

**Mechatronic Engineering Program
Annual Program Improvement Report
2014 - 2015**

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1. Introduction

The educational objectives, outcomes, and process to make improvements to the mechatronic engineering program, aka, “The Program”, are listed in the Mechatronic Engineering Program Improvement Plan for 2013-2014.

This document, the Mechatronic Engineering Annual Program Improvement Report provides a summary of findings and actions for the 2014-2015 academic year resulting from implementation of the 2013-2014 Mechatronic Engineering Program Improvement Plan.

This report is divided into three major sections_ namely, actions taken in 2014-2015 to improve “The Program,” assessment data gathered in 2014-2015, and recommendations for improvements to “The Program” based on assessment results.

More complete data can be found in the assessment files in the file cabinet located in the MMEM Department in OCNL 436A and in the MMEM Department folder in the Chico State Bay server.

2. Actions Taken in 2014-2015 to Improve “The Program”

2.1 Areas Recommended for Improvement in 2013-2014 Program Improvement Report.

The 2013-2014 Annual Program Improvement Report recommended four areas of improvement, e.g., faculty instructional effectiveness, fundamentals of engineering (FE) exam, curriculum, graduating senior survey, student evaluation of teaching, and student learning outcomes assessment in CIVL 495 course.

2.1.1 Faculty Instructional Effectiveness

The 2013-2014 Program Improvement Report identified that instructional effectiveness varied greatly among department faculty. The MMEM department has hired four new faculty members in the last two years, two for the Mechatronic engineering program, one for the mechatronic engineering program, and one for the sustainable manufacturing program. Some of the new faculty were experiencing some teaching issues that were reported in the student evaluation of teachers (SET) forms. The new faculty were provided with a mentor for the RTP process that included professional development techniques, as well as, advice on teaching techniques.

Some of the faculty excel in teaching and who provide laudable instruction. A few of the instructors, though, fall below the students’ expectations. All of the faculty were reminded of effective teaching techniques and opportunities to use online resources for more effective teaching.

The results from the graduating senior survey identified the quality of teaching by faculty in the MEM department was rated as 4.1 out of 5 points in a Likert scale questionnaire. The comments from the graduating senior survey included the following positive comments, "Many very good professors that bring up the experience in this major." The survey also included some negative comments. "Many very good professors that bring up the experience in this major," "Several bad apples are difficult to learn from however," " For the most part the faculty was really good at teaching the subject, however there are a few teachers that I feel need improvement," "More novel, creative, hands on in-class/lab exercises," "Incorporate more hands on projects in every class in the curriculum."

Teaching effectiveness can also be measured with the Student Evaluation of Teaching (SET) forms that the students complete in the fall and spring semesters. The SET provides an opportunity for students to rate the quality of education using the Likert scale. An example SET with the SIR II form is provided in the appendix. It lists ten sections and 45 questions that include the following sections:

1. Course organization and planning
2. Communication
3. Faculty/student interaction
4. Assignments, exams, and grading
5. Instructional methods and materials
6. Course outcomes
7. Student effort and involvement
8. Course difficulty, work load, and pace
9. Overall evaluation
10. Student information

The average ratings of the MEM faculty for eight of the ten categories for MEM courses for fall of 2014 and spring of 2015 are listed in Figures 1 and 2. The rating scale is 1 to 5 with 5 being most effective.

