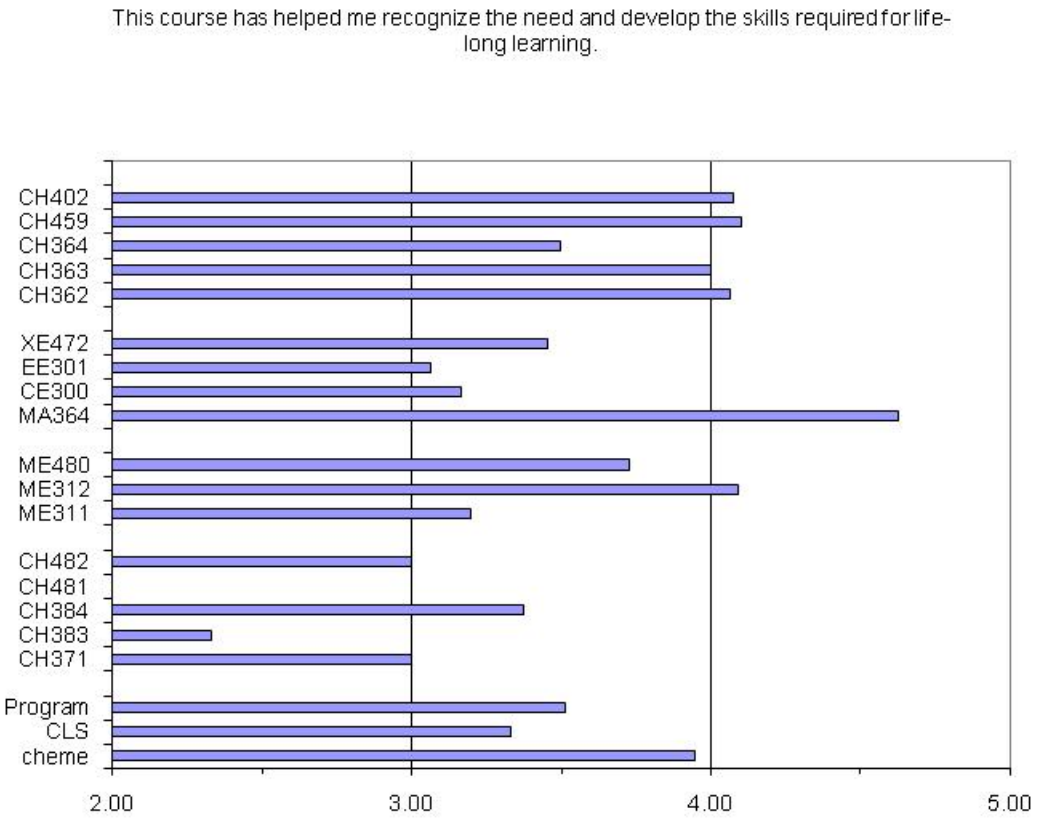
Assessment Results:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators



2. Fundamentals of Engineering Examination (FEE). For the class of 2009, 11 out of 13 cadets (85%) took the FEE exam and 6 of 11 (55%) passed.

3. End of Semester Student Surveys



4. Chemical Engineering Program Exit Survey (n=13): 4.62/5.00.

5. USMA First Class Academic Survey

#	**Survey Item**	**Avg. Resp.**
4	Importance of academic performance at USMA	4.25
75	Comprehend scientific literature appearing in the popular press	4.25
84	Confident in ability to learn more about complex information-age technology	4.25
	USMA Average Response (n=216)	4.41
	USMA Engineering Average Response (n=46)	4.47
	Chemical Engineering Average Response (n=4)	**4.25**

6. Percentage of Students Taking Fundamentals of Engineering Exam: 11/13.

Evaluation:

Level of achievement of Outcome 18: 4-Very Good

Feedback to Program:

Pass rate is only one factor, related to preparation level, which is a measure of Outcome 18. Program will monitor progress after implementation of review. Other key indicators and surveys are very good. Sustain.

