

**Assessment Results for the Marshall University  
Bachelor of Science in Engineering (BSE) Program  
2010-2011**

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**Assessment Report for the Marshall University  
Bachelor of Science in Engineering (BSE) Program  
2010-2011**

**I. Background**

The MU BSE Assessment Plan describes several instruments that are to be used to measure the degree to which the program is achieving its published educational objectives and learning outcomes. The following pages describe the results obtained using each of these instruments, conclusions that can be drawn from the data, and any suggestions for program changes or modifications to the assessment mechanisms that may be warranted.

The BSE educational objectives and learning outcomes are restated below for reference. Data collected using the various tools cited in the BSE Assessment Plan will be discussed in the following pages.

**BSE Program Educational Objectives** - The Marshall University Bachelor of Science in Engineering (BSE) program goals are:

1. BSE graduates will be recognized for their success in designing engineering systems that promote the health, safety, and welfare of the public.
2. BSE graduates will demonstrate their awareness of an engineer's role in contemporary society and their understanding of the societal and environmental contexts of engineering projects.
3. BSE graduates will practice in specific areas of engineering that are consistent with the needs of the region served by Marshall University.

**BSE Program Learning Outcomes** - Marshall University BSE graduates shall have:

- (a) an ability to apply knowledge of mathematics, science and engineering;
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data;
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
- (d) an ability to function on multidisciplinary teams;
- (e) an ability to identify, formulate, and solve engineering problems;
- (f) an understanding of professional and ethical responsibility;
- (g) an ability to communicate effectively;
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
- (i) a recognition of the need for, and an ability to engage in life-long learning;
- (j) a knowledge of contemporary issues;
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## II. ABET Accreditation Status

In September 2009 the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET) conducted an on-campus interview of the MU BSE program after reading a Self-Study Report submitted prior to the visit. As a result of the visit the MU BSE program was awarded accreditation with the next comprehensive accreditation review scheduled for 2015-2016. ABET evaluates programs using eight criteria, and the evaluation can result in one of three findings:

- **Deficiency:** A deficiency indicates that a criterion, policy, or procedure is not satisfied. Therefore, the program is not in compliance with the criterion, policy, or procedure.
- **Weakness:** A weakness indicates that a program lacks the strength of compliance with a criterion, policy, or procedure to ensure that the quality of the program will not be compromised. Therefore, remedial action is required to strengthen compliance with the criterion, policy, or procedure prior to the next evaluation.
- **Concern:** A concern indicates that a program currently satisfies a criterion, policy, or procedure; however, the potential exists for the situation to change such that the criterion, policy, or procedure may not be satisfied.

In the original ABET Draft Statement (October 20, 2009), the visitation team cited no deficiencies, two weaknesses, and one concern. As a result of our due-process response, one weakness was “upgraded” to a concern, leaving a single weakness to resolve before the next evaluation. The two concerns and one weakness, along with our response submitted to ABET, are described below.

The ABET evaluation process is designed to determine compliance with eight criteria:

1. Students – **No deficiencies, weaknesses, or concerns cited.**
2. Program Educational Objectives – Cited as a weakness in the ABET Draft Statement and changed to a concern as a result of the due-process response.
3. Program Outcomes – Cited as a weakness in the ABET Final Statement.
4. Continuous Improvement - **No deficiencies, weaknesses, or concerns cited.**
5. Curriculum - **No deficiencies, weaknesses, or concerns cited.**
6. Faculty – Cited as a concern in the ABET Final Statement, but concern was “**resolved**” as a result of the Interim Report submitted to ABET in June, 2011.
7. Facilities - **No deficiencies, weaknesses, or concerns cited.**
8. Support - **No deficiencies, weaknesses, or concerns cited.**

To summarize, the 2009 visit resulted in finding a weakness in one of the eight ABET criteria by which we are evaluated, Criterion 3.

Before addressing the weakness cited in the November 10, 2011, Draft Statement, I would like to point out that the concern related to Criterion-2 ("No evidence has been provided that assessment tools have been exercised.") seems unreasonable since this criterion relates to the BSE long-term educational objectives; the attributes and accomplishments of graduates three to five years after graduation. Since our first graduating class was, effectively, in May 2009, the earliest that we could apply these

assessment tools would be summer of 2012. Our assessment plan, in fact, has scheduled administration of these tools during the summer of 2012. Nevertheless, this concern does not need to be resolved before the next comprehensive accreditation cycle in 2015-2016. By that time, at least two sets of data will have been collected from graduate and employer surveys.

For the MU BSE program, we have adopted the standard eleven (a) - (k) program learning outcomes, the attributes and skills that graduates should possess at graduation. These outcomes are:

- a. an ability to apply knowledge of mathematics, science and engineering
- b. an ability to design and conduct experiments, as well as to analyze and interpret data;
- c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
- d. an ability to function on multidisciplinary teams;
- e. an ability to identify, formulate, and solve engineering problems;
- f. an understanding of professional and ethical responsibility;
- g. an ability to communicate effectively;
- h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;**
- i. a recognition of the need for, and an ability to engage in life-long learning;**
- j. a knowledge of contemporary issues;**
- k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

In the most recent ABET Draft statement (November 2011), the assessment mechanisms for only three of the 11 were cited as lacking – essentially because our assessment plan relies on results from senior exit surveys and did not include university-wide assessment data for the MU Core Curriculum. These three outcomes - (h), (i), and (j) – are highlighted above. Omission of the MU data was an oversight as the BSE Assessment Plan does indicate that this data will be use for assessing outcomes (h) and (j).

Our response to the ABET Draft Statement included the omitted university assessment data (CLA and NSEE) and a description of our very successful, student-driven Winter Technical Conference. Our belief is that the additional information provided in our response is sufficient justification for removal of the single remaining weakness, and we are requesting this removal as part of our response. Should our request be denied, an additional Interim Report will have to be submitted in the summer of 2012.

### **III. Summary of 2010-2011 BSE Assessment Results**

Detailed data, where available, are provided for each assessment tool identified in the MU BSE Assessment Plan employed during the 2010-2011 academic year. These tools were used to measure published goals for both the BE program educational objectives and the BSE learning outcomes. Where possible, 2010-11 data were combined with data collected from prior years to identify any trends that might exist. A summary of assessment results for BSE educational objectives is provided in Table 1, and Table 3 contains a summary of assessment results for each of the BSE learning outcomes. Detailed

explanations are provided for the various assessment measures, along with observations and recommendations.

**Table 1 - Summary of Assessment Results for MU BSE Program Educational Objectives**

Measure	Objective(s)	Goal
FE Exam Participation	1	100% of BSE graduates will take the FE Exam within one year of graduation.
<b>Participation:</b> 92.3% (2009-2011) <b>Goal Achieved:</b> No <b>Action:</b> None at this time. Continue to monitor. 100% participation may be too ambitious since taking the FE is voluntary. Students who did not take the FE have indicated they plan to take soon after graduating.		
FE Exam Passage Rate	1	MU BSE FE passage rate will be at or above the national level.
<b>Passage Rate:</b> 80.6% (2009-2011) <b>Goal Achieved:</b> Yes (National FE passage rate is approximately 76%) <b>Action:</b> None at this time. Continue to monitor. And trend over time.		
Senior Exit Interviews	1 & 3	All graduating seniors will participate in an exit interview; overall satisfaction with the BSE program will be 80% or higher.
<b>Overall Satisfaction:</b> 80% or higher (2009-2010) <b>Goal Achieved:</b> Yes (See attached detailed report.) <b>Action:</b> None at this time. Continue to monitor and trend over time.		
Alumni Surveys	1, 2, & 3	BSE Alumni will indicate: <ul style="list-style-type: none"> <li>• a cumulative satisfaction with their level of technical preparation of 80% or higher;</li> <li>• employment in areas consistent with the needs of the MU service region;</li> <li>• active participation in regional professional organizations; and</li> <li>• successively higher levels of professional responsibility</li> </ul>
<b>Results:</b> None – 1 <sup>st</sup> administration in 2012 <b>Goal Achieved:</b> N/A <b>Action:</b> None at this time. Continue to monitor. And trend over time		
Employer Surveys	1, 2, & 3	MU BSE employers will indicate: <ul style="list-style-type: none"> <li>• a cumulative satisfaction of 80% or higher with the level MU BSE graduates' technical preparation;</li> <li>• a cumulative satisfaction of 80% or higher regarding BSE graduates' communications and non-technical skills; and</li> <li>• BSE graduates are fulfilling the technical needs of regional employers.</li> </ul>
<b>Results:</b> None – 1 <sup>st</sup> administration in 2012 <b>Goal Achieved:</b> N/A <b>Action:</b> None at this time. Continue to monitor. And trend over time		
PE Exam Participation	1	75% of MU BSE graduates will take the PE Exam
<b>Results:</b> None – 2014 is the earliest date to begin measuring <b>Goal Achieved:</b> N/A <b>Action:</b> None at this time. Continue to monitor. And trend over time		
PE Passage Rate	1	MU BSE PE passage rates will be at or above the national; average
<b>Results:</b> None – 2014 is the earliest date to begin measuring <b>Goal Achieved:</b> N/A <b>Action:</b> None at this time. Continue to monitor. And trend over time		

Each educational objective is assessed using a minimum of two measures. Due to the newness of the program, all tools have not been applied. However, when available, results from the various assessment measures will be compared, as shown in Table 2, to determine if any inconsistencies exist. Using

currently available data, results from FE participation and passage rates seem to be consistent with student perception obtained from surveys of graduating seniors.

**Table 2 – Assessment Measure / Educational Objective Achievement Matrix**

<b>Objective Measure</b>	<b>1</b>	<b>2</b>	<b>3</b>
FE Participation	?	N/A	N/A
FE Passage Rates	+	N/A	N/A
Senior Exit Interviews	+	N/A	+
Alumni Surveys	TBD	TBD	TBD
Employer Surveys	TBD	TBD	TBD
PE Exam Participation	TBD	N/A	N/A
PE Passage Rates	TBD	N/A	N/A

The following matrix identifies the mechanisms and courses used to assess the various BSE learning outcomes. With the exception of the senior exit interviews that measure student perception, all assessment tools provide a direct measure of student achievement.

**Table 3 - Learning Outcomes Assessment Matrix**

<b>Outcome</b>	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>f</b>	<b>g</b>	<b>h</b>	<b>i</b>	<b>j</b>	<b>k</b>
FE Exam	x	x	x		x	x					x
Senior Exit Interview	x	x	x	x	x	x	x	x	x	x	x
MU Core								x		x	
CE331		x <sup>1</sup>									
ENGR451							x <sup>1</sup>				
ENGR452									x <sup>1</sup>		
ENGR453			x <sup>1</sup>	x <sup>1</sup>			x <sup>1</sup>				x <sup>1</sup>

<sup>1</sup> Locally developed rubric

**Table 4 - Summary of Assessment Results for MU BSE Program Learning Outcomes**

Outcome	Measure	Goal	Met
(a)	1	• MU students perform at or above the national average on the FE exam.	Yes
	2	• Students shall perceive that this outcome has been attained	Yes
(b)	1	• MU students perform at or above the national average on the FE exam.	Yes
	2	• Students shall perceive that this outcome has been attained.	Yes
	3	• CE331 Rubric	Yes
(c)	1	• MU students perform at or above the national average on the FE exam.	Yes
	2	• Students shall perceive that this outcome has been attained.	Yes
	3	• ENGR453 Rubric (75% of students rated as “Acceptable” or above)	NO
(d)	2	• Students shall perceive that this outcome has been attained.	Yes
	3	• ENGR453 Rubric	Yes
(e)	1	• MU students perform at or above the national average on the FE exam.	Yes
	2	• Students shall perceive that this outcome has been attained.	Yes
(f)	1	• MU students perform at or above the national average on the FE exam.	Yes
	2	• Students shall perceive that this outcome has been attained.	Yes
(g)	2	• Students shall perceive that this outcome has been attained.	Yes
	3	• ENGR451 Rubric (written presentations) (results pending, 1 <sup>st</sup> use fall 2012) <sup>a</sup>	TBD
	3	• ENGR453 Rubric (oral presentations)	Yes
(h)	2	• Students shall perceive that this outcome has been attained.	Yes
	3	• Results from MU Gen Ed assessment (CLA & NSSE)	Yes
(i)	2	• Students shall perceive that this outcome has been attained.	Yes
	3	• ENGR452 Rubric	Yes
(j)	2	• Students shall perceive that this outcome has been attained.	Yes
	3	• Results from MU Gen Ed assessment (CLA & NSSE)	Yes
(k)	1	• MU students perform at or above the national average on the FE exam.	Yes
	2	• Students shall perceive that this outcome has been attained.	Yes
	3	• ENGR453 Rubric (75% of students rated as “acceptable or above)	Partially

1 – Fundamentals of Engineering exam results.

2 – Senior exit interviews

3 – Locally developed rubric/measures.

<sup>a</sup> ENGR451 was taught by an adjunct in 2011; survey was not administered

#### IV. Observations and Recommendations

**Achievement of Educational Objectives:** While a complete picture cannot be generated until the program has an opportunity to administer and analyze results from alumni surveys, employer surveys, and PE exam results, preliminary indications from other assessment tools provide a high level of confidence that the stated MU BSE program objectives will be met. This level of confidence is based upon the following facts:

1. Voluntary participation in the NCEES FE exam is high (92%).
2. Three-year FE exam passage rates are consistently above the national average.
3. Responses from first senior exit survey indicates a high level of satisfaction with technical instruction and strong (94%) indication of plans to take the NCEES PE exam when eligible.