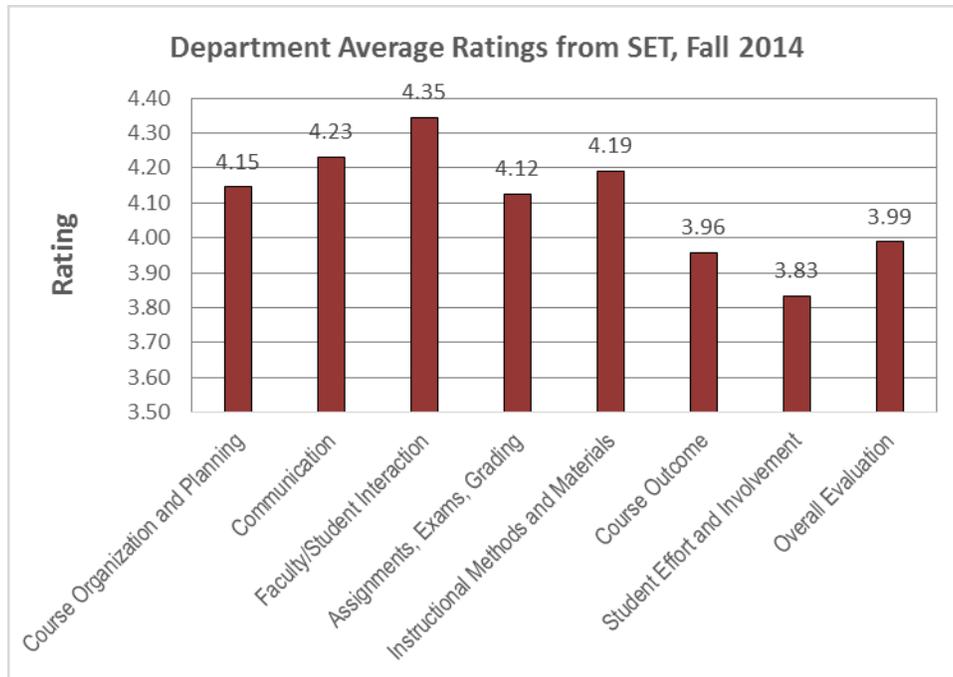


Figure 1. Average SET scores for the MMEM Department in fall 2014

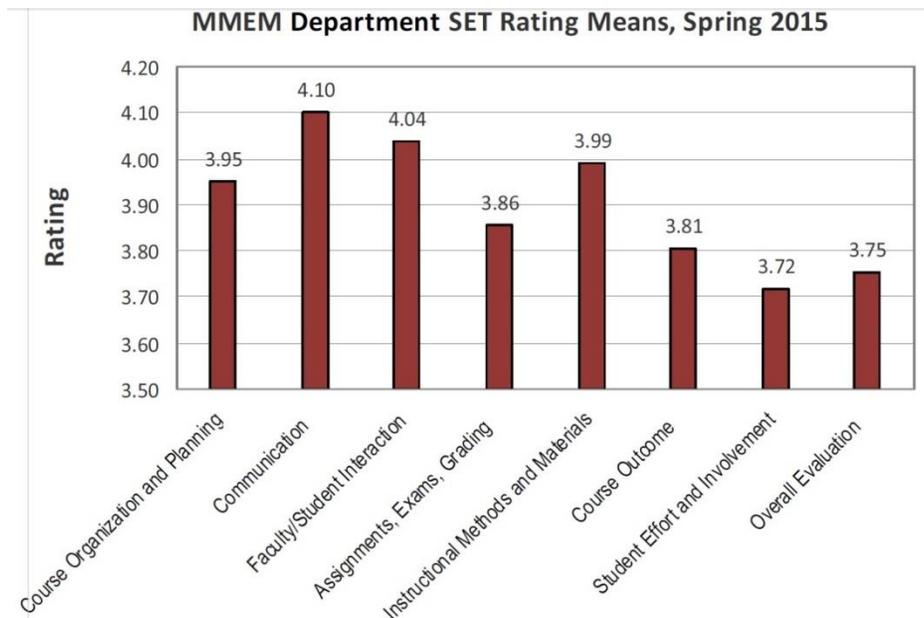


Figure 2. Average SET scores for the MMEM Department in spring 2015

Overall the faculty in the department is deemed very effective in all eight categories. The strengths in the teaching techniques are with “communication”, “faculty/student interactions”, and “instructional methods and materials.” The weaknesses in the teaching techniques are with “student effort”, “overall evaluation”, and “course outcomes.”

The SET evaluations for “overall evaluation” and “course outcomes” can be expanded across all of the instructors for the courses taught in the spring of 2015. The courses in MMEM are taught by tenured (5 faculty), tenure-track (5 faculty), full-time lecturers (2 faculty), and part-time lecturers (7 faculty). The SET evaluations for the courses taught in the MMEM for the “course outcomes” and “overall evaluation” are listed in the following:

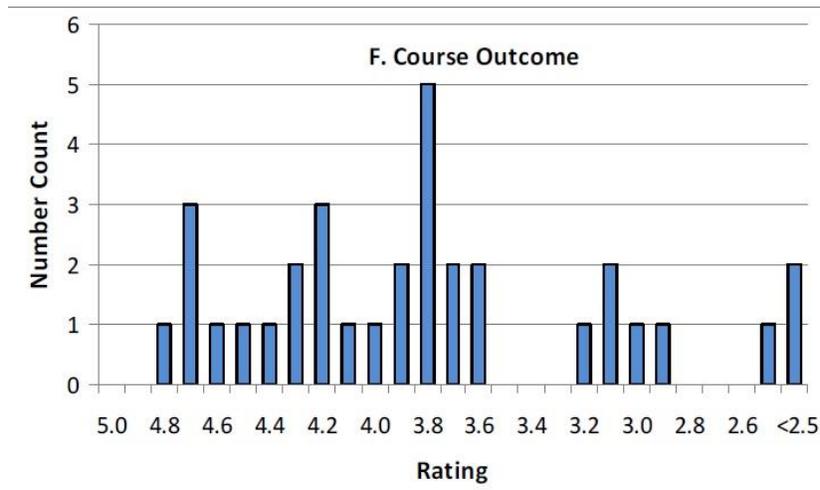


Figure 3. SET scores for the “course outcomes” in MMEM courses in spring 2015

The SET scores illustrates three groupings of scores for the classes. The first group has a score higher than 3.6 and is considered “highly effective.” 50% of the courses had an evaluation of greater than 4.0 and indicated excellent teaching effectiveness. The second group of SET evaluations in the middle of the figure is considered “effective.” The third group on the right with SET scored less than 2.6 is considered “not effective.”

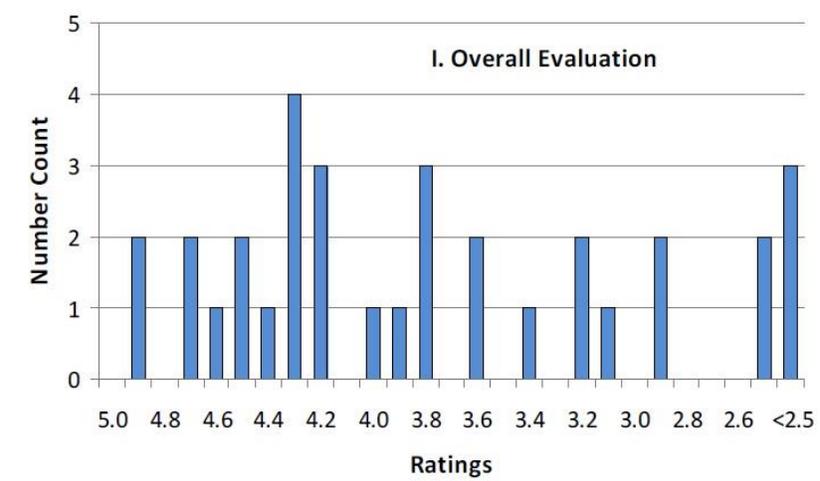


Figure4. SET scores for the “overall evaluation” in MMEM courses in spring 2015

The SET scores illustrates three groupings of scores for the classes. The first group has a score higher than 3.8 and is considered highly effective. The second group of SET evaluations in the middle of the figure is considered effective. The third group on the right with SET scored less than 2.6 is considered not effective.

SET results for the spring 2015 and fall 2014 were distributed to the faculty. Discussions on teaching effectiveness techniques will be discussed in the fall department meetings. Another indicator of faculty instructional quality, although not course specific can be gauged using the responses from graduating senior as to the quality of teaching by faculty in your department. For the last 5 years the rating of the question is listed in the following table.

Table 1. Averages of responses to the question on MMEM faculty teaching quality

Question on survey	2010	2011	2012	2013	2014
Quality of teaching by faculty in your department	3.70	4.00	3.95	3.83	4.16

The results indicate that the changes made to the curriculum and labs have increased the student’s evaluation of teaching quality in the department.