Level of Achievement of General (Criterion 3) Outcomes 19:

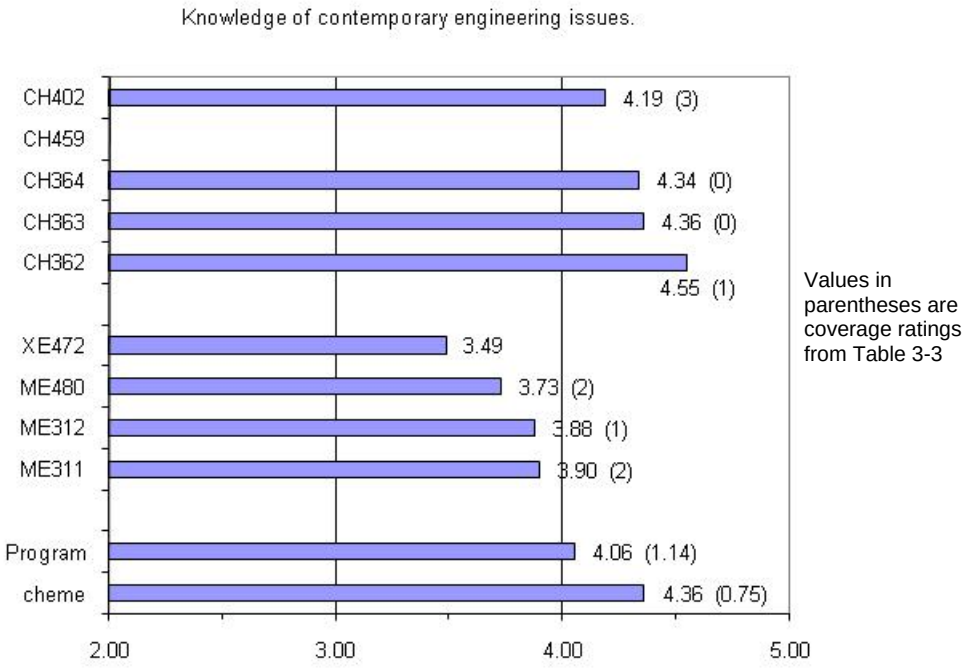
On completion of the chemical engineering program, our graduates will be able to demonstrate knowledge of contemporary issues.

Assessment Instruments:

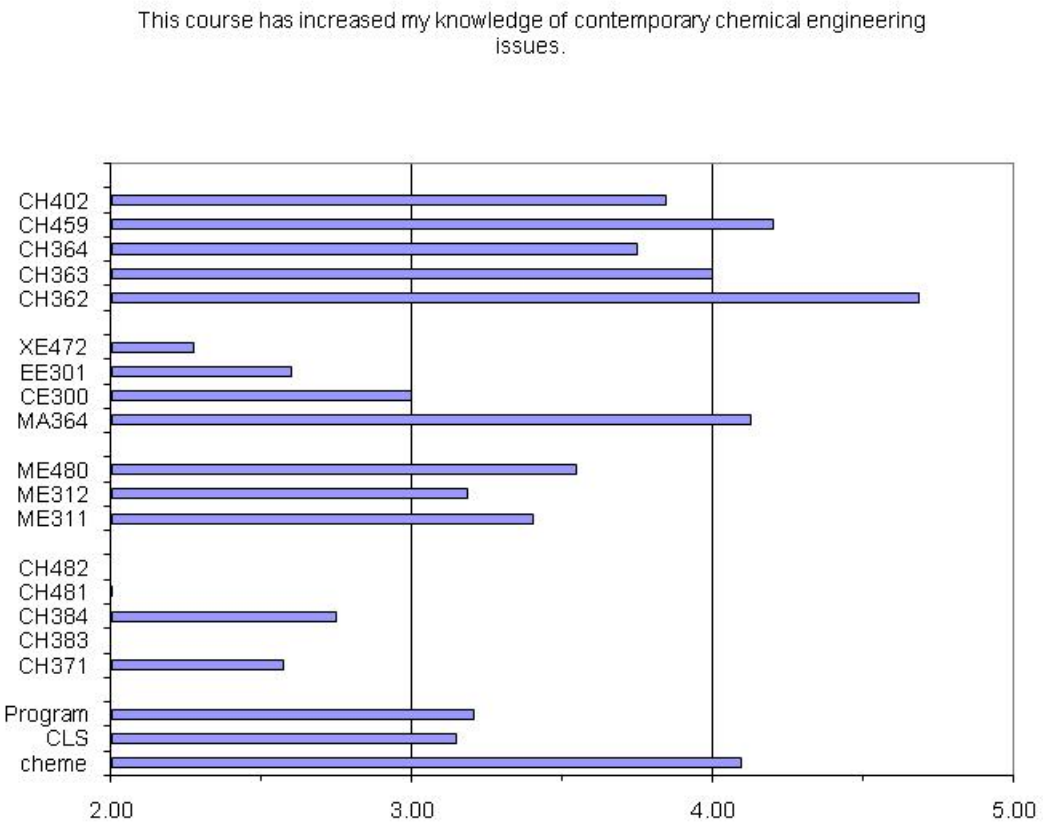
1. Chemical and Mechanical Engineering Course Work Embedded Indicators
2. End of Semester Student Surveys
3. Chemical Engineering Program Exit Survey
4. USMA First Class Academic Survey