**Achievement of Learning Outcomes:** Assessment data indicate that the MU BSE learning outcomes are being satisfied. This conclusion is based upon the following facts:

1. MU BSE seniors taking the Fundamentals of Engineering (FE) exam have a passage rate that is consistently higher than the national average for students taking the same exam.
2. With the exception of mathematics and dynamics, MU BSE seniors taking the FE exam appear to score at or above the national average in each subject matter area of the AM (breadth) component of the exam. Using a range of scores based upon a 95% confidence interval, however, BSE scores are at least equivalent to the national average in all subject matter areas of the AM component of the FE exam.
3. MU BSE seniors taking the FE exam appear to meet the stated goal of scoring "at or above the national average level of performance on at least five of the nine subject matter areas of the FE PM Civil Engineering module". Using a 95% confidence interval, MU BSE student scores are equivalent to the national average in all nine subject matter areas of the FE PM civil engineering module. Using raw scores, MU BSE students scored at or above the national average in four of the nine categories in April 2009, seven of the nine in April 2010, and five of nine in April 2011. The substantial improvement between the 2009 and 2010 exam administrations is a very positive indicator.
4. Results obtained via a senior exit survey are consistent with FE exam results. Graduating seniors indicate a high (92%) level of satisfaction that each of the eleven BSE program learning outcomes is being attained.
5. Positive results has been obtained from the application of locally developed rubrics for learning outcomes b, d, and g.

**Recommendations:** While assessment data provide positive indications regarding attainment of the program's published educational objectives and learning outcomes, there are several issues that need special attention.

1. **FE exam performance in mathematics and dynamics.** While it is somewhat premature to conclude that stated goals are not being met, additional attention needs to be given to these two subject matter areas during the FE review process. Should performance still fall below the established goal, curricular changes may be necessary.
2. **Continued analysis and refinement of locally developed rubrics.** Not all of the eleven BSE learning objectives can be measured using the FE exam. Locally developed rubrics are needed to provide data needed for assessing BSE learning outcomes not addressed by the FE exam. In addition, locally developed rubrics will provide an additional measurement for the outcomes that are assessed by the FE exam.
3. **Capstone Design Experience.** Fewer than 75% of the students taking the capstone design course (ENGR453) during the spring of 2011 indicated an "acceptable" response. In order to improve this measure, several changes have been implemented:
  - a. A registered professional engineer with many years of real-world engineering experience will take over the course. This professor will take a novel approach to the

design project by using previously designed and constructed projects provided agencies such as the USACE and/or WV DOH and assign them to the students. Without prior knowledge of the final designs already generated, student will determine what data are needed and “collect” the data to be used in design calculations. Students will have to prepare schedules, maintain time sheets, and produce drawings needed to implement their designs. This approach allows a real-world project to be completed while maintaining some control over time constraints imposed by the academic semester.

- b. One deficiency noticed by faculty and senior students is the lack of acceptable CAD proficiency. In order to address this concern and help insure that seniors have adequate CAD skills, a stronger effort has been made to thread CAD concepts throughout BSE courses, starting in the freshman year and continuing with key courses in subsequent years.

- 4. **Administering alumni and employer surveys.** The first scheduled administration of alumni and employer surveys is scheduled for 2012. While the survey instruments have been developed, a plan is needed to guarantee an adequate response level for each survey. Most likely, the surveys will be administered electronically.

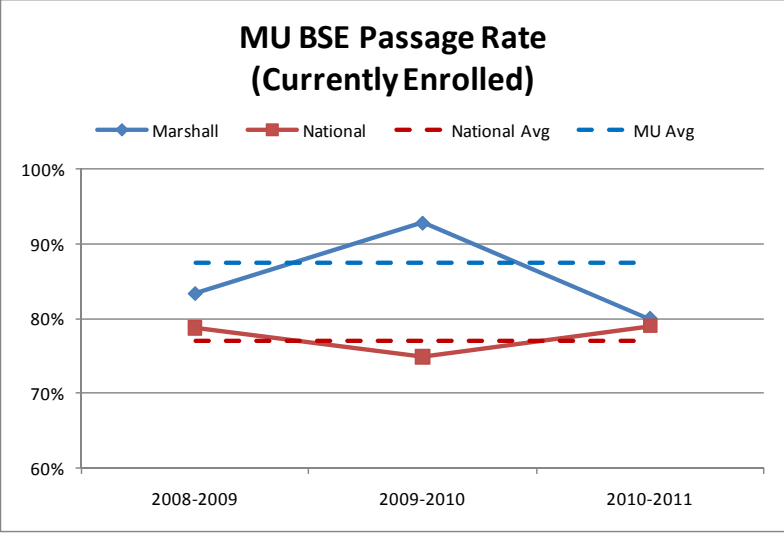
**V. BSE Assessment Detail**

**Table 5 - BSE Assessment Detail: Educational Objectives**

Tool	Objective(s) Addressed	Rationale	Indicator/Goal	Review Schedule
<b>FE Exam Participation</b>	1	Taking and passing the FE exam is a required step in becoming a licensed professional engineer (PE). The primary purpose of PE licensure is to “protect the health, safety, and welfare of the public”.	100% of BSE graduates will take the FE Exam within one year of graduation.	Annually, with participation level and passage rate trends examined over time.
<p><b>Results:</b> To date, the goal of 100% participation has not been met for every graduating class. Participation rates by year are:</p> <ul style="list-style-type: none"> <li>• 2008-2009: 75% (3/4)</li> <li>• 2009-2010: 100% (21/21)</li> <li>• 2010-2011: 86% (12/14)</li> <li>• Overall Average: 92.3% (36/39)</li> </ul> <p>This level of voluntary participation indicates that MU BSE students understand the importance of professional licensure, and that the students have taken the first step to their ultimate goal: professional licensure.</p>				
<p><b>Action Required:</b> None. Continue to monitor participation rate.</p>				

Tool	Objective(s) Addressed	Rationale	Indicator/Goal	Review Schedule
FE Exam Passage Rate	1	Taking and passing the FE exam is a required step in becoming a licensed professional engineer (PE). The primary purpose of PE licensure is to “protect the health, safety, and welfare of the public”.	MU BSE FE passage rate will be at or above the national level.	Annually, with participation level and passage rate trends examined over time.

**Results:** As indicated by the graph below, the passage rate for MU BSE students has been above the national passage rate for all years that MU BSE students have taken the FE exam. The three-year average is also higher than the national average.



**Action Required:** None. Continue to monitor passage rate.

Tool	Objective(s) Addressed	Rationale	Indicator/Goal	Review Schedule
Senior Exit Interviews	1 & 3	Exit interviews will determine employment and/or additional education plans of BSE graduates. Information regarding student perception of technical preparation, as well as other facets of the BSE program, will also be collected during exit interviews.	Graduating seniors will participate in an exit interview indicating their satisfaction with the BSE program / 100% participation with a cumulative satisfaction of 80% or higher.	Annually, with trends examined over time.

**Results:** The first senior exit interviews were conducted during the spring semester of 2010; the results of these interviews are attached to this report. It appears that the goals, 100% participation and an 80% or higher satisfaction level, were achieved. The 100% participation level may have been a result of an easy-to-use online format that was developed and applied in the capstone design course, ENGR453.

**Action Required:** None. Continue to administer exit interviews and trend responses over time.

Tool	Objective(s) Addressed	Rationale	Indicator/Goal	Review Schedule
Alumni Surveys	1, 2 & 3	Alumni surveys will provide information regarding professional accomplishments such as passage of the PE exam, graduate education, and the nature of engineering projects alumni have undertaken since graduation. Alumni surveys will also provide alumni perceptions of each of the BSE objectives.	BSE Alumni will indicate: <ul style="list-style-type: none"> <li>• a cumulative satisfaction with their level of technical preparation of 80% or higher;</li> <li>• employment in areas consistent with the needs of the MU service region;</li> <li>• active participation in regional professional organizations; and</li> <li>• successively higher levels of professional responsibility</li> </ul>	Annually, with each alumnus receiving the survey once every three years, starting in June, 2012.
<b>Results:</b> None. First administration of these surveys <sup>1</sup> is scheduled for 2012.				
<b>Action Required:</b> N/A				

Tool	Objective(s) Addressed	Rationale	Indicator/Goal	Review Schedule
Employer Surveys	1, 2 & 3	Employer surveys will provide employer perception regarding each of the BSE objectives.	MU BSE employers will indicate: <ul style="list-style-type: none"> <li>• a cumulative satisfaction of 80% or higher with the level MU BSE graduates' technical preparation;</li> <li>• a cumulative satisfaction of 80% or higher regarding BSE graduates' communications and non-technical skills; and</li> <li>• BSE graduates are fulfilling the technical needs of regional employers.</li> </ul>	Annually, with each employer receiving the survey once every three years, starting in June, 2012.
<b>Results:</b> None. First administration of these surveys <sup>1</sup> is scheduled for 2012.				
<b>Action Required:</b> N/A				

<sup>1</sup>Copies of the proposed alumni and employer surveys are included in the MU BSE Assessment Plan.

Tool	Objective(s) Addressed	Rationale	Indicator/Goal	Review Schedule
PE Exam Participation	1	After acquiring adequate experience, taking and passing the PE exam is a required step in becoming a licensed professional engineer (PE). The primary purpose of PE licensure is to "protect the health, safety, and welfare of the public".	75% of MU BSE graduates will take the PE Exam	Annually, beginning in 2014, with participation level and passage rate trends examined over time.
<b>Results:</b> None. The first MU BSE graduates will not be eligible to take the PE exam until acquiring the required four years of professional experience.				
<b>Action Required:</b> N/A				

Tool	Objective(s) Addressed	Rationale	Indicator/Goal	Review Schedule
PE Exam Passage Rates	1	After acquiring adequate experience, taking and passing the PE exam is a required step in becoming a licensed professional engineer (PE). The primary purpose of PE licensure is to “protect the health, safety, and welfare of the public”.	MU BSE PE passage rates will be at or above the national average.	Annually, beginning in 2014, with participation level and passage rate trends examined over time.
<b>Results:</b> None. The first MU BSE graduates will not be eligible to take the PE exam until acquiring the required four years of professional experience.				
<b>Action Required:</b> N/A				

### BSE Assessment Detail: Learning Outcomes

As stated in the NCEES white paper titled *Using the Fundamentals of Engineering (FE) Exam as an Outcomes Assessment Tool*, the FE exam can be used to assess six of the eleven MU BSE learning outcomes:

- (a) an ability to apply knowledge of mathematics, science, and engineering;
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data;
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
- (e) an ability to identify, formulate, and solve engineering problems;
- (f) an understanding of professional and ethical responsibility; and
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

By analyzing the performance over time of MU students in the subject matter areas of the general (AM) component of the exam and the discipline-specific (PM) component of the exam, areas of needed improvement can be identified. Below are the performance goals established by the BSE faculty for the various subject matter areas of the FE exam (civil discipline). An evaluation of whether the established goals have been met is also given. It must be noted, however, that two years’ of data are not sufficient to identify any significant performance trends.

Detailed three-year (April 2009 - April 2011) performance results are also shown for each subject matter area for both the AM and PM components of the FE exam. The number of students taking the exam in 2011 was low (10), and may not provide the same statistical significance as a larger sample size. While the FE exam is administered nationally twice per year, in October and April, the data presented are from the April exams only. Nationally, there is fluctuation in results in the exam given in the fall compared to the exam given in the spring semesters. Greater consistency will be attained by using only April exam results. Furthermore, a greater number of MU students take the exam in April, after they have taken most of their required professional courses. For example, in reports obtained from NCEES, three “currently enrolled” students took the exam in October 2009, while 13 “currently enrolled” students took the exam in April 2010. Using the larger sample size from the April exam administration will also

provide greater statistical reliability. A multi-year average would also tend to compensate for the relatively small yearly sample sizes. It is expected that approximately 20 students will take the 2012 FE exam.

**Table 6 – MU BSE FE AM Performance**

FE AM Subject Matter Area	MU BSE Target Performance	Goal Achieved?
Mathematics	At or above the national average	No
Engineering Probability and Statistics	At or above the national average	Yes
Chemistry	At or above the national average	Yes
Computers	At or above the national average	Yes
Ethics and Business Practices	At or above the national average	Yes
Engineering Economics	At or above the national average	Yes
Engineering Mechanics: Statics	At or above the national average	Inconclusive <sup>1</sup>
Engineering Mechanics: Dynamics	At or above the national average	No
Strength of Materials	At or above the national average	Yes
Material Properties	At or above the national average	Yes
Fluid Mechanics	At or above the national average	Yes
Electricity and Magnetism	At or above the national average	Yes
Thermodynamics	At or above the national average	Yes

<sup>1</sup> Below the national average in 2009, above in 2010, and lower in 2011; will continue to monitor.