2.13 Lab equipment upgrade

We have upgraded the lab equipment in the Mechatronics Laboratory (MECA 482) and the CNC laboratory for Introduction to Manufacturing course (SMFG 160). Additional laboratory upgrades are being pursued by several faculty with external and internal grants.

2.1.4 Graduating Senior Survey and SET Participation Rates

Student participation is required in the graduating senior survey in the MECA 440 B class in the spring semester. The participation rate is nearly 100%. The participation rate of students in the SET evaluations depends n the choice of the faculty weather to administer it electronically or with paper. The participation rate of the paper evaluations are higher than with the electronic form.

2.1.5 CIVL 495 Data for Program Assessment

The participation rate for the CIVL 495 in the program assessment was improved for 2014 to 2015 academic year. Assessment data was gathered for spring 2015 semester but not available for fall 2014.

3. Program Educational Objectives and Student Learning Outcomes Assessments

3.1 Statement of Program Educational Objectives

The Mechatronic Engineering Program's educational objectives are best framed in terms of goals for its graduates. Mechatronic engineering graduates will:

1. be effective engineers and problem solvers.
2. be well educated in the mechanical engineering sciences.
3. be able to use engineering tools that will enhance their productivity.
4. be familiar with current technology and how it can be incorporated into their design, analysis, and testing activities including an understanding of manufacturing methods and the use of computers, sensors, and actuators to automate machines and processes.
5. be effective oral, written, and graphical communicators.
6. be able to function effectively as members of multi-disciplinary teams.
7. have an appreciation for the individual, society, and human heritage, and be aware of the impact of their designs on human-kind and the environment.
8. be prepared for a variety of engineering careers, graduate studies, and continuing education.

3.2 Student Learning Outcomes

The educational objectives of the program are achieved mainly through the Mechatronic engineering curriculum. The educational objectives allow the department to develop student learning outcomes for the students that are associated with courses in the curriculum. Graduates of the mechatronic engineering program should demonstrate the following:

- a. *An ability to apply knowledge of mathematics, science, and engineering*
- b₁. *An ability to design experiments to evaluate the performance of a mechatronic system or component with respect to specifications*
- b₂. *An ability to conduct experiments, as well as analyze and interpret data*
- c. *An ability to design a mechatronic system, component, or process to meet desired needs*
- d. *An ability to function effectively as members of multidisciplinary teams*
- e₁. *An ability to define engineering problems*
- e₂. *An ability to solve engineering problems*
- f. *An understanding of professional ethical responsibility*
- g₁. *An ability to communicate technical matters effectively in oral form*
- g₂. *An ability to communicate technical matters effectively in written form*
- g₃. *An ability to communicate technical matters effectively in graphical form*
- h. *The broad education necessary to understand the impact of engineering solutions in a global 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 mechatronic engineering tools necessary for engineering practice*

3.3 Assessment of Achievement of Program Outcomes

Program outcomes b_1 , b_2 , g_1 , g_2 , and k are achieved in multiple courses. Many courses in the curriculum have a lab component, including CHEM 111, CIVL 321, EECE 211L, MECA 380, MECH 100L, MECH 140, MECH 200, MECH 210, MECH 338, MECH 432, MECH 440B, PHYS 204A, PHYS 204B, and SMFG 160. In most cases students do not design experiments (program outcome b_1). The students typically run experiments that are designed by the course instructor or others (program outcome b_2). Nonetheless, these experiences set the groundwork for working with design of experiments in MECH 440B.

Communication skills are taught in general education courses as well as courses in the major. The foundation of oral communication skills (program outcome g_1) is set down in the required general education speech course (CMST 131 or CMST 132). Academic writing (ENGL 131) is a required general education course that sets the groundwork for proficiency in written communication (program outcome g_2). Each of the remaining general education courses that a student takes has a writing component to the class that improves the writing skills of the student. The Mechatronic Engineering program has a writing proficiency course included in the curriculum, i.e., MECA 440A and MECA 440 B. Significant writing assignments are also required in other engineering courses, e.g., CIVL 495, MECA 380, and MECH 340.

Selection of courses and instruments for assessment are based on the course material and structure that are suitable for measurements of the defined outcome. The outcome assessment is conducted every time the selected course is taught.

Students are not aware of the embedded components designed for outcome measurement. Sample size typically is the enrollment of the designated course which changes every semester. Instructors of the same course use similar measurement instruments and measurement criteria. Individual instructors frequently modify exam questions or project assignments.

During the academic year, the chair can distribute an electronic program outcome record sheet for each outcome assessed in the course. The sheet identifies the outcome being assessed, the assessment instrument used, how the instrument is used to demonstrate basic competency, the name of each student in the course, the student's grade or score on each assessment measure, and the student's course grade.

These outcome record sheets are submitted electronically by instructors to the department chair who archives them in the on-line BlackBoard Learn Resource Community and places a hard copy in the Mechatronic Engineering program file. The data in these sheets is used together with other information to write the annual program improvement report.

The instructor provides the embedded assessment for the learning outcome to the students in the class. The embedded assessment can be a homework assignment, quiz, exam, or other assignment in the class. A list of the embedded assessments for the classes is provided in Table 3.3. The instructor grades the course work materials that can include the embedded assessment. The list of students passing the embedded assessment in the fall of 2014 and spring of 2015 is provided in the following table.