Assessment Results:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators



2. End of Semester Student Surveys



3. Chemical Engineering Program Exit Survey (n=13): 4.31/5.00.

4. USMA First Class Academic Survey

#	**Survey Item**	**Avg. Resp.**
62	Confident in ability to analyze contemporary and historical events from different cultural perspectives	4.00
	USMA Average Response (n=216)	4.25
	USMA Engineering Average Response (n=46)	4.33
	Chemical Engineering Average Response (n=4)	**4.00**

Evaluation:

Level of achievement of Outcome 19: 4-Very Good

Feedback to Program:

Key indicators and surveys are very good. Sustain.

Level of Achievement of General (Criterion 3) Outcomes 20:

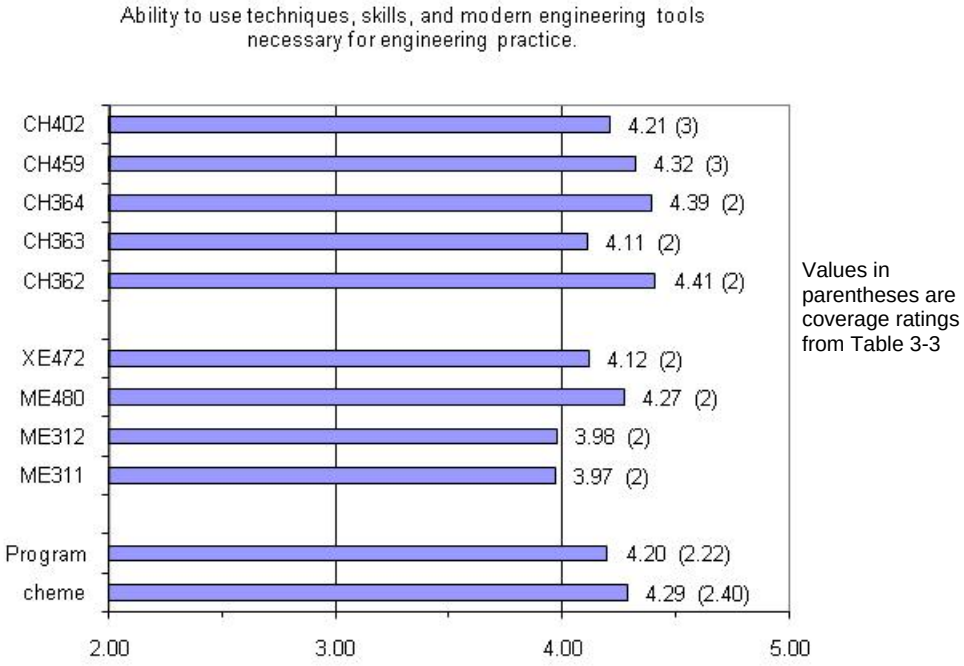
On completion of the chemical engineering program, our graduates will be able to demonstrate an ability to use techniques, skills, and modern engineering tools necessary for engineering practice.