Two potential problem areas may have been identified: mathematics and dynamics. Greater attention may need to be given to these subject matter areas, depending on future exam results. The BSE faculty has reconsidered its initial decision to not establish a performance goal in the area of Material Properties. The original rationale assumed that performance of MU BSE students should be lower than the national average since there is no general materials course required in the MU BSE curriculum. Over the last two exam administrations, however, the performance of MU BSE students has been statistically equivalent to or higher than the national performance. This result may be due to the fact that MU BSE students are being compared to not all FE exam takers, but only those examinees opting to take the civil engineering module. It is likely that most of these students would not have had a general, dedicated materials course either. Consequently, the MU BSE faculty has revised its performance goal to read:

***MU BSE graduates shall perform at or above the national average level of performance in all subject matter areas of the FE AM exam module.***

**Table 7a – MU BSE FE AM Performance: Mathematics**

FE AM Subject Matter Area	MU BSE Target Performance												
Mathematics	At or above the national average												
<h3>FE Comparison: Mathematics</h3> <table border="1"> <caption>Data for FE Comparison: Mathematics</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>68%</td> <td>67%</td> </tr> <tr> <td>April 2010</td> <td>49%</td> <td>58%</td> </tr> <tr> <td>April 2011</td> <td>57%</td> <td>66%</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	68%	67%	April 2010	49%	58%	April 2011	57%	66%
Year	Marshall (%)	National (%)											
April 2009	68%	67%											
April 2010	49%	58%											
April 2011	57%	66%											
<p><b>Observations:</b> MU student performance was statistically equivalent to the national level (68% compared to 67%) for the 2009 exam, but was significantly lower (49% compared to 56%) in 2010.</p> <p><b>Action:</b> Continue to monitor; more emphasis will be given to this area during the FE exam reviews. Arrange a meeting with the Math department to discuss.</p>													

**Table 7b – MU BSE FE AM Performance: Probability and Statistics**

FE AM Subject Matter Area	MU BSE Target Performance												
Probability and Statistics	At or above the national average												
<h3>FE Comparison: Probability and Statistics</h3> <table border="1"> <caption>Data for FE Comparison: Probability and Statistics</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>54%</td> <td>53%</td> </tr> <tr> <td>April 2010</td> <td>65%</td> <td>62%</td> </tr> <tr> <td>April 2011</td> <td>58%</td> <td>62%</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	54%	53%	April 2010	65%	62%	April 2011	58%	62%
Year	Marshall (%)	National (%)											
April 2009	54%	53%											
April 2010	65%	62%											
April 2011	58%	62%											
<p><b>Observations:</b> MU student performance appears to be statistically equivalent to the national level of performance.</p> <p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 7c – MU BSE FE AM Performance: Chemistry**

FE AM Subject Matter Area	MU BSE Target Performance												
Chemistry	At or above the national average												
<h3>FE Comparison: Chemistry</h3> <table border="1"> <caption>Data for FE Comparison: Chemistry</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>64</td> <td>64</td> </tr> <tr> <td>April 2010</td> <td>86</td> <td>76</td> </tr> <tr> <td>April 2011</td> <td>63</td> <td>64</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	64	64	April 2010	86	76	April 2011	63	64
Year	Marshall (%)	National (%)											
April 2009	64	64											
April 2010	86	76											
April 2011	63	64											
<p><b>Observations:</b> MU student performance appears to be statistically equivalent to or higher than the national level of performance.</p>													
<p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 7d – MU BSE FE AM Performance: Computers**

FE AM Subject Matter Area	MU BSE Target Performance												
Computers	At or above the national average												
<h3>FE Comparison: Computers</h3> <table border="1"> <caption>Data for FE Comparison: Computers</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>69</td> <td>62</td> </tr> <tr> <td>April 2010</td> <td>80</td> <td>69</td> </tr> <tr> <td>April 2011</td> <td>70</td> <td>70</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	69	62	April 2010	80	69	April 2011	70	70
Year	Marshall (%)	National (%)											
April 2009	69	62											
April 2010	80	69											
April 2011	70	70											
<p><b>Observations:</b> MU student performance appears to be higher than or equal to the national level of performance.</p>													
<p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 7e – MU BSE FE AM Performance: Ethics and Business Practice**

FE AM Subject Matter Area	MU BSE Target Performance												
Ethics	At or above the national average												
<h3>FE Comparison: Ethics</h3> <table border="1"> <caption>Data for FE Comparison: Ethics</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>90</td> <td>83</td> </tr> <tr> <td>April 2010</td> <td>86</td> <td>78</td> </tr> <tr> <td>April 2011</td> <td>83</td> <td>75</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	90	83	April 2010	86	78	April 2011	83	75
Year	Marshall (%)	National (%)											
April 2009	90	83											
April 2010	86	78											
April 2011	83	75											
<p><b>Observations:</b> MU student performance appears to be higher than the national level of performance.</p>													
<p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 7f – MU BSE FE AM Performance: Engineering Economics**

FE AM Subject Matter Area	MU BSE Target Performance												
Engineering Economics	At or above the national average												
<h3>FE Comparison: Engineering Economics</h3> <table border="1"> <caption>Data for FE Comparison: Engineering Economics</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>82</td> <td>76</td> </tr> <tr> <td>April 2010</td> <td>72</td> <td>61</td> </tr> <tr> <td>April 2011</td> <td>59</td> <td>63</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	82	76	April 2010	72	61	April 2011	59	63
Year	Marshall (%)	National (%)											
April 2009	82	76											
April 2010	72	61											
April 2011	59	63											
<p><b>Observations:</b> MU student performance appears to be higher than or stistically equivalent to the national level of performance.</p>													
<p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 7g – MU BSE FE AM Performance: Statics**

FE AM Subject Matter Area	MU BSE Target Performance												
Engineering Mechanics: Statics	At or above the national average												
<h3>FE Comparison: Statics</h3> <table border="1"> <caption>FE Comparison: Statics Data</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>56</td> <td>69</td> </tr> <tr> <td>April 2010</td> <td>80</td> <td>74</td> </tr> <tr> <td>April 2011</td> <td>41</td> <td>57</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	56	69	April 2010	80	74	April 2011	41	57
Year	Marshall (%)	National (%)											
April 2009	56	69											
April 2010	80	74											
April 2011	41	57											
<p><b>Observations:</b> While MU student performance was lower in 2009 (56% compared to 69%), significant improvement occurred in 2010 and MU students performed at a higher level (80% versus 74%). 2011 results are a concern and will be discussed.</p>													
<p><b>Action:</b> Continue to monitor and emphasize subject during FE reviews.</p>													

**Table 7h – MU BSE FE AM Performance: Dynamics**

FE AM Subject Matter Area	MU BSE Target Performance												
Engineering Mechanics: Dynamics	At or above the national average												
<h3>FE Comparison: Dynamics</h3> <table border="1"> <caption>FE Comparison: Dynamics Data</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>43</td> <td>49</td> </tr> <tr> <td>April 2010</td> <td>62</td> <td>68</td> </tr> <tr> <td>April 2011</td> <td>56</td> <td>62</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	43	49	April 2010	62	68	April 2011	56	62
Year	Marshall (%)	National (%)											
April 2009	43	49											
April 2010	62	68											
April 2011	56	62											
<p><b>Observations:</b> MU student performance appears to be about 6% lower than the national level of performance.</p>													
<p><b>Action:</b> Continue to monitor; add additional emphasis during the FE review sessions.</p>													

**Table 7i – MU BSE FE AM Performance: Strength of Materials**

FE AM Subject Matter Area	MU BSE Target Performance												
Strength of Materials	At or above the national average												
<h3>FE Comparison: Strength of Materials</h3> <table border="1"> <caption>Data for FE Comparison: Strength of Materials</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>70</td> <td>70</td> </tr> <tr> <td>April 2010</td> <td>61</td> <td>56</td> </tr> <tr> <td>April 2011</td> <td>53</td> <td>60</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	70	70	April 2010	61	56	April 2011	53	60
Year	Marshall (%)	National (%)											
April 2009	70	70											
April 2010	61	56											
April 2011	53	60											
<p><b>Observations:</b> MU student performance was statistically equivalent in 2009, but appeared to improve relative to the national level in 2010 (61% versus 56%). 2011 results may be statistically equivalent.</p>													
<p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 7j – MU BSE FE AM Performance: Material Properties**

FE AM Subject Matter Area	MU BSE Target Performance												
Engineering Materials	No goal established (no general materials course is taught as part of the BSE curriculum)												
<h3>FE Comparison: Material Properties</h3> <table border="1"> <caption>Data for FE Comparison: Material Properties</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>54</td> <td>56</td> </tr> <tr> <td>April 2010</td> <td>70</td> <td>62</td> </tr> <tr> <td>April 2011</td> <td>46</td> <td>51</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	54	56	April 2010	70	62	April 2011	46	51
Year	Marshall (%)	National (%)											
April 2009	54	56											
April 2010	70	62											
April 2011	46	51											
<p><b>Observations:</b> MU performance appears to be statistically equivalent or higher than the national level of performance.</p>													
<p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 7k – MU BSE FE AM Performance: Fluid Mechanics**

FE AM Subject Matter Area	MU BSE Target Performance												
Fluid Mechanics	At or above the national average												
<h3>FE Comparison: Fluid Mechanics</h3> <table border="1"> <caption>Data for FE Comparison: Fluid Mechanics</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>71</td> <td>66</td> </tr> <tr> <td>April 2010</td> <td>81</td> <td>64</td> </tr> <tr> <td>April 2011</td> <td>66</td> <td>61</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	71	66	April 2010	81	64	April 2011	66	61
Year	Marshall (%)	National (%)											
April 2009	71	66											
April 2010	81	64											
April 2011	66	61											
<p><b>Observations:</b> MU student performance appears to be higher than the national level.</p> <p><b>Action:</b> Continue to monitor; no action at this time.</p>													

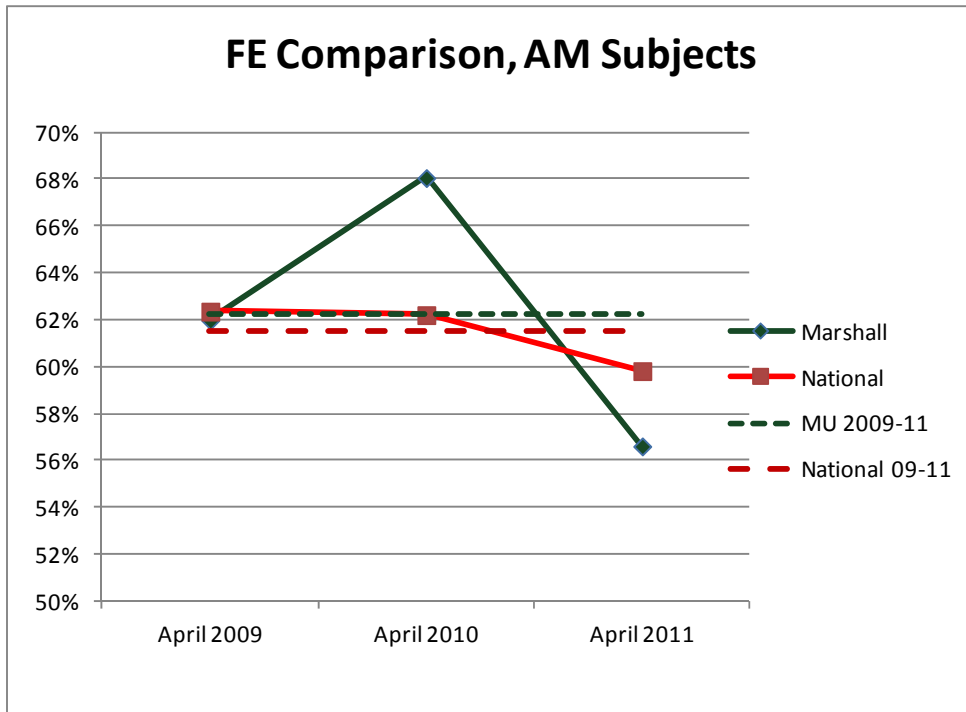
**Table 7l – MU BSE FE AM Performance: Electricity and Magnitism**

FE AM Subject Matter Area	MU BSE Target Performance												
Electricity and Magnetism	At or above the national average												
<h3>FE Comparison: Electricity &amp; Magnetism</h3> <table border="1"> <caption>Data for FE Comparison: Electricity &amp; Magnetism</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>50</td> <td>44</td> </tr> <tr> <td>April 2010</td> <td>53</td> <td>45</td> </tr> <tr> <td>April 2011</td> <td>44</td> <td>45</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	50	44	April 2010	53	45	April 2011	44	45
Year	Marshall (%)	National (%)											
April 2009	50	44											
April 2010	53	45											
April 2011	44	45											
<p><b>Observations:</b> MU student performance appears to be at or higher than the national level.</p> <p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 7m – MU BSE FE AM Performance: Thermodynamics**

FE AM Subject Matter Area	MU BSE Target Performance												
Thermodynamics	At or above the national average												
<h3>FE Comparison: Thermodynamics</h3> <table border="1"> <caption>Data for FE Comparison: Thermodynamics</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>46</td> <td>53</td> </tr> <tr> <td>April 2010</td> <td>40</td> <td>36</td> </tr> <tr> <td>April 2011</td> <td>41</td> <td>42</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	46	53	April 2010	40	36	April 2011	41	42
Year	Marshall (%)	National (%)											
April 2009	46	53											
April 2010	40	36											
April 2011	41	42											
<p><b>Observations:</b> Relative to the national performance, MU student performance appears to be improving or equivalent. Improvement may be due to the introduction of a required course in the subject.</p>													
<p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 7n – MU BSE FE AM Three-Year Performance**



Because the MU BSE program is a general engineering degree with a civil engineering emphasis, MU students are not required to take multiple courses in as many civil engineering disciplines as students are typically required to take as part of a BS in Civil Engineering (BSCE). Consequently, the following goal has been established for MU BSE students for the FE exam with civil (PM) module:

***MU BSE graduates who select the civil engineering area of emphasis shall perform at or above the national average level of performance on at least five of the nine subject matter areas of the FE PM Civil Engineering module.***

MU BSE student performance for 2009 - 2011 for each of the subject matter areas of the FE PM Civil module are listed in Table 8. The conclusion is that the established goal was met in years 2010 and 2011, showing a definite improvement over 2009. Results fluctuate from year-to-year; partially due to students' abilities and partially due to the small sample size. Two subject matter areas deserve particular attention: Construction Management and Civil Engineering Materials. A new required Project Management course has been inserted into the curriculum, and the course will focus on construction management topics. Insertion of this new course is expected to improve performance in this area. Additional discussion and analysis is needed to explore ways to improve performance in the Civil Engineering Materials area.