Table 1. Percentage of students achieving student learning outcomes

Program Outcome	Course	Outcome Statement	Number of majors demonstrating competency / Number of majors enrolled (Pass rate)	
			Fall 2014	Spring 2015
<i>a</i>	MECH 340	<i>An ability to apply knowledge of mathematics, science, and engineering</i>	<i>not taught</i>	25/29 (86%)
<i>b1</i>	MECA 440B	<i>An ability to design experiments to evaluate the performance of a mechatronic system or component with respect to specifications</i>	<i>not taught</i>	25/30 (83%)
<i>b2</i>	MECA 380	<i>An ability to conduct experiments, as well as analyze and interpret data</i>	<i>not taught</i>	32/34 (94%)
<i>c</i>	MECA 486	<i>An ability to design a mechatronic system, component, or process to meet desired needs</i>	<i>not taught</i>	2/30 (93%)
<i>d</i>	CIVL 495	<i>An ability to function effectively as members of multidisciplinary teams</i>	15/15 (100%)	18/18 (100%)
	MECA 440A	<i>An ability to function effectively as members of multidisciplinary teams</i>	31/31 (100%)	<i>not taught</i>
<i>e1</i>	MECA 440A	<i>An ability to define engineering problems</i>	31/31 (100%)	<i>not taught</i>
<i>e2</i>	MECA 482	<i>An ability to solve engineering problems</i>	23/25 (92%)	<i>not taught</i>
<i>f</i>	CIVL 495	<i>An understanding of professional ethical responsibility</i>	15/15 (100%)	18/18 (100%)
<i>g1</i>	MECA 440A	<i>An ability to communicate technical matters effectively in oral form</i>	31/31 (100%)	<i>not taught</i>
<i>g2</i>	MECH 340	<i>An ability to communicate technical matters effectively in written form</i>	<i>not taught</i>	28/29 (97%)
<i>g3</i>	MECH 340	<i>An ability to communicate technical matters effectively in graphical form</i>	<i>not taught</i>	21/29 (72%)
<i>h</i>	CIVL 495	<i>The broad education necessary to understand the impact of engineering solutions in a global and societal context</i>	15/15 (100%)	18/18 (100%)
<i>i</i>	CIVL 495	<i>A recognition of the need for, and an ability to engage in, life-long learning</i>	15/15 (100%)	18/18 (100%)
<i>j</i>	CIVL 495	<i>A knowledge of contemporary issues</i>	15/15 (100%)	18/18 (100%)
<i>k</i>	MECA 380	<i>An ability to use the techniques, skills, and modern mechatronic engineering tools necessary for engineering practice</i>	<i>not taught</i>	31/34 (91%)

3.4 Assessment Data Summaries

The data collected from designated courses taught in fall 2014 and spring 2015 are summarized in the following table.

Table 2. Percentage of students failing to achieve student learning outcomes

Program Outcome	Course	Assessment Instrument	Demonstration of basic competency above a minimum grade or score	Number of MECA majors FAILING to demonstrate basic competency / Number of MECA majors enrolled in class	
				Fall 2014	Spring 2015
<i>a</i>	MECH 340	Exams (x3)	Better than 60% correct	<i>not taught</i>	4/29 (14%)
<i>b1</i>	MECA 440B	Individual written test plan	Pass/fail assessment	<i>not taught</i>	5/30 (17%)
<i>b2</i>	MECA 380	Lab assignment report	C+ grade or better	<i>not taught</i>	2/34 (6%)
<i>c</i>	MECA 486	Design projects (x3)	Average C+ or better	<i>not taught</i>	2/30 (7%)
<i>d</i>	CIVL 495	Reports, instructor observation	Score of 7 or better out of 10	0/15 (0%)	<i>no data</i>
	MECA 440A	Performance in group project	Faculty Advisor evaluation	0/31(0%)	<i>not taught</i>
<i>e1</i>	MECA 440A	Assignment of design specifications	Pass/fail assessment	0/31(0%)	<i>not taught</i>
<i>e2</i>	MECA 482	Exams and projects	Total at least 57 out of 95 points	2/25 (8%)	<i>not taught</i>
<i>f</i>	CIVL 495	Reports, instructor observation	Score of 7 or better out of 10	0/15 (0%)	<i>no data</i>
<i>g1</i>	MECA 440A	Presentation in design review	Pass/fail assessment	0/31(0%)	<i>not taught</i>
<i>g2</i>	MECH 340	Writing in design report	C or better	<i>not taught</i>	1/29 (3%)
<i>g3</i>	MECH 340	Drawings in design report	C or better	<i>not taught</i>	8/29 (28%)
<i>h</i>	CIVL 495	Reports, instructor observation	Score of 7 or better out of 10	0/15 (0%)	0/18 (0%)
<i>i</i>	CIVL 495	Reports, instructor observation	Score of 7 or better out of 10	0/15 (0%)	0/18 (0%)
<i>j</i>	CIVL 495	Reports, instructor observation	Score of 7 or better out of 10	0/15 (0%)	0/18 (0%)
<i>k</i>	MECA 380	Three lab assignments using LabVIEW	At least 2 assignments achieving $\geq 70\%$	<i>not taught</i>	3/34 (9%)

The assessment results serve to identify the relative weakness of student learning in defined outcomes. The students achieved more than 90% on 11 of the 15 outcomes listed. As indicated in Table 1 all of the students achieved greater than 80% on all outcomes, except the “ability to communicate technical matters in graphical form”.

Table 2 above lists the percentage of students who failed to achieve an embedded outcome. A failure rate of 28% for graphical communication raises several concerns about the CAD skills of students. The results would need to be discussed by the faculty in the future. These results are not consistent with the weaknesses in the program listed in the alumni and the graduating student surveys who express confidence in their CAD abilities.

3.5 Summary of Senior Survey

The educational objectives were also topics on the graduating senior survey that are sent out to graduating students every spring. The survey is provided by the college office to the graduating students. The questions are broken into two categories_ the first pertains to a survey of the overall Chico State experience and the second pertains to the individual departments in the college.