Assessment Instruments:

1. Chemical and Mechanical Engineering Course Work Embedded Indicators
2. Fundamentals of Engineering Examination
3. End of Semester Student Surveys
4. Chemical Engineering Program Exit Survey
5. USMA First Class Academic Survey

Assessment Results:

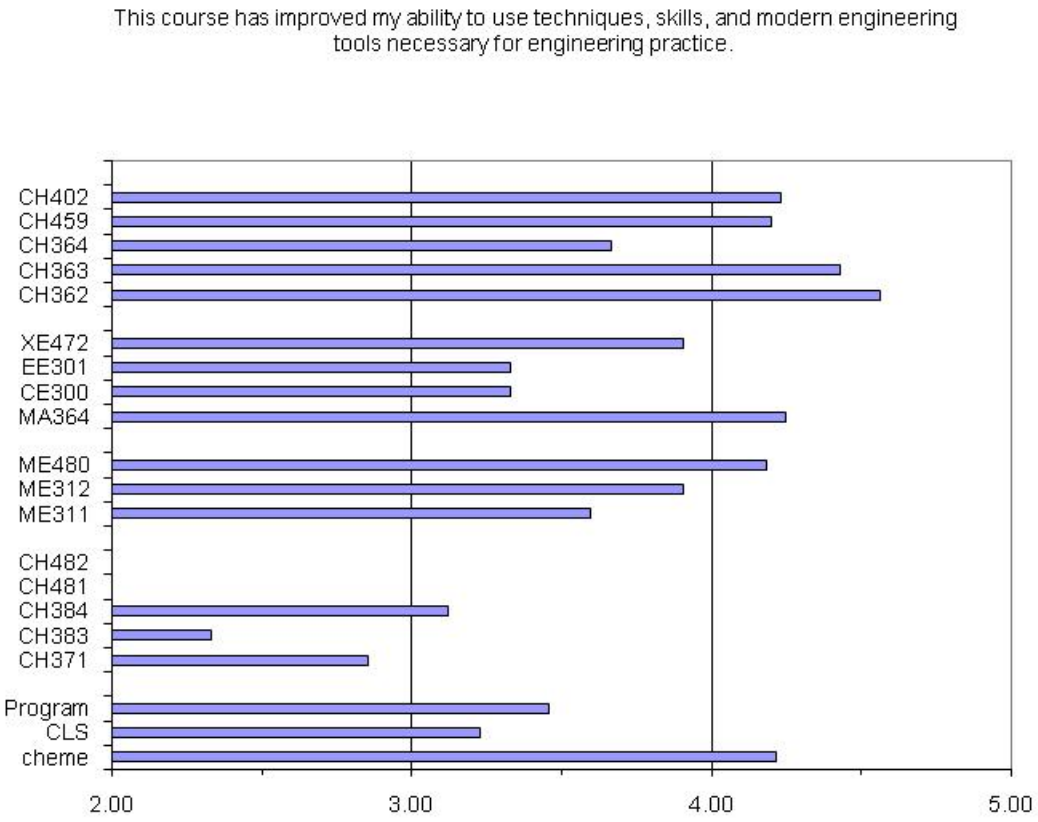
1. Chemical and Mechanical Engineering Course Work Embedded Indicators



2. Fundamentals of Engineering Examination

Time	Subject	Outcome	Questions	USMA %	National %
AM	Computers	9	8	66	69
PM	Computer Usage & Chem. Engineering	9	3	61	68

3. End of Semester Student Surveys



4. Chemical Engineering Program Exit Survey (n=13): 4.69/5.00.

5. USMA First Class Academic Survey

#	Survey Item	Avg. Resp.
73	Confident in ability to solve real-world technical problems using math, science, and other tools	4.00
74	Confident in ability to employ the Army's new technology	4.00
81	Confident in ability to use computers and networks to communicate and collaborate with others	4.00
	USMA Average Response (n=216)	4.36
	USMA Engineering Average Response (n=46)	4.38
	Chemical Engineering Average Response (n=4)	**4.33**

Evaluation:

Level of achievement of Outcome 20:

Feedback to Program:

All key indicators and surveys are excellent. Sustain.