**Table 8 – MU BSE FE PM Performance: Civil Module**

	<b>2009</b>	<b>2010</b>	<b>2011</b>	
<b>FE Civil PM Subject Matter Areas</b>	<b>MU/National</b>	<b>MU/National</b>	<b>MU/National</b>	<b>Goal Met</b>
Surveying	45% / 51%	57% / 49%	50% / 27%	N / Y / Y
Hydraulics and Hydrologic Systems	74% / 62%	58% / 57%	61% / 61%	Y / Y / Y
Soil Mechanics and Foundations	39% / 45%	60% / 56%	57% / 59%	N / Y / Y
Environmental Engineering	69% / 73%	67% / 66%	56% / 61%	N / Y / N
Transportation	60% / 53%	61% / 59%	53% / 51%	Y / Y / Y
Structural Analysis	47% / 48%	63% / 62%	42% / 51%	Y / Y / N
Structural Design	36% / 51%	55% / 53%	62% / 63%	N / Y / Y
Construction Management	75% / 72%	53% / 60%	48% / 65%	Y / N / N
Civil Materials	50% / 59%	55% / 57%	52% / 62%	N / N / N
<b>Goal Met:</b>	<b>4 of 9</b>	<b>7 of 9</b>	<b>5 of 9</b>	<b>N / Y / Y</b>

Table 9 shows a comparison of MU BSE student performance to the national average for all PM subjects in the FE PM Civil module. More detailed results for each subject matter area in the PM exam are provided in Table 10.

**Table 9 – MU BSE FE Three-Year Performance: PM Module**

FE Exam Overall Performance	MU BSE Target Performance																				
All AM and PM Subjects	No goal established																				
<h3>FE Comparison, PM Subjects</h3> <table border="1" style="margin-left: auto; margin-right: auto;"> <caption>FE Comparison, PM Subjects Data</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> <th>MU 2009-11 (%)</th> <th>National 09-11 (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>56.5</td> <td>58.5</td> <td>55.8</td> <td>57.0</td> </tr> <tr> <td>April 2010</td> <td>61.0</td> <td>59.5</td> <td>55.8</td> <td>57.0</td> </tr> <tr> <td>April 2011</td> <td>55.5</td> <td>57.5</td> <td>55.8</td> <td>57.0</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	MU 2009-11 (%)	National 09-11 (%)	April 2009	56.5	58.5	55.8	57.0	April 2010	61.0	59.5	55.8	57.0	April 2011	55.5	57.5	55.8	57.0
Year	Marshall (%)	National (%)	MU 2009-11 (%)	National 09-11 (%)																	
April 2009	56.5	58.5	55.8	57.0																	
April 2010	61.0	59.5	55.8	57.0																	
April 2011	55.5	57.5	55.8	57.0																	
<p><b>Observations:</b> On all AM subjects, MU student performance appears to have improved significantly from 2009 to 2010. This may be due to a better review process implemented between the administration of the two exams. The drop in performance in 2011 may have been due to a small class size (10). The three-year average across all subjects appears to be fairly constant.</p>																					
<p><b>Action:</b> Continue to monitor; no action at this time.</p>																					

**Table 10a – MU BSE FE PM Performance: Surveying**

FE PM Subject Matter Area	MU BSE Target Performance												
Surveying	At or above the national average												
<h3>FE Comparison: Surveying</h3> <table border="1"> <caption>Data for FE Comparison: Surveying</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>45</td> <td>51</td> </tr> <tr> <td>April 2010</td> <td>57</td> <td>49</td> </tr> <tr> <td>April 2011</td> <td>50</td> <td>29</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	45	51	April 2010	57	49	April 2011	50	29
Year	Marshall (%)	National (%)											
April 2009	45	51											
April 2010	57	49											
April 2011	50	29											
<p><b>Observations:</b> MU student performance seems to be improving in this area and significantly better than the national average.</p>													
<p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 10b – MU BSE FE PM Performance: Hydraulics**

FE AM Subject Matter Area	MU BSE Target Performance												
Hydraulics and Hydrologic Systems	At or above the national average												
<h3>FE Comparison: Hydraulics</h3> <table border="1"> <caption>Data for FE Comparison: Hydraulics</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>74</td> <td>62</td> </tr> <tr> <td>April 2010</td> <td>58</td> <td>57</td> </tr> <tr> <td>April 2011</td> <td>61</td> <td>61</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	74	62	April 2010	58	57	April 2011	61	61
Year	Marshall (%)	National (%)											
April 2009	74	62											
April 2010	58	57											
April 2011	61	61											
<p><b>Observations:</b> MU student performance appears to be equal to or higher than the national level.</p>													
<p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 10c – MU BSE FE PM Performance: Soil Mechanics and Foundations**

FE PM Subject Matter Area	MU BSE Target Performance												
Soil Mechanics and Foundations	At or above the national average												
<h3>FE Comparison: Soils and Foundations</h3> <table border="1"> <caption>Data for FE Comparison: Soils and Foundations</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>39</td> <td>45</td> </tr> <tr> <td>April 2010</td> <td>60</td> <td>56</td> </tr> <tr> <td>April 2011</td> <td>57</td> <td>59</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	39	45	April 2010	60	56	April 2011	57	59
Year	Marshall (%)	National (%)											
April 2009	39	45											
April 2010	60	56											
April 2011	57	59											
<p><b>Observations:</b> MU student performance seems to be equivalent to the national level.</p> <p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 10d – MU BSE FE PM Performance: Environmental Engineering**

FE AM Subject Matter Area	MU BSE Target Performance												
Environmental Engineering	At or above the national average												
<h3>FE Comparison: Environmental Engineering</h3> <table border="1"> <caption>Data for FE Comparison: Environmental Engineering</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>69</td> <td>73</td> </tr> <tr> <td>April 2010</td> <td>67</td> <td>66</td> </tr> <tr> <td>April 2011</td> <td>56</td> <td>61</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	69	73	April 2010	67	66	April 2011	56	61
Year	Marshall (%)	National (%)											
April 2009	69	73											
April 2010	67	66											
April 2011	56	61											
<p><b>Observations:</b> Relative to the national level of performance, MU student performance appears to be equivalent.</p> <p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 10e – MU BSE FE PM Performance: Transportation**

FE PM Subject Matter Area	MU BSE Target Performance
Transportation	At or above the national average
<p><b>Observations:</b> MU student performance appears at or above the national level.</p> <p><b>Action:</b> Continue to monitor; no action at this time.</p>	

**Table 10f – MU BSE FE PM Performance: Structural Analysis**

FE AM Subject Matter Area	MU BSE Target Performance
Structural Analysis	At or above the national average
<p><b>Observations:</b> With the exception of 2011, MU student performance appears to be equivalent to the national level (especially because of “Structural Design” results in next table).</p> <p><b>Action:</b> Continue to monitor; no action at this time.</p>	

**Table 10g – MU BSE FE PM Performance: Structural Design**

FE PM Subject Matter Area	MU BSE Target Performance												
Structural Design	At or above the national average												
<p><b>FE Comparison: Structural Design</b></p> <table border="1"> <caption>Data for FE Comparison: Structural Design</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>36</td> <td>51</td> </tr> <tr> <td>April 2010</td> <td>55</td> <td>53</td> </tr> <tr> <td>April 2011</td> <td>62</td> <td>63</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	36	51	April 2010	55	53	April 2011	62	63
Year	Marshall (%)	National (%)											
April 2009	36	51											
April 2010	55	53											
April 2011	62	63											
<p><b>Observations:</b> MU student performance appears to be improving relative to the national level of performance and equivalent during 2010-11.</p>													
<p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 10h – MU BSE FE PM Performance: Construction Management**

FE AM Subject Matter Area	MU BSE Target Performance												
Construction Management	At or above the national average												
<p><b>FE Comparison: Construction Management</b></p> <table border="1"> <caption>Data for FE Comparison: Construction Management</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>75</td> <td>72</td> </tr> <tr> <td>April 2010</td> <td>53</td> <td>60</td> </tr> <tr> <td>April 2011</td> <td>48</td> <td>65</td> </tr> </tbody> </table>		Year	Marshall (%)	National (%)	April 2009	75	72	April 2010	53	60	April 2011	48	65
Year	Marshall (%)	National (%)											
April 2009	75	72											
April 2010	53	60											
April 2011	48	65											
<p><b>Observations:</b> MU student performance appears to be decreasing relative to the national level. A new required course in Project Management may reverse this trend.</p>													
<p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Table 10i – MU BSE FE PM Performance: Civil Engineering Materials**

FE PM Subject Matter Area	MU BSE Target Performance												
Civil Engineering Materials	At or above the national average												
<div style="text-align: center;"> <p><b>FE Comparison: CE Materials</b></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <caption>Data for FE Comparison: CE Materials</caption> <thead> <tr> <th>Year</th> <th>Marshall (%)</th> <th>National (%)</th> </tr> </thead> <tbody> <tr> <td>April 2009</td> <td>50</td> <td>59</td> </tr> <tr> <td>April 2010</td> <td>55</td> <td>57</td> </tr> <tr> <td>April 2011</td> <td>52</td> <td>62</td> </tr> </tbody> </table> </div>		Year	Marshall (%)	National (%)	April 2009	50	59	April 2010	55	57	April 2011	52	62
Year	Marshall (%)	National (%)											
April 2009	50	59											
April 2010	55	57											
April 2011	52	62											
<p><b>Observations:</b> MU student performance appears to be lag behind national levels; further study is needed.</p>													
<p><b>Action:</b> Continue to monitor; no action at this time.</p>													

**Senior Exit Interviews**

All 2010 graduating BSE students were required to take an anonymous online survey that gathers student perception/opinion regarding various aspects of the MU BSE program. A second survey will be conducted for 2012 graduates; because of the small class size, no survey results were obtained for 2011 graduates. The exit interview is designed to collect student perception about the level of achievement attained in each of the eleven (a-k) learning outcomes established for the program. Seventeen 2010 students took the survey and were to provide one of five responses indicating the degree to which the program is achieving each of its learning outcomes: Very Satisfied, Satisfied, Neutral, Unsatisfied, or Very Unsatisfied. The results from the initial survey are provided in the following pages. Overall, there seems to be a high level of satisfaction from the students that the published learning outcomes are being achieved.

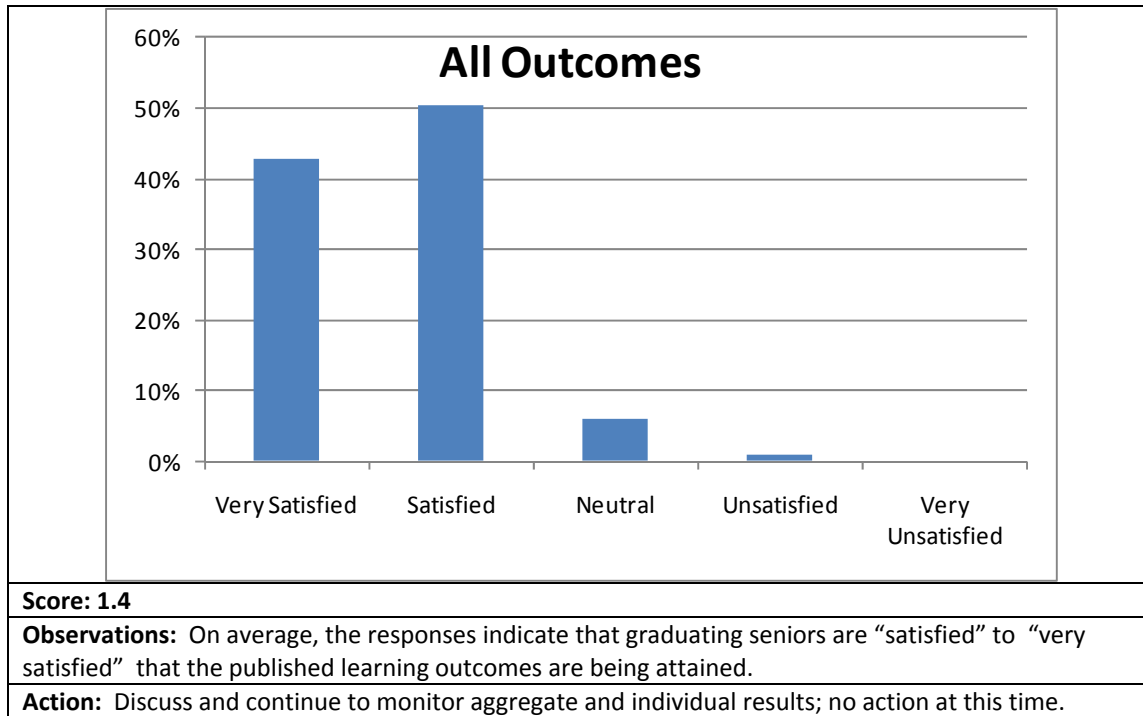
For analysis purposes, the following weights were assigned to each response:

- 2 = Very Satisfied
- 1 = Satisfied
- 0 = Neutral
- 1 = Unsatisfied
- 2 = Very Unsatisfied