The first list of questions in the survey has several questions that relate to the department. The surveys for the last three years had 14 students responding in 2014, 17 students responding in 2013, and 30 students responding in 2012. The questions in the survey were different in the previous years. Those questions include the following: (The averages for the last three years are listed out of a range from 1 for dissatisfied to 5 for satisfied for 2014, 2013, and 2012)

At Chico State, how satisfied were you with the... (2014, 2013, 2012 averages)

1. Quality of teaching by faculty in your department. (3.929, 3.889, 3.963)
2. Access to faculty in your department. (4.357, 3.944, 4.148)
3. Availability of courses in your department.(4.357, 3.778, 3.556)
4. Quality of courses in your department.(4.017, 3.889, 3.815)
5. Access to laboratory facilities and equipment.(3.929, 4.056, 4.148)
6. Quality of laboratories and equipment. (3.643, 3.722, 3.778)
7. Access to computer facilities. (3.786, 4.000, 4.074)
8. Quality of computer facilities (3.714, 3.278, 3.296)
9. Academic advising from your major advisor. (4.214, 4.222, 3.556)
10. Career information from your department.(3.786, 3.944, 3.370)
11. The overall quality of your education. (4.286, 4.000, 3.519)
12. Your overall experience at Chico State. (4.429, 3.722, 3.185)

The results of the student evaluation of the Mechanical and Mechatronic Engineering and Sustainable Manufacturing Department, faculty, curriculum, and laboratory facilities illustrates that the strengths of the department are access to faculty in the department, the quality of courses in the department, and the quality of teaching in the department. The overall experience has improved for mechatronic engineering students over the last 3 years as highlighted by the improvements in questions 12. The weaknesses in the department program are the quality of computing facilities, access to computing facilities, quality of laboratories, and career information from the faculty. These strengths and shortcomings were discussed

with the department faculty in department meetings. We requested and received new computers and tables for the computing lab and redesigned the laboratory space for more efficient pedagogy in computing courses. We also decided to add additional courses for both fall and spring semesters.

The second set of questions is supplemental questions that relate to our programs educational objectives and student learning outcomes. Examples of questions related to student learning outcomes are listed below: (Note: the scale is 1: Very Unprepared to 5: Very Prepared) (Note: 13 students answered the survey in 2014, 29 students in 2013, and 44 students in 2012)

Based on your educational experience here at Chico State how well prepared are you to:
(2014, 2013, 2012 averages)

1. Apply knowledge of math, science, and engineering. (4.615, 4.294, 4.000)
2. Design and execute test procedures (for equipment/hardware components or software). (3.923, 4.471, 4.296)
3. Analyze, assess, and interpret data/results from test procedures (3.615, 4.423, 4.444)
4. Design a component or system to meet desired needs (4.308, 4.176, 4.370)
5. Function in a multidisciplinary team. (4.212, 4.235, 4.370)
6. Identify, formulate and solve technical problems. (4.538, 4.118, 4.370)
7. Communicate technical matters in writing. (4.385, 4.059, 4.407)
8. Communicate technical matters orally. (4.692, 4.357, 4.500)
9. Understand and apply professional and ethical principles. (4.923, 4.000, 4.333)
10. Understand contemporary issues facing society (4.000, 3.786, 4.333)
11. Use modern tools and technology. (4.615, 3.857, 4.000)
12. Appreciate impact of your solutions on society and environment. (4.615, 3.643, 3.833)
13. Continue learning. (4.231, 3.929, 4.333)

The results from the survey show that the students feel the most qualified to apply knowledge of math, science, and engineering, communicate technical matters orally, and identify/formulate/ solve technical problems. All of the questions had an average rating above 4.0, and thus the students feel prepared to enter the professional engineering workforce. The results of the survey were discussed with faculty at the department meetings. The faculty agreed that we were weak in computer facilities and hope the new computers will resolve the issue.

3.6 Alumni Survey

The degree to which the program educational objectives are attained is assessed by gathering data about alumni and alumnae after they leave the university. This is accomplished by periodically providing surveys to alumni, alumnae, and their employers. The alumni survey is designed to elicit information regarding attainment of the program educational objectives, as well as career related information. Trends and patterns can emerge to relate the educational objectives and engineering performance of graduates.

The educational objectives and student learning outcomes were also topics on an alumni survey that was sent out to alumni periodically. The survey was sent to an alumni list provided by the development officer of the college. Seven alumni responded to the email request. The questions are as follows with the average for each item listed.

- A. Name _____
- B. Degree Major: Mechatronic Engineering _____
- C. Year graduated: _____
- D. Company name currently working _____
- E. Current job title: _____
- F. Length of time working as an engineer (average years) : _____
- G. Do you have a graduate degree? _____

Based on your educational experience here at Chico State how well prepared are you to... (Score: 1 for not well prepared to 5 for well prepared)

- | | |
|---|--------------------|
| 1. Apply knowledge of mathematics, science, and engineering. | Score: <u>4.43</u> |
| 2. Design experiments to evaluate the performance of a mechatronic system or component with respect to specification. | Score: <u>4.29</u> |
| 3. Conduct experiments, as well as analyze and interpret data. | Score: <u>4.14</u> |
| 4. Design a mechatronic system/component/process to meet needs. | Score: <u>3.71</u> |
| 5. Function effectively as members of multidisciplinary teams. | Score: <u>4.86</u> |
| 6. Define engineering problems. | Score: <u>4.43</u> |
| 7. Solve engineering problems. | Score: <u>4.50</u> |
| 8. Understand professional ethical responsibility. | Score: <u>4.57</u> |
| 9. Communicate technical matters effectively in oral form. | Score: <u>4.57</u> |
| 10. Communicate technical matters effectively in written for. | Score: <u>4.43</u> |
| 11. Communicate technical matters effectively in graphical for. | Score: <u>4.57</u> |
| 12. Understand the impact of engineering solutions in a global and societal context. | Score: <u>4.14</u> |
| 13. Recognize the need for, ability to engage in, life-long learning. | Score: <u>4.14</u> |
| 14. Understand contemporary issues. | Score: <u>4.14</u> |
| 15. Use the techniques, skills, and modern mechanical engineering tools necessary for engineering practice. | Score: <u>4.29</u> |
| 16. Enter the engineering workplace or company. | Score: <u>4.14</u> |

Other needed student learning outcomes.

1. ___ Printed Circuit Board (PCB) design.
2. ___ Drop wire wrapping
3. ___ Engineering cost analysis and economics.
4. ___ Mechatronics based thermal class.

Comments

1. The hands-on experience has definitely given me an advantage over other engineers and I happily recommend that new engineers get a hands-on education. CSUC Chico provided a well-rounded education
2. Chico was a great place to study. It prepared me for the workforce
3. There are a lot of people from tech schools that come out better prepared in some aspects. Some are equipped with experience in working with the immense types of controls and equipment.