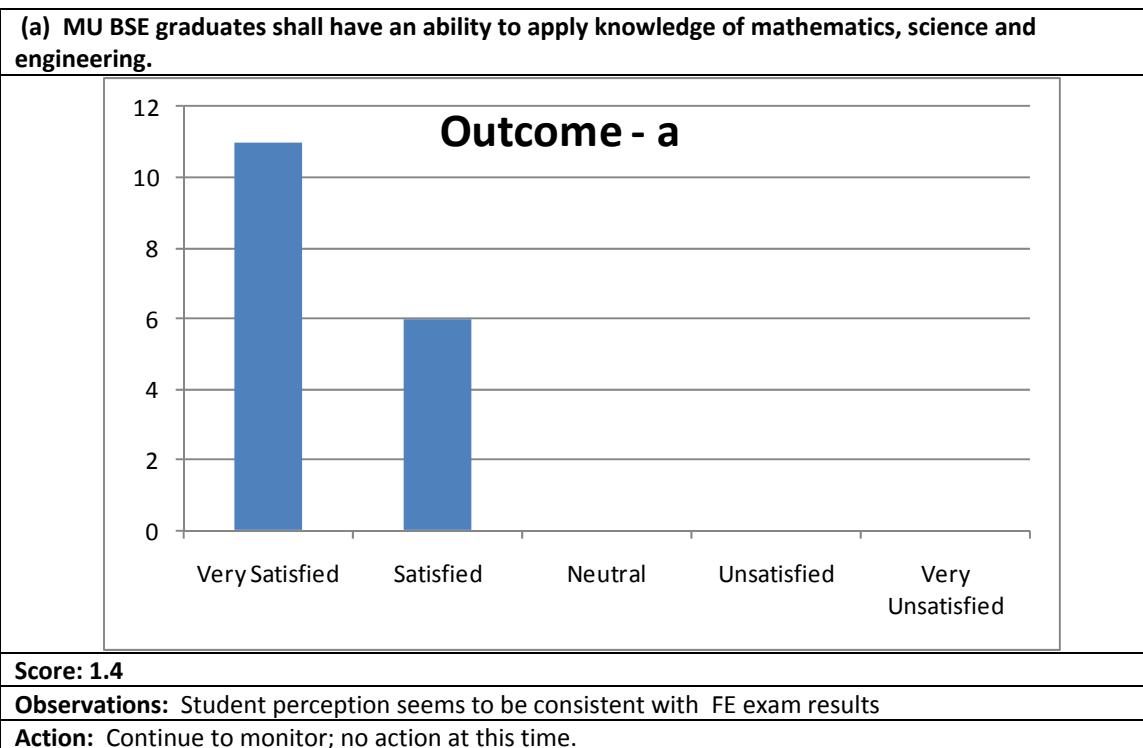
A score of 2 would indicate that all students were “Very Satisfied” that that an outcome was being achieved, while a score of 1 would indicate “Satisfied”. The mean score for each outcome varied

between 1.3 and 1.6; the median score was 1.4. Overall results for all (a)-(k) learning outcomes are shown in Table 11. Results for each individual outcome are shown in Table 12.

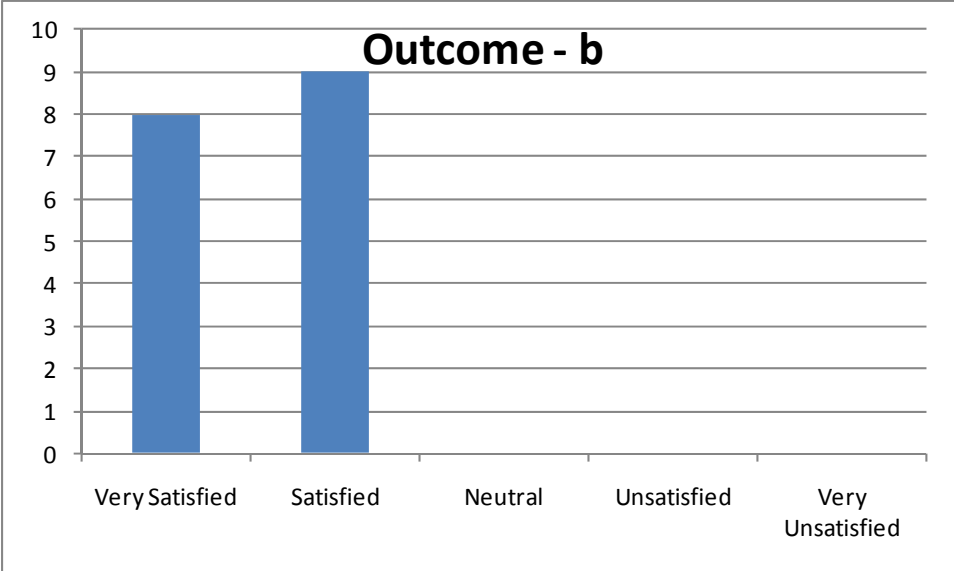
**Table 11 – MU BSE Senior Survey Results: Aggregate of All Learning Outcomes**



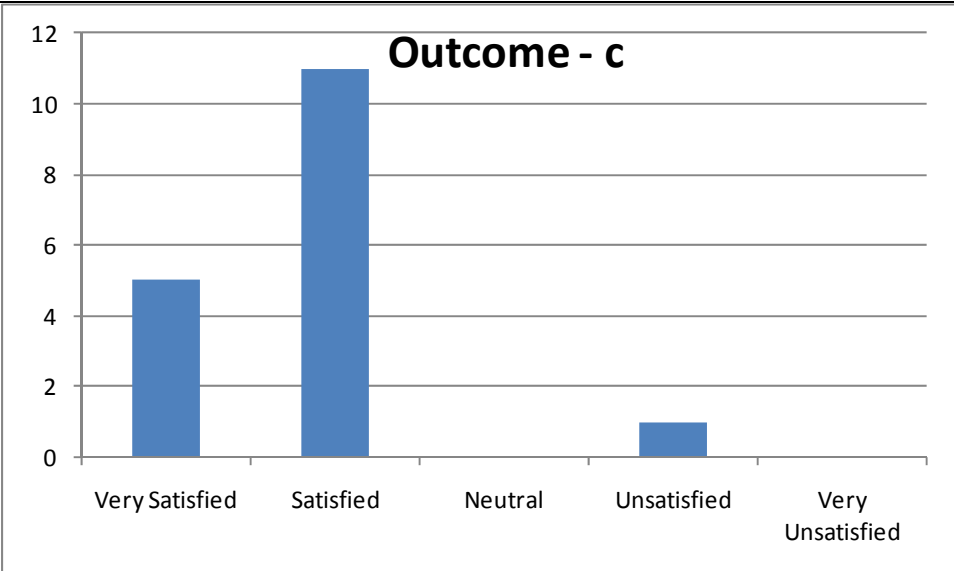
**Table 12a – MU BSE Senior Survey Results: Learning Outcome a**



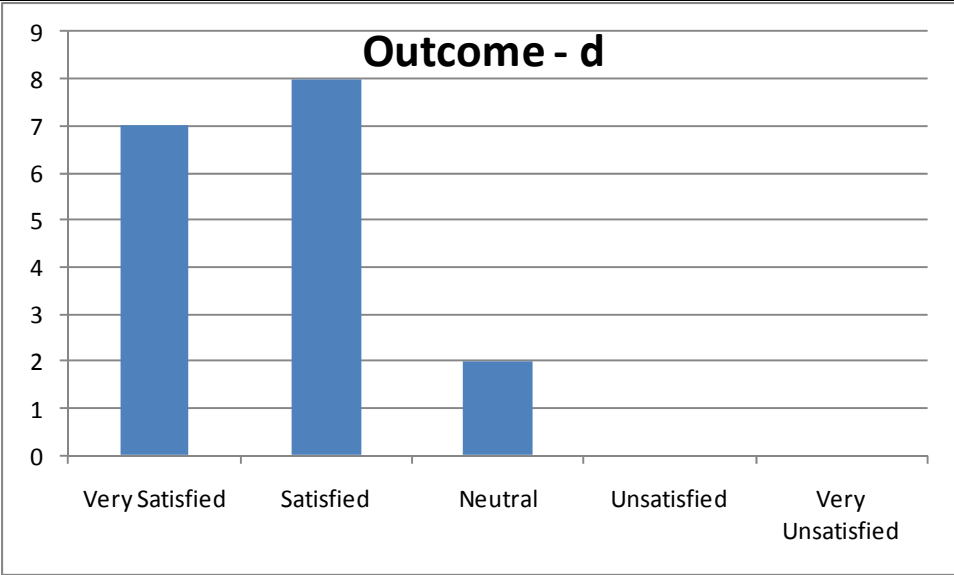
**Table 12b – MU BSE Senior Survey Results: Learning Outcome b**

<b>(b) MU BSE graduates shall have an ability to design and conduct experiments as well as analyze and interpret data.</b>													
 <table border="1"> <caption>Outcome - b Data</caption> <thead> <tr> <th>Satisfaction Level</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Very Satisfied</td> <td>8</td> </tr> <tr> <td>Satisfied</td> <td>9</td> </tr> <tr> <td>Neutral</td> <td>0</td> </tr> <tr> <td>Unsatisfied</td> <td>0</td> </tr> <tr> <td>Very Unsatisfied</td> <td>0</td> </tr> </tbody> </table>		Satisfaction Level	Count	Very Satisfied	8	Satisfied	9	Neutral	0	Unsatisfied	0	Very Unsatisfied	0
Satisfaction Level	Count												
Very Satisfied	8												
Satisfied	9												
Neutral	0												
Unsatisfied	0												
Very Unsatisfied	0												
<b>Score: 1.5</b>													
<b>Observations:</b> Student perception seems to be consistent with FE exam results.													
<b>Action:</b> Continue to monitor; no action at this time.													

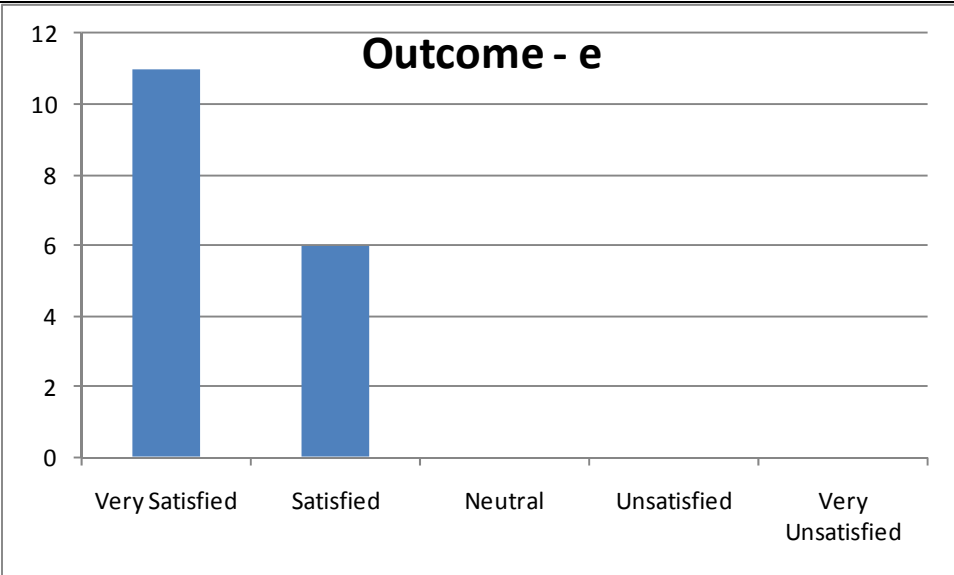
**Table 12c – MU BSE Senior Survey Results: Learning Outcome c**

<b>(c) MU BSE graduates shall an ability to design a system, component, or process to meet desired needs.</b>													
 <table border="1"> <caption>Outcome - c Data</caption> <thead> <tr> <th>Satisfaction Level</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Very Satisfied</td> <td>5</td> </tr> <tr> <td>Satisfied</td> <td>11</td> </tr> <tr> <td>Neutral</td> <td>0</td> </tr> <tr> <td>Unsatisfied</td> <td>1</td> </tr> <tr> <td>Very Unsatisfied</td> <td>0</td> </tr> </tbody> </table>		Satisfaction Level	Count	Very Satisfied	5	Satisfied	11	Neutral	0	Unsatisfied	1	Very Unsatisfied	0
Satisfaction Level	Count												
Very Satisfied	5												
Satisfied	11												
Neutral	0												
Unsatisfied	1												
Very Unsatisfied	0												
<b>Score: 1.5</b>													
<b>Observations:</b> While the level of satisfaction is not as strong as for other outcomes, the overall perception is positive.													
<b>Action:</b> Discuss and continue to monitor; no action at this time.													

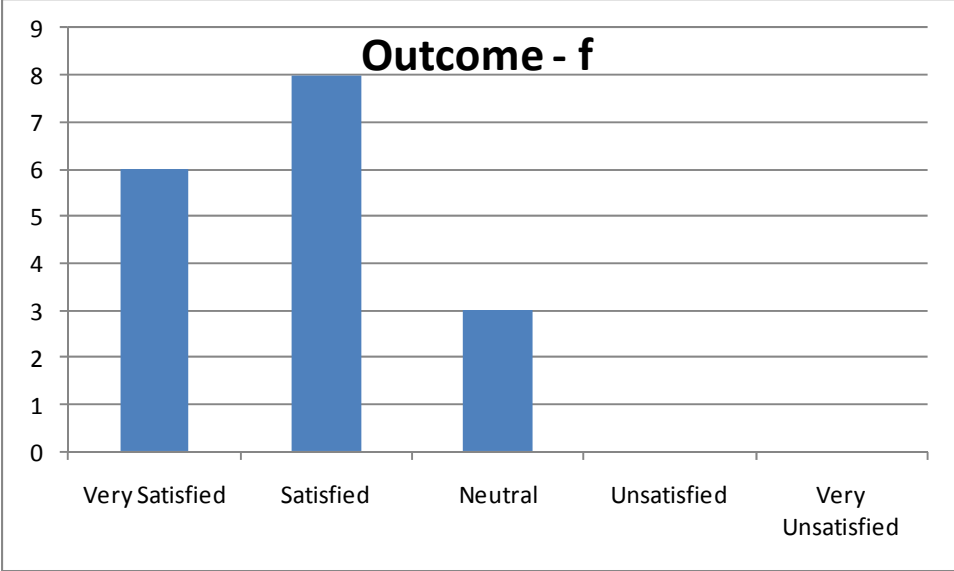
**Table 12d – MU BSE Senior Survey Results: Learning Outcome d**

<b>(d) MU BSE graduates shall have an ability to function on multidisciplinary teams.</b>													
 <p style="text-align: center;"><b>Outcome - d</b></p> <table border="1"> <thead> <tr> <th>Response</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Very Satisfied</td> <td>7</td> </tr> <tr> <td>Satisfied</td> <td>8</td> </tr> <tr> <td>Neutral</td> <td>2</td> </tr> <tr> <td>Unsatisfied</td> <td>0</td> </tr> <tr> <td>Very Unsatisfied</td> <td>0</td> </tr> </tbody> </table>	Response	Count	Very Satisfied	7	Satisfied	8	Neutral	2	Unsatisfied	0	Very Unsatisfied	0	
Response	Count												
Very Satisfied	7												
Satisfied	8												
Neutral	2												
Unsatisfied	0												
Very Unsatisfied	0												
<b>Score: 1.4</b>													
<b>Observations:</b> The student perception seems to be positive. However, the perception is not as positive as some of the other outcomes.													
<b>Action:</b> Discuss and continue to monitor; no action at this time.													

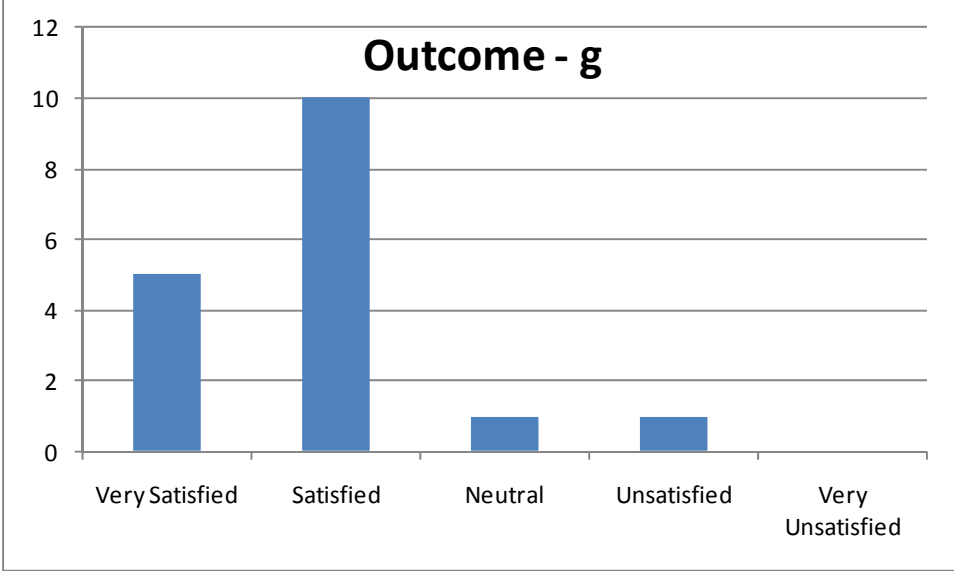
**Table 12e – MU BSE Senior Survey Results: Learning Outcome e**

<b>(e) MU BSE graduates shall an ability to identify, formulate, and solve engineering problems.</b>													
 <p style="text-align: center;"><b>Outcome - e</b></p> <table border="1"> <thead> <tr> <th>Response</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Very Satisfied</td> <td>11</td> </tr> <tr> <td>Satisfied</td> <td>6</td> </tr> <tr> <td>Neutral</td> <td>0</td> </tr> <tr> <td>Unsatisfied</td> <td>0</td> </tr> <tr> <td>Very Unsatisfied</td> <td>0</td> </tr> </tbody> </table>	Response	Count	Very Satisfied	11	Satisfied	6	Neutral	0	Unsatisfied	0	Very Unsatisfied	0	
Response	Count												
Very Satisfied	11												
Satisfied	6												
Neutral	0												
Unsatisfied	0												
Very Unsatisfied	0												
<b>Score: 1.4</b>													
<b>Observations:</b> Student perception seems to be consistent with FE exam results.													
<b>Action:</b> Continue to monitor; no action at this time.													

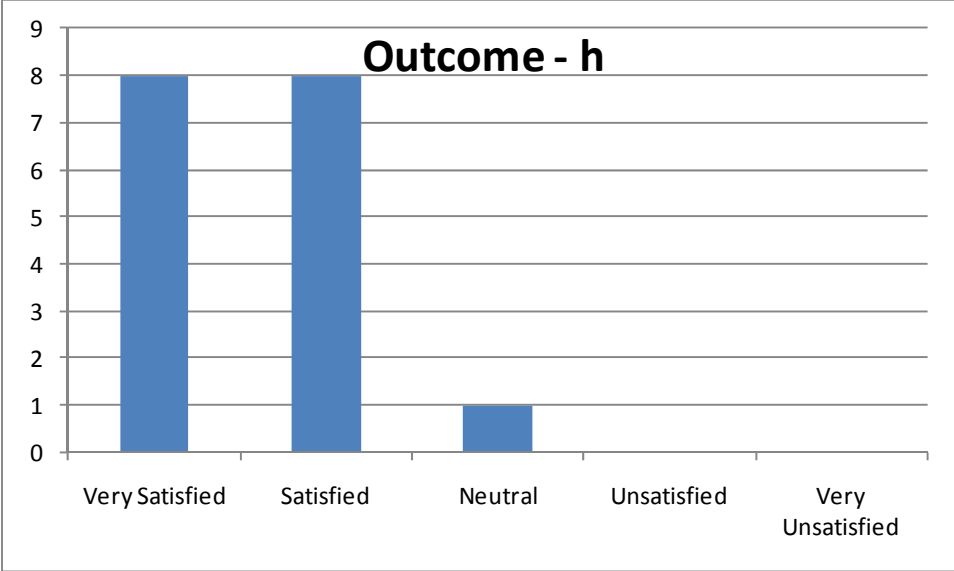
**Table 12f – MU BSE Senior Survey Results: Learning Outcome f**

<b>(f) MU BSE graduates shall have an understanding of professional and ethical responsibility.</b>													
 <p><b>Outcome - f</b></p> <table border="1"> <thead> <tr> <th>Category</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Very Satisfied</td> <td>6</td> </tr> <tr> <td>Satisfied</td> <td>8</td> </tr> <tr> <td>Neutral</td> <td>3</td> </tr> <tr> <td>Unsatisfied</td> <td>0</td> </tr> <tr> <td>Very Unsatisfied</td> <td>0</td> </tr> </tbody> </table>		Category	Count	Very Satisfied	6	Satisfied	8	Neutral	3	Unsatisfied	0	Very Unsatisfied	0
Category	Count												
Very Satisfied	6												
Satisfied	8												
Neutral	3												
Unsatisfied	0												
Very Unsatisfied	0												
<b>Score: 1.3</b>													
<b>Observations:</b> Student perception seems to be consistent with FE exam results.													
<b>Action:</b> Discuss and continue to monitor; no action at this time.													

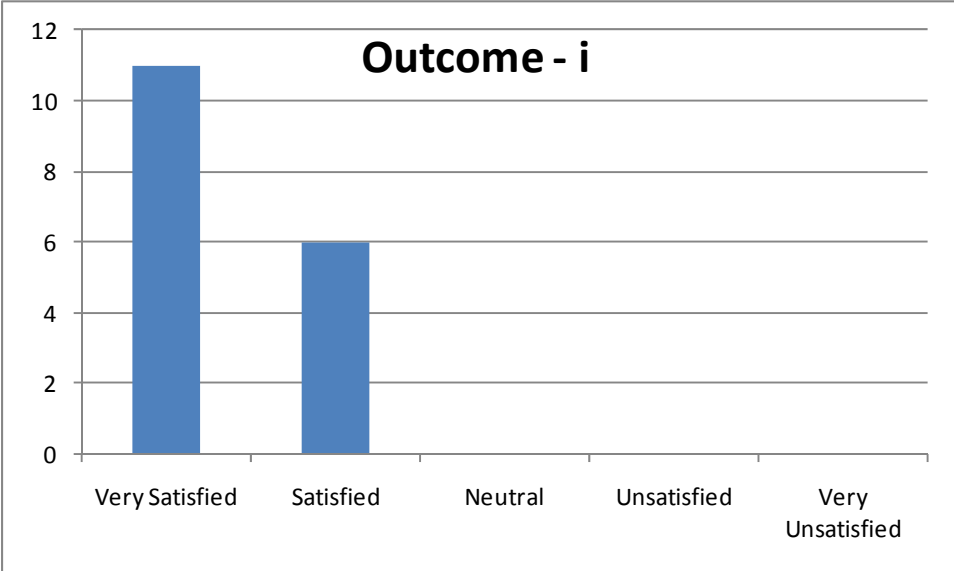
**Table 12g – MU BSE Senior Survey Results: Learning Outcome g**

<b>(g) MU BSE graduates shall an ability to communicate effectively.</b>													
 <p><b>Outcome - g</b></p> <table border="1"> <thead> <tr> <th>Category</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Very Satisfied</td> <td>5</td> </tr> <tr> <td>Satisfied</td> <td>10</td> </tr> <tr> <td>Neutral</td> <td>1</td> </tr> <tr> <td>Unsatisfied</td> <td>1</td> </tr> <tr> <td>Very Unsatisfied</td> <td>0</td> </tr> </tbody> </table>		Category	Count	Very Satisfied	5	Satisfied	10	Neutral	1	Unsatisfied	1	Very Unsatisfied	0
Category	Count												
Very Satisfied	5												
Satisfied	10												
Neutral	1												
Unsatisfied	1												
Very Unsatisfied	0												
<b>Score: 1.4</b>													
<b>Observations:</b> While the level of satisfaction is not as strong as for other outcomes, the overall perception is positive.													
<b>Action:</b> Discuss and continue to monitor; no action at this time.													

**Table 12h – MU BSE Senior Survey Results: Learning Outcome h**

<b>(h) MU BSE graduates shall have the broad education necessary to understand the impact of engineering solutions.</b>													
 <table border="1"> <caption>Outcome - h Data</caption> <thead> <tr> <th>Satisfaction Level</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Very Satisfied</td> <td>8</td> </tr> <tr> <td>Satisfied</td> <td>8</td> </tr> <tr> <td>Neutral</td> <td>1</td> </tr> <tr> <td>Unsatisfied</td> <td>0</td> </tr> <tr> <td>Very Unsatisfied</td> <td>0</td> </tr> </tbody> </table>		Satisfaction Level	Count	Very Satisfied	8	Satisfied	8	Neutral	1	Unsatisfied	0	Very Unsatisfied	0
Satisfaction Level	Count												
Very Satisfied	8												
Satisfied	8												
Neutral	1												
Unsatisfied	0												
Very Unsatisfied	0												
<b>Score: 1.4</b>													
<b>Observations:</b> Student perception seems to be positive.													
<b>Action:</b> Discuss and continue to monitor; no action at this time.													

**Table 12i – MU BSE Senior Survey Results: Learning Outcome i**

<b>(i) MU BSE graduates shall a recognition of the need for, and an ability to engage in, life-long learning.</b>													
 <table border="1"> <caption>Outcome - i Data</caption> <thead> <tr> <th>Satisfaction Level</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Very Satisfied</td> <td>11</td> </tr> <tr> <td>Satisfied</td> <td>6</td> </tr> <tr> <td>Neutral</td> <td>0</td> </tr> <tr> <td>Unsatisfied</td> <td>0</td> </tr> <tr> <td>Very Unsatisfied</td> <td>0</td> </tr> </tbody> </table>		Satisfaction Level	Count	Very Satisfied	11	Satisfied	6	Neutral	0	Unsatisfied	0	Very Unsatisfied	0
Satisfaction Level	Count												
Very Satisfied	11												
Satisfied	6												
Neutral	0												
Unsatisfied	0												
Very Unsatisfied	0												
<b>Score: 1.4</b>													
<b>Observations:</b> Student satisfaction is positive.													
<b>Action:</b> Discuss and continue to monitor; no action at this time.													

**Table 12j – MU BSE Senior Survey Results: Learning Outcome j**

<b>(j) MU BSE graduates shall have a knowledge of contemporary issues.</b>													
<table border="1"> <caption>Data for Outcome - j</caption> <thead> <tr> <th>Satisfaction Level</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Very Satisfied</td> <td>3</td> </tr> <tr> <td>Satisfied</td> <td>11</td> </tr> <tr> <td>Neutral</td> <td>3</td> </tr> <tr> <td>Unsatisfied</td> <td>0</td> </tr> <tr> <td>Very Unsatisfied</td> <td>0</td> </tr> </tbody> </table>		Satisfaction Level	Count	Very Satisfied	3	Satisfied	11	Neutral	3	Unsatisfied	0	Very Unsatisfied	0
Satisfaction Level	Count												
Very Satisfied	3												
Satisfied	11												
Neutral	3												
Unsatisfied	0												
Very Unsatisfied	0												
<b>Score: 1.5</b>													
<b>Observations:</b> While the level of satisfaction is not as strong as for other outcomes, the overall perception is positive.													
<b>Action:</b> Discuss and continue to monitor; no action at this time.													