Figure 4.1 Alumni Survey

The survey was completed by seven graduates from the mechatronic engineering program at Chico State. The range of experience as an engineer ranged from 1 year to seven years with an average of 3.29 years. None of the graduates has a graduate degree. The respondents rated the following two areas as the best prepared from their education: “*Function effectively as members of multidisciplinary teams,*” and “*Communicate technical matters effectively in oral form.*” The respondents rated the following area as the least prepared from their education: “*Design a mechanical system to meet a desired need.*” The alumni rated all of the items with a score above 4.0 except the one for designing a mechanical system.

Results from the survey were reviewed with faculty and changes to the curriculum and student learning outcomes will be addressed in the fall semester at department meetings.

3.8 Student Evaluation of Teaching (SET)

The mandatory student evaluation of teaching is given to students for fall and spring semester courses. The SET questionnaire contains ten categories to evaluate the course. Each of the ten categories has a list of questions that relate to class organization, instructor preparation, instructor teaching techniques, and student preparation to name a few. The ten sets of questions are listed in the Appendix.

The average ratings for eight of the ten categories for MMEM courses for fall 2014 and spring 2015 are listed in Figures 1 and 2. The rating scale is 1 to 5 with 5 being most effective.

The results show that the top three categories of instruction for the department are the “Instructor Communication”, “Faculty/Student Interaction”, and “Instructional Methods and Materials.” The lowest scoring categories were “Student Effort and Involvement”, “Overall Evaluation”, and “Course Outcome.” The information was shared with faculty and will be discussed in future department meetings.

4. Program Improvement Recommendations

4.1 Assessments, Student Evaluations, and Surveys

The results from the student learning outcomes, graduating senior survey, alumni survey, and SET results can offer some areas of improvement for the mechatronic engineering program.

The assessment results serve to identify the relative weakness of student learning in defined outcomes. The students achieved more than 90% on 13 of the 15 outcomes listed. As indicated in the table all of the students achieved greater than 80% on all outcomes, except the “ability to communicate technical matters in graphical form”.

Table 2 above lists the percentage of students who failed to achieve an embedded outcome. A failure rate of 28% for graphical communication raises several concerns about the CAD skills of students. A high failure rate for graphical communication raises several concerns is surprising and was not identified in previous years. We will review the results with faculty and review the embedded assessment assignments to be sure they are similar to assessments in the past. These results are not consistent with the weaknesses in the program listed in the alumni and the graduating student surveys.

The results of the graduating senior survey of the mechatronic engineering program, faculty, curriculum, and laboratory facilities illustrates that the strengths of the department are access to faculty in the department, the quality of courses in the department, and the quality of teaching in the department. The weaknesses in the department program are the quality of computing facilities, quality of laboratories, and career information from the faculty. We have made changes to the computer labs and the instructional labs to improve the computer and laboratory equipment.

The results from the alumni survey found that our graduates are very well prepared to enter the mechatronic engineering careers. The alumni and alumnae rated all of the items in the survey with a score above 4.0 except “*Design a mechanical system/component/process to meet need.*” This is surprising since the students complete a design of mechanical and electrical components in their senior project class.

The alumni would also like additional instruction in the following areas:

- *Printed Circuit Board (PCB) design,*
- *Drop wire wrapping,*
- *Engineering cost analysis and economics, and*
- *Mechatronics based thermal class.*

These items will be discussed in the faculty meetings to see if the curriculum will be modified.

4.2 Faculty

Although the majority of student written comments and the evaluations from the SET are fairly positive, there is a wide range of rating distribution in the “Course Outcomes” and “Overall Evaluation Categories” in the SET. Teaching effectiveness tools can be discussed with faculty during faculty meetings and with Retention-Tenure Promotion (RTP) for the new faculty. The faculty and department chair should find ways to minimize the negative effects of student learning.

The students in the graduating senior survey also had several comments about the faculty in the MEM department. Those comments include, “I think that we need faculty members who are well aware of the current technology. I had a few professors, who were not up to date with technology and as a result, I felt it made my educational experience a little challenging.” “I am going to speak very blatantly about this topic and I hope I do not offend anyone too much. There are professors in the College of Engineering that need to be replaced. They have been here far too long and care far too little about the students.” The student comments will be shared with the faculty at future department meetings.

4.3 Curriculum

The curriculum can be modified to improve student learning. One of the comments in the senior exit survey for 2013-2014 was “The use of labs and team projects is what has helped me understand the material.” We have added the courses every semester to improve the course availability for the students.

The lowest scoring class, MECA 380, can be modified to add a laboratory or activity section in addition to the lecture portion of the class. This can help emphasize key components of the curriculum and provide a practicum for the students. This can help address the educational concerns identified by some students. The course load for faculty and other administrative items would need to be considered to offer additional classroom time for the Faculty

Although the majority of student written comments and the evaluations from the SET are fairly positive, there is a wide range of rating distribution in the “Course Outcomes” and “Overall Evaluation Categories” in the SET. Teaching effectiveness tools can be discussed with faculty during faculty meetings and with Retention-Tenure Process (RTP) for the new faculty. The faculty and department chair should find ways to minimize the negative effects of student learning.

Student Outcome Assessment for CIVL 495

The student learning outcome assessment data from CIVL 495 was only recently available for this academic year (2014-2015). Missing assessment data from the previous years hindered the

assessment of some learning outcomes and the improvement for the mechatronic engineering program. The Dean's office will need to provide pressure to the Civil Engineering Department to continuously comply with the assessment plans of programs in the college.