**Table 12k – MU BSE Senior Survey Results: Learning Outcome k**

<b>(k) MU BSE graduates shall have an ability to use the techniques, skills, and modern engineering tools.</b>													
<table border="1"> <caption>Data for Outcome - k</caption> <thead> <tr> <th>Satisfaction Level</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Very Satisfied</td> <td>5</td> </tr> <tr> <td>Satisfied</td> <td>11</td> </tr> <tr> <td>Neutral</td> <td>1</td> </tr> <tr> <td>Unsatisfied</td> <td>0</td> </tr> <tr> <td>Very Unsatisfied</td> <td>0</td> </tr> </tbody> </table>		Satisfaction Level	Count	Very Satisfied	5	Satisfied	11	Neutral	1	Unsatisfied	0	Very Unsatisfied	0
Satisfaction Level	Count												
Very Satisfied	5												
Satisfied	11												
Neutral	1												
Unsatisfied	0												
Very Unsatisfied	0												
<b>Score: 1.6</b>													
<b>Observations:</b> While the level of satisfaction is not as strong as for other outcomes, the overall perception is positive and consistent with FE exam results.													
<b>Action:</b> Discuss and continue to monitor; no action at this time.													

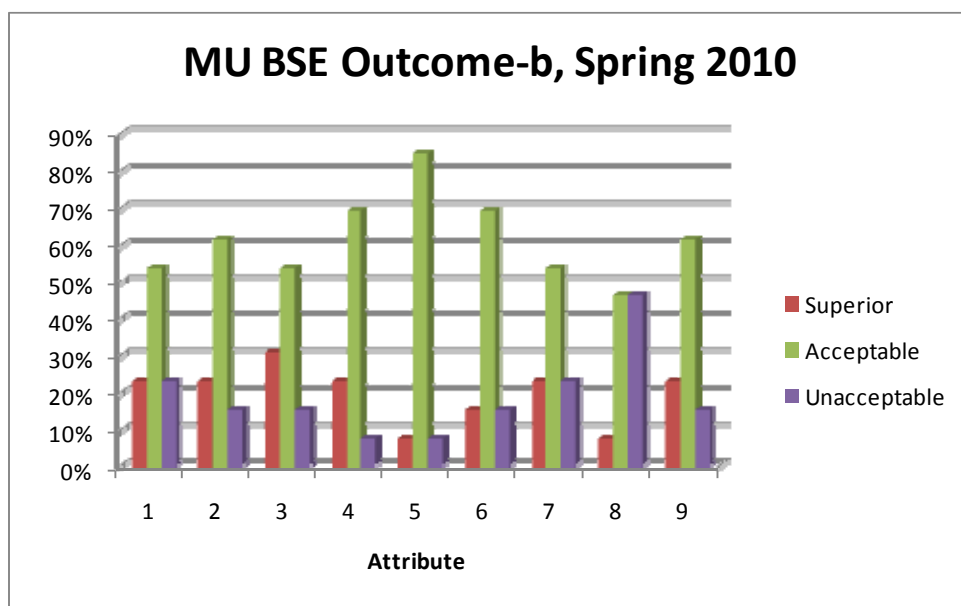
## Results from Locally Administered Rubrics

**Outcome-b:** an ability to design and conduct experiments, as well as analyze and interpret data;

The rubric to assess Outcome-b was developed during the 2009-2010 academic year (see MU BSE Assessment Plan, Appendix B). The rubric measures nine different attributes, each on a three-point scale. The results from the initial application of the rubric, during the 2009-2010 academic year, are shown in the chart in Figure 1 below. The nine attributes assessed are:

1. Identify and explain key variables related to the hydraulic phenomenon to be investigated.
2. Identify relevant empirical and/or fundamental equations that describe the hydraulic phenomenon to be investigated.
3. Determine appropriate equipment and/or lab resources to be utilized to induce the hydraulic phenomenon to be investigated.
4. Develop an experimental procedure and instructions on how to collect data.
5. Create a table appropriate for collecting data during the lab experiment.
6. Prepare a tabular summary of data and calculations performed, including a description of equations used in computing table entries.
7. Create graphs representing the variation of dependent variables with respect to variation in relevant independent variables.
8. Identify, quantify, and comment on the significance of trends illustrated by the experimental results.
9. Prepare a written report that includes a summary of the hydraulic phenomenon investigated, purpose of the experiment, experimental procedures, results, and conclusions.

Figure 1 – 2010 Outcome-b Results



**Results:** With the exception of attribute #8, the rubric appears to indicate that, overall, acceptable levels of performance are being demonstrated regarding this learning outcome.

**Action:** Data will be collected and trended each year to determine if consistent results are obtained. The relatively poor performance for attribute #8 will be examined more closely to determine how performance in this area can be improved.

All BSE graduates are required to take a capstone design course, ENGR453. During this course, several rubrics are administered to assess several of the BSE learning outcomes. Results from each of these rubrics are described below.

**Outcome-c:** an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;

The rubric to assess learning outcome-c measures eleven different attributes, each on a five-point scale. The results from the initial application of the rubric, during spring 2011 in the capstone design courses are summarized below. The eleven attributes assessed are:

1. Apply previously acquired knowledge of mathematics, science, and engineering in the design of a comprehensive, real-world engineering project.
2. Identify, formulate and solve engineering problems associated with the design of a comprehensive engineering project, system, component or process.
3. Provide documentation required to fulfill the needs of a typical client for an engineering project, including field data, reporting and final plans.
4. Demonstrate an ability to contribute discipline-specific input to a multi-disciplinary project.
5. Demonstrate the ability to meet realistic design constraints.
6. Evaluate reasonable design alternatives.
7. Select correct critical design condition(s).
8. Utilize building codes and design standards to determine design requirements.
9. Understand the process of defining design parameters.
10. Determine possible design issues.
11. Can apply important components/steps of the design process.

Results from the spring 2011 application of the rubric were mixed and somewhat disappointing as illustrated by the chart in Figure 2 and the data in Table 13.

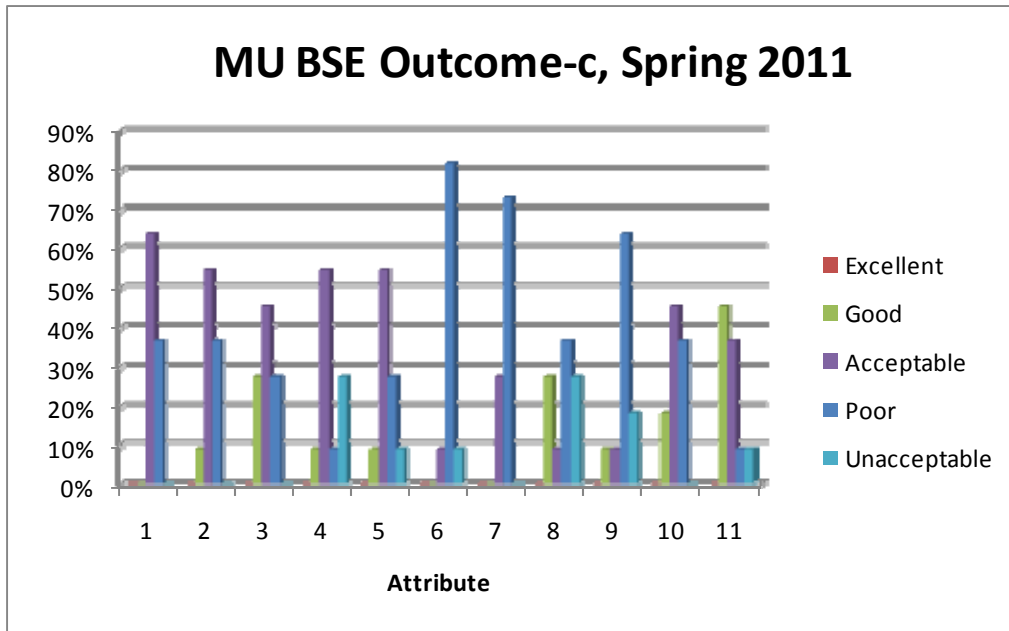
**Results:** The goal of having at least 75% of the students achieve a rating of “Acceptable” or higher was met only for attribute #11 (and probably attribute #3). Furthermore, as noted in Table 13, more than half the students were rated less than acceptable for attributes 6, 7, 8, and 9.

**Action:** Strategies will be developed during the fall 2011 semester to address the less-than-acceptable performance. Particular emphasis will be placed on those attributes with the least acceptable results. Performance levels for 2012 will be monitored and compared to 2011 levels to determine if improvement occurs. It is also possible that the evaluation criteria and the evaluation process described in the rubric for outcome-c need to be reevaluated and better defined.

**Table 13 –Learning Outcome-c Results, Spring 2011**

Attribute	G.E Acceptable	L.T. Acceptable
1	64%	36%
2	64%	36%
3	73%	27%
4	64%	36%
5	64%	36%
6	9%	91%
7	27%	73%
8	36%	64%
9	18%	82%
10	64%	36%
11	82%	18%

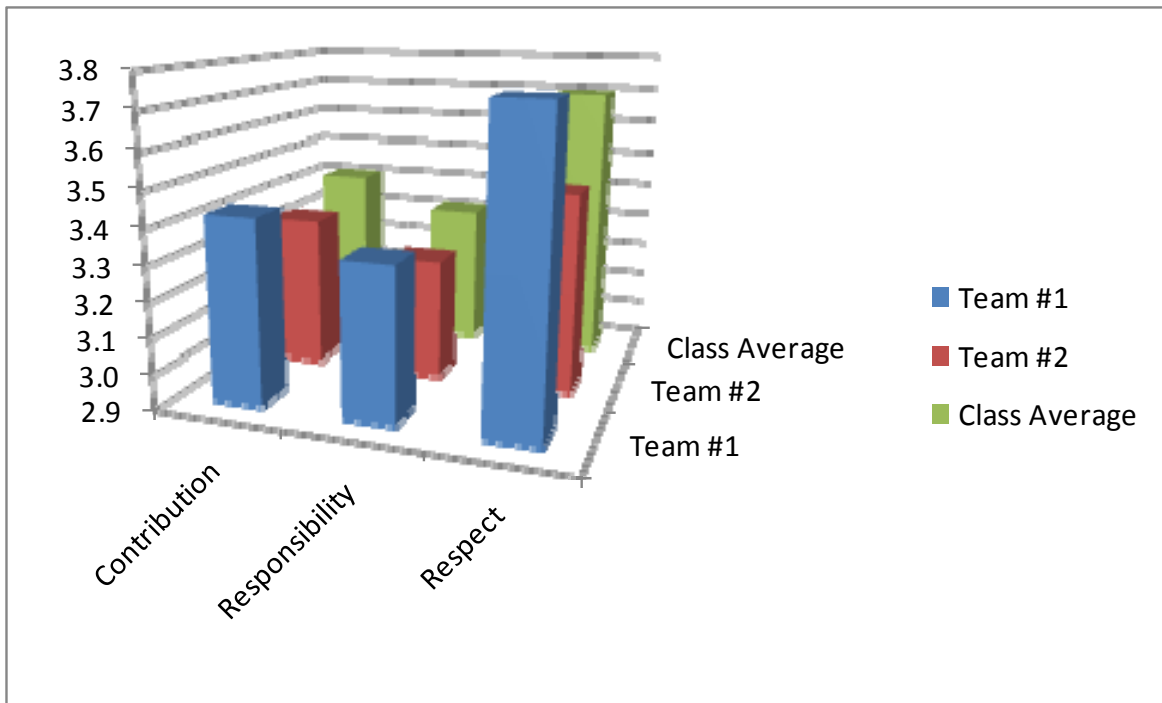
**Figure 2 – Distribution of Results for Learning Outcome-c, Spring 2011**



**Outcome-d:** an ability to function on multidisciplinary teams

All students in ENGR453 during the spring of 2010 were required to complete an anonymous evaluation of their peers. The evaluation required students to rate their teammates on three critical aspects of being an effective team member: overall contribution to the team effort, responsibility, and respectfulness. The rubric used to provide the rating is attached to this report, and the results summarized in the bar graph in Figure 3.

**Figure 3 – 2010 Team Peer Evaluation Results, Outcome d**



**Results:** An aggregate score of 3/4 (75%) indicates that the established goal is being met. The lowest performing category was for the attribute “responsibility”.

**Action:** While acceptable, student performance was rated lowest for the “responsibility” attribute. A revised rubric that uses a five-point scale and provides a better description of expectations has been developed and will be applied during the 2011-2012 academic year. The revised rubric (attached at the end of this report) should provide better feedback in assessing this learning outcome.

**Outcome-g:** an ability to communicate effectively;

Two rubrics to assess this outcome have been developed: one for oral presentations and one for written presentations. The rubric for written presentations was developed in ENGR451 during the spring 2011 semester as part of the process to have the course certified as a Writing Across the Curriculum (WAC) course. This rubric will be administered and data collected for the first time during the fall 2011 semester.