Appendices

Sample Mechatronic Engineering Program Outcome Record Sheet

Mechatronic Engineering Program Outcome Record-Sheet

Course:	MECA 486 Motion and Machine Automation		Semester:	Spring 2014
MECA Program Outcome:	c. An ability to design a mechatronic component, system, or process to meet desired needs		Instructor:	Dr. Mechatronics
Description of instruments used in this course to measure attainment of program outcome:	1	Design Project 1b		
	2	Design Project 2		
	3	Design Project 3		
	4			
	5			
	6			

How instruments are used to measure achievement of program outcome:	1	To achieve the ABET outcome, an average grade of C+ is required on design projects 1b, 2 & 3. Collectively, these projects demonstrate minimal competency in mechatronic design. This includes the technical aspects of a design and communicating the		
	2			
	3			
	4			
	5			
	6			

Number of MECA students in class achieving program outcome:	15	88%
Number of MECA students in class not achieving program outcome:	2	12%

Comments on the suitability of the instruments used to measure achievement of the program outcome:

Suggestions for possible changes of how achievement of the program outcome can be measured:

Suggestions for improving the program:

Graduating Senior Survey Instrument

9/8/2014

IR Survey



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ECC Graduating Senior Survey College of Engineering, Computer Science, and Construction Management CSU, Chico

Dear Graduating Senior,

The College of ECC has developed this Survey to give you a forum for letting us know what you think of your experience at CSU, Chico, and to help us to continually improve the curriculum and services we offer. We care a great deal about the programs and your feedback is essential to helping us provide the highest quality education we can deliver. Thank you in advance for your time and attention to this survey.

We hope the years you have spent with us have enriched your life and provided you with the foundation for a successful career. Please stay in touch!

With best wishes, The College of ECC Faculty

Educational Satisfaction Questions

		1	2	3	4	5
	At Chico State, how satisfied were you with the...	Very Dissatisfied				Very Satisfied
Q15	1. Quality of teaching by faculty in your department	<input type="radio"/>				
Q16	2. Quality of teaching by other faculty	<input type="radio"/>				
Q17	3. Access to faculty in your department	<input type="radio"/>				
Q18	4. Availability of courses in your department	<input type="radio"/>				
Q19	5. Quality of courses in your department	<input type="radio"/>				
Q20	6. Access to laboratory facilities and equipment	<input type="radio"/>				
Q21	7. Quality of laboratories and equipment	<input type="radio"/>				
Q22	8. Access to computer facilities	<input type="radio"/>				
Q23	9. Quality of computer facilities	<input type="radio"/>				
Q24	10. Academic Advising from your major advisor	<input type="radio"/>				
Q25	11. Academic Advising from the University Advising Office	<input type="radio"/>				
Q26	12. Career information from your department	<input type="radio"/>				
Q27	13. Availability of General Education courses	<input type="radio"/>				

<https://ir.csuchico.edu/surveys/admin/default.aspx?ticket=ST-1671883-JMbbZSmgFadoOBcSL0gJ-cas>

1/15

- Q28** 14. Quality of General Education courses
- Q29** 15. The overall quality of your education
- Q30** 16. Your overall experience at Chico State

Program Outcomes Questions

	1	2	3	4	5
Based on your educational experience here at Chico State, how well prepared are you to...	Very Unprepared				Very Prepared
Q31 17. Apply knowledge of math, science, engineering, or technology to solve problems	<input type="radio"/>				
Q32 18. Design and execute test procedures (for equipment/hardware components or software)	<input type="radio"/>				
Q33 19. Analyze, assess, and interpret data/results from test procedures	<input type="radio"/>				
Q34 20. Design a component or system to meet desired needs	<input type="radio"/>				
Q35 21. Function in a multidisciplinary team	<input type="radio"/>				
Q36 22. Identify, formulate and solve technical problems	<input type="radio"/>				
Q37 23. Communicate technical matters in writing	<input type="radio"/>				
Q38 24. Communicate technical matters orally	<input type="radio"/>				
Q39 25. Understand and apply professional and ethical principles	<input type="radio"/>				
Q40 26. Understand contemporary issues facing society	<input type="radio"/>				
Q41 27. Use modern tools and technology	<input type="radio"/>				
Q42 28. Appreciate impact of your solutions on society and environment	<input type="radio"/>				
Q43 29. Continue learning	<input type="radio"/>				
	1	2	3	4	5
	Strongly Disagree				Strongly Agree
Q44 30. I would recommend my major program at CSU, Chico to others.	<input type="radio"/>				

Page Break

31. Major: **Q1** Please Select One...
APCG [APCG]
CINS [CINS]
CIMT [CIMT]
CIVL [CIVL]
CMGT [CMGT]
CMPE [CMPE]
CSCI [CSCI]
EENG [EENG]
MENG [MENG]
MECA [MECA]
SMFG [SMFG]
Other [Other]

32. Graduation Date Semester **Q2** **1** **2** **3** **4**

Spring Summer Fall
 Year 2014 2014 2015 2015 2016 2016 2017 2017

33. Did you come to Chico State as a ... 1 2
 1 First-time freshman 2 Transfer
 34. How many semesters did you attend Chico State? 1 2 3 4 5
 1 1-3 2 4-6 3 7-9 4 10-12 5 13+

35. What is your Overall GPA? 1 2 3 4 5
 1 Below 2.25
 2 2.25-2.49
 3 2.50-2.74
 4 2.75-2.99
 5 3.00-3.24
 6 3.25-3.49
 7 3.50-3.74
 8 3.75-4.00

36. If you had an internship, co-op, or job related to your major while in school, how valuable was the experience? 1 2 3 4 5
 1 Did not have internship, co-op, or job
 2 Very Valuable
 3 Valuable
 4 Somewhat Valuable
 5 Not Valuable

37. If you were involved in any student/professional society, activities, or clubs, how valuable was the experience? 1 2 3 4 5
 1 Was not involved in societies, activities, or clubs
 2 Very Valuable
 3 Valuable
 4 Somewhat Valuable
 5 Not Valuable

38. Immediately after graduating are you planning to...
 Attend graduate School 1 2

1 Yes 2 No
 Begin Working 1 2
 1 Yes 2 No

If you are **NOT** planning to work full-time, or if you have not begun looking for a job, please skip to Question 13.

39. How many job offers have you received? 1 2 3 4
 1 None 1 One 2 Two 3 Three 4 Four +

40. Do you currently have a job offer that you are likely to accept? 1 2
 1 Yes
 2 No

Nested Question Group for Response [1] of question [Q10]

If 'Yes,' Please provide:

Company Name: 1

You Have 50 Characters Remaining.

Your Job Title: Q10 2

You Have 50 Characters Remaining.