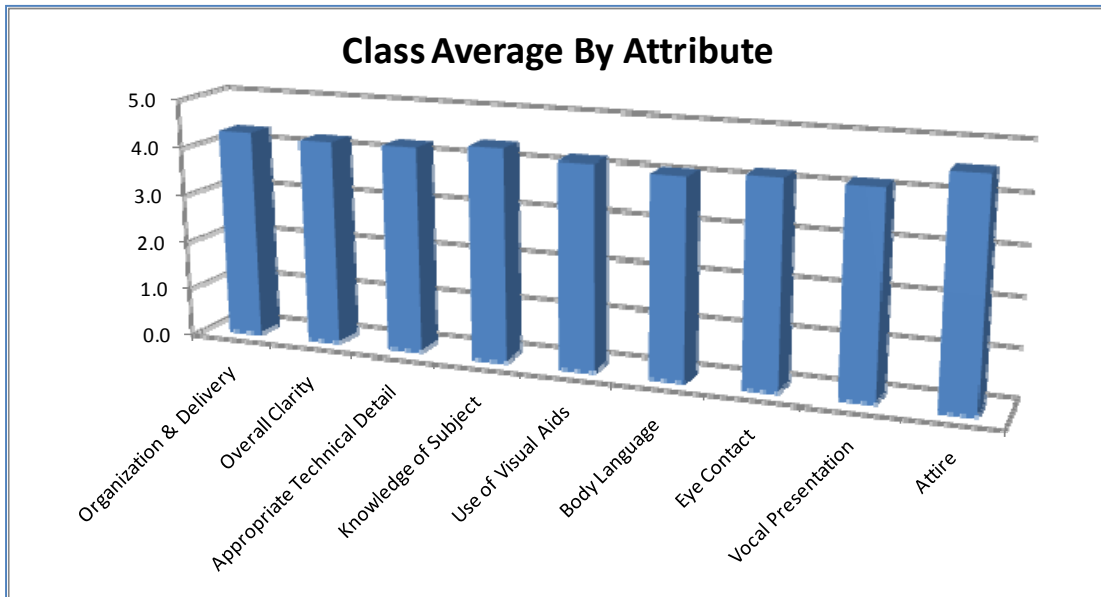
A rubric to assess oral presentations was developed during the fall 2009 semester and “test driven” during the spring 2010 semester. Based upon the experiences from 2010, the original rubric was updated and applied various times during the spring 2011 semester in the capstone design course, ENGR453. This oral presentation rubric was used to evaluate final presentations made by graduating seniors to an audience that included members of the BSE Advisory Board and other practicing engineers, faculty members, and other guests. A summary of results is shown in Figures 4 and 5 below.

**Results:** The data obtained indicate that the established level of performance for this learning outcome is being achieved. As noted in the graphs, each student was evaluated on nine different

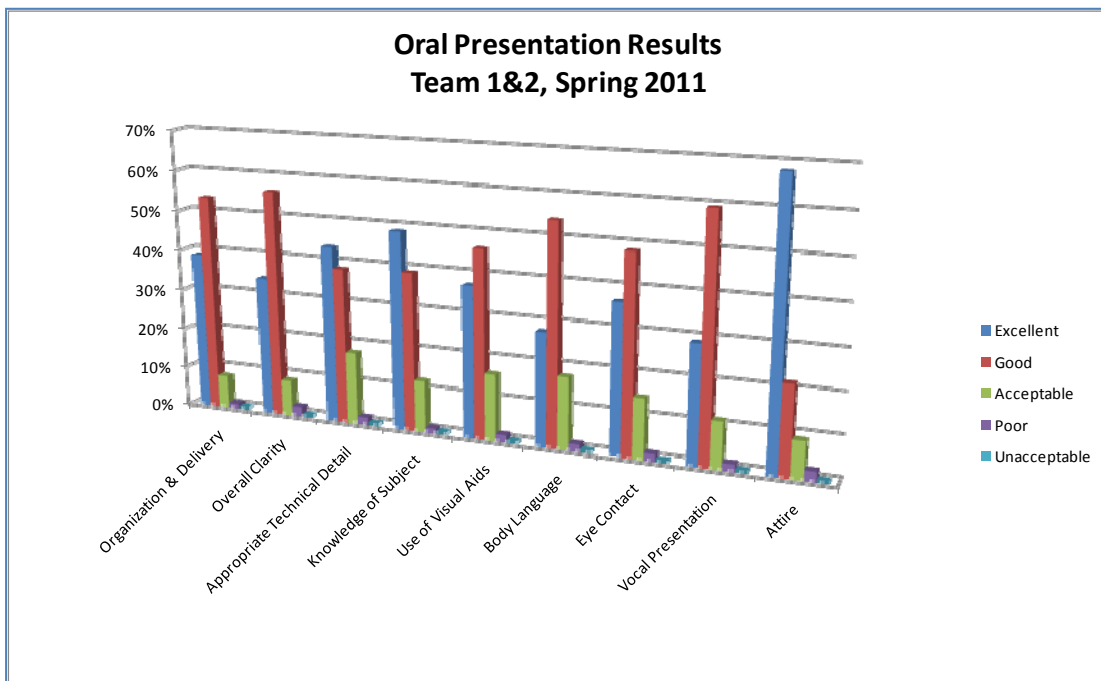
presentation attributes, each on a five-point scale. The class average for each attribute (Figure 4) was at or above 4.0/5, indicating an overall class performance level of “Good” for each attribute. The graph in Figure 5 shows the response distribution for each attribute, and the majority of responses from the evaluators were above the “Acceptable” level (“Good” or “Excellent”).

**Action:** Year-to-year results will be trended over time to insure that this acceptable level of achievement is maintained.

**Figure 4 – 2011 Oral Presentation Results, Outcome g**



**Figure 5 – 2011 Oral Presentation Distribution of Responses, Outcome g**



**Outcome-k:** an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

A rubric for this outcome was developed and applied during the spring 2011 semester in the capstone design course, ENGR453. The rubric to assess learning outcome-c measures eleven different attributes, each on a five-point scale. The eleven attributes assessed are:

1. Apply previously acquired knowledge of mathematics, science, and engineering in the design of a comprehensive, real-world engineering project.
2. Identify, formulate and solve engineering problems associated with the design of a comprehensive engineering project, system, component or process.
3. Understands and can apply basic concepts of project management.
4. Understands and can apply basic concepts of scheduling and budgeting.
5. Can generate record-keeping documents such as project time sheets, change orders, design calculation, design reports, meeting minutes, progress reports and presentations.
6. Can complete documentation required to fulfill the needs of a typical client for an engineering project, including field data, reporting and final plans.
7. Recognizes the need for and demonstrate good communication skills, both written and oral.
8. Demonstrates an ability to work in small and large teams in different roles throughout the semester.
9. Demonstrates the ability to use the techniques, skills and modern engineering tool necessary for engineering practice.
10. Demonstrates an appreciation of the interaction between the various disciplines in the design of their project.
11. Utilizes building codes and design standards to determine design requirements.

Results from the spring 2011 application of the rubric were mixed and somewhat disappointing as illustrated by the chart in Figure 6 and the data in Table 14.

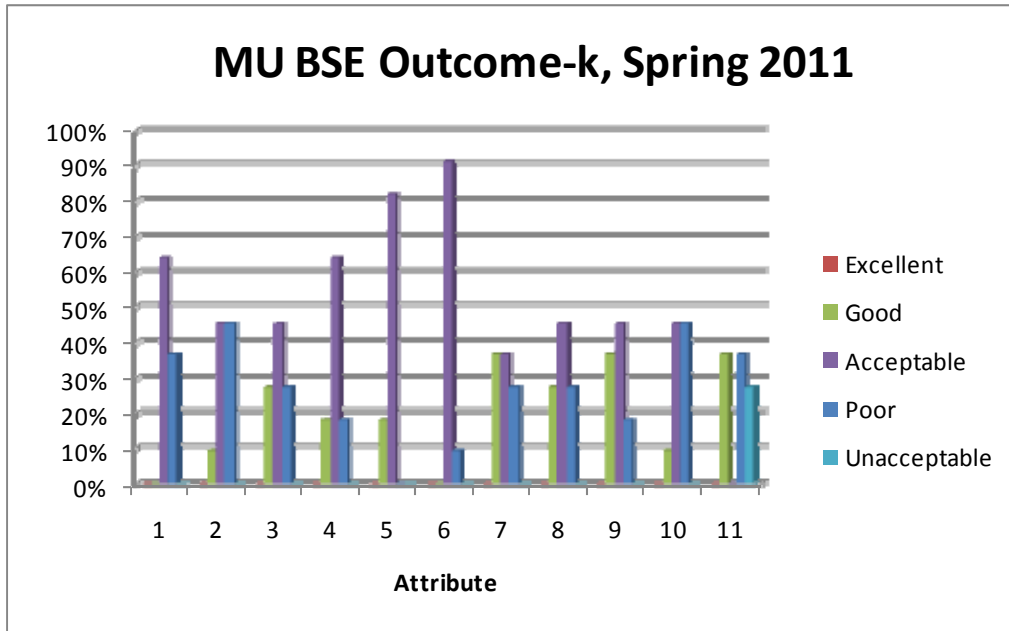
**Results:** The goal of having at least 75% of the students achieve a rating of “Acceptable” or higher was not met for attributes #1, #2, #10, and #11

**Action:** Strategies will be developed during the fall 2011 semester to address the less-than-acceptable performance. Performance levels for 2012 will be monitored and compared to 2011 levels to determine if improvement occurs.

**Table 14 –Learning Outcome-k Results, Spring 2011**

Attribute	G.E Acceptable	L.T. Acceptable
1	64%	36%
2	55%	45%
3	73%	27%
4	82%	18%
5	100%	0%
6	91%	9%
7	73%	27%
8	73%	27%
9	82%	18%
10	55%	45%
11	36%	64%

**Figure 6 – Distribution of Results for Learning Outcome-k, Spring 2011**



**ENGR453 Revised Team Peer Evaluation (Spring 2010)**

**Learning Outcome d:** an ability to function on multidisciplinary teams

<b>Attribute</b>	<b>Excellent (5)</b>	<b>Good (4)</b>	<b>Acceptable (3)</b>	<b>Poor (2)</b>	<b>Unacceptable (1)</b>
<b>Contribution to team project/work</b>	Collects and presents a great deal of relevant information; offers well-developed and clearly expressed ideas directly related to the group's purpose.	Collects basic and some advanced information useful to the project; often offers useful ideas to meet the team's needs.	Collects basic, useful information related to the project; occasionally offers useful ideas to meet the team's needs.	Collects information when prodded; tries to offer some ideas, but not well developed, and not clearly expressed, to meet team's needs.	Does not collect any relevant information; no useful suggestions to address team's needs.
<b>Taking responsibility</b>	Performs all tasks very effectively; attends all meetings and takes a positive leadership role.	Performs all tasks very effectively; attends all meetings and participates enthusiastically; very reliable.	Performs all assigned tasks; attends meetings regularly and usually participates effectively; generally reliable.	Performs assigned tasks but needs many reminders; attends meetings regularly but generally does not say anything constructive; sometimes expects others to do his/her work.	Does not perform assigned tasks; often misses meetings and, when present, does not have anything constructive to say; relies on others to do the work.
<b>Valuing other team members</b>	Always listens to others and their ideas; helps others develop their ideas while giving them full credit; always helps the team reach a fair decision.	Always listens to others and their ideas; always helps the team reach a fair decision.	Generally listens to others' points of view; always uses appropriate and respectful language; tries to make a definite effort to understand others' ideas.	Does much of the talking; does not pay attention when others talk; often assumes their ideas will not work; no personal attacks and put-downs but sometimes patronizing.	Often argues with team mates; doesn't let anyone else talk; occasional personal attacks and "put-downs"; wants to have things done his way and does not listen to alternate approaches.

**ENGR452 2011 Survey Results**

ENGR452 is a required course that is taught in a seminar format. The objective of the course is to begin to prepare students for real-world engineering practice. To accomplish this objective, presentations are made by numerous speakers about contemporary engineering issues, engineering ethics, licensure, and professionalism. The survey shown below was conducted, and the student perceptions give valuable feedback regarding several of the BSE learning objectives – particularly outcomes (i), (j), and (k).

**ENGR 452 – Engineering Practice and Design  
Course Evaluation, Fall 2011 (21 Students)**

Please answer the following questions regarding course outcomes. **Strongly Agree = 5, Somewhat Agree = 4, Neither Agree Nor Disagree = 3, Somewhat Disagree = 2, Strongly Disagree = 1.**

Agree ← → Disagree

		5	4	3	2	1	2011 Average
1.	The course helped me better understand the role the engineer plays in society and in public decision making.						4.2
2.	I obtained knowledge of governing ethical and professional codes of conduct in the course.						4.5
3.	The course helped me understand my responsibility to be an ethical member of my profession and society.						4.6
4.	The course helped me understand the role of professional societies and organizations.						3.9
5.	The course helped me understand the impact that political and judicial processes, culture and current events have on the practice of engineering.						4.3
6.	The course helped me understand professional liability issues for engineers.						4.6
7.	The course strengthened my ability to communicate ideas in verbal and written form.						3.4
8.	After completing the course, I better understand the importance of professional engineering registration and the continuing education requirements for professional practice.						4.4
9.	After completing the course, I have a better understanding of how environmental issues affect engineering practice and design.						4.0

Agree ← → Disagree

		5	4	3	2	1	2011 Average
11.	The course provided me with a better understanding of the need for keeping up-to-date on contemporary issues that affect engineering practice and design throughout my engineering career.						4.3
12.	The presentations and interactions with engineering practitioners and instructors provided useful and current information on a variety of professional issues.						4.2
13.	I plan to continue my engineering education throughout my career through attendance in seminars, workshops, courses, conferences, membership in professional societies, and/or subscription to relevant newsletters or journals.						4.8
14.	The course prepared me for additional study and discussion of professional, technical, environmental, financial, legal and societal issues as we work toward completion of the senior design project next semester.						3.9

Results for questions seem to indicate that students have an appreciation of the need for life-long learning (outcome-l, questions 8-14) and a better understanding of contemporary engineering issues (outcome-j, questions 1-5).