Starting annual Salary Q10 3:

- 1: Less then \$30k
 2: \$30k-\$40k
 3: \$41k-\$50k
 4: \$51k-\$60k
 5: \$61k-\$70k
 6: \$71k or more

41. If you interviewed through the campus Career Planning & Placement Office, how helpful was it? Q11:

- 1: Did not interview through campus office
 2: Very Helpful
 3: Helpful
 4: Somewhat Helpful
 5: Not Helpful

42. If you found a job that you are likely to accept, how did you find it? Q12:

- 1: Campus Career Planning & Placement Office
 2: Faculty/department referral
 3: Online Posting
 4: Mailed resume
 5: Personal Connections
 6: Other

Nested Question Group for Response [6] of question [Q12]

Please Specify:

Q12 1:

You Have 3500 Characters Remaining.

43. Did you take a comprehensive exam (FE, CMdgT, MFT or other) for your discipline? Q13:

- 1: No, did not take
 2: Yes, and passed
 3: Yes and did not pass
 4: Yes and waiting for results

44. If you took a comprehensive exam, did you also attend a review course to prepare you for the exam? Q14:

- 1: Yes
 2: No

Nested Question Group for Response [1] of question [Q14]

If 'Yes,' how valuable was the course? Q14 1:

- 1: Very Valuable
 2: Valuable

- Somewhat Valuable
 Not Valuable

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45. How satisfied are you with the department support you received while enrolled at Chico State? Q45

- Very dissatisfied
 Somewhat dissatisfied
 Neutral
 Somewhat satisfied
 Very satisfied

46. How often did you meet with someone in the University Advising Office? Q46

- More than once a semester
 Once a semester
 Once a year
 Less than once a year
 Never

47. How often did you meet with your major (departmental) advisor? Q47

- More than once a semester
 Once a semester
 Once a year
 Less than once a year
 Never

48. How has the quality of your educational experience varied over the time period you were enrolled at Chico State? Q48

- Quality improved significantly
 Quality improved somewhat
 Quality stayed fairly consistent
 Quality declined somewhat
 Quality decline considerably

49. Permanent e-mail Address (so we can keep in touch) Q50

You Have 3500 Characters Remaining.

Page Break

APCG Supplemental Questions

1. Do you feel you are prepared to pursue a career in the Computer Graphics industry? APCG Q1

- Very unprepared

MECA Supplemental Questions

Based on your educational experience at Chico State, how well prepared are you to:	1	2	3	4	5
	Very Unprepared				Very Prepared
MECA Q1: 1. Write verifiable engineering specifications based on customer needs	<input type="radio"/>				
MECA Q2: 2. Produce a set of dimensioned engineering drawings	<input type="radio"/>				
MECA Q3: 3. Produce a circuit diagram for a printed circuit board	<input type="radio"/>				
MECA Q4: 4. Produce a wiring diagram for a particular design	<input type="radio"/>				
MECA Q5: 5. Communicate manufacturing needs, including tolerances, to a technician	<input type="radio"/>				
MECA Q6: 6. Create a Gantt chart for a project	<input type="radio"/>				
MECA Q7: 7. Identify the critical path for a project	<input type="radio"/>				
MECA Q8: 8. Develop a detailed project budget	<input type="radio"/>				
MECA Q9: 9. Integrate mechanical, electronics, and computing into a subsystem	<input type="radio"/>				
MECA Q10: 10. Present information for a design review	<input type="radio"/>				
MECA Q11: 11. Prepare and execute an experimental test plan	<input type="radio"/>				
MECA Q12: 12. Select hardware and develop software for automated data collection	<input type="radio"/>				
MECA Q13: 13. Select a material for a specific application	<input type="radio"/>				
MECA Q14: 14. Solve equations using numerical techniques	<input type="radio"/>				
15. Simulate or write equations of the					

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MECA Q15: performance of a system	<input type="radio"/>				
MECA Q16: 16. Select machine parts and lubrication for a particular application	<input type="radio"/>				
MECA Q17: 17. Select a motor for a particular application	<input type="radio"/>				

18. In the space provided, please provide additional comments that will help faculty to improve the quality of the education they provide. **MECA Q18:**

You Have 3500 Characters Remaining.

Alumni Survey Instrument

Alumni Survey

April 2015

Name: _____
Degree Major: _____
Year graduated: _____
Company name currently working _____
Current job title: _____
Length of time working as an engineer (years) : _____
Do you have a graduate degree? _____

Based on your educational experience her at Chico State how well prepared are you to...(Score 1 for not well prepared to 5 for well prepared)

Apply knowledge of mathematics, science, and engineering. Score: ____

Design experiments to evaluate the performance of a Mechatronic/thermal system or component with respect to specification. Score: ____

Conduct experiments, as well as analyze and interpret data. Score: ____

Design a Mechatronic system/ component/process to meet need. Score: ____

Function effectively as members of multidisciplinary teams. Score: ____

Define engineering problems. Score: ____

Solve engineering problems. Score: ____

Understand professional ethical responsibility. Score: ____

Communicate technical matters effectively in oral form. Score: ____

Communicate technical matters effectively in written for. Score: ____

Communicate technical matters effectively in graphical for. Score: ____

Understand the impact of engineering solutions in a global and societal context. Score: ____

Recognize the need for, ability to engage in, life-long learning. Score: ____

Understand contemporary issues. Score: ____

Use the techniques, skills, and modern Mechatronic engineering tools necessary for engineering practice. Score: ____

Enter the engineering workplace or company. Score: ____

Other needed student learning outcomes.

Comments

STUDENT INSTRUCTIONAL REPORT



Class Report
 Subunit: ECC - Mech Engr,
 Mechatronic Engr, Manufact Tech
 Course: Measurements and
 Instrumentation
 Instructor:
 Enrollment:
 Survey Period: Spring 2012

Assessing Courses and Instruction

PERCENTAGES reported below are based on the total number responding, which is: 7*

A. Course Organization and Planning	Omit	Not Applicable	5 Very Effective	4 Effective	3 Moderately Effective	2 Somewhat Ineffective	1 Ineffective	Mean
1. The instructor's explanation of the course requirements								
2. The instructor's preparation for each class period								
3. The instructor's command of the subject matter								
4. The instructor's use of class time								
5. The instructor's way of summarizing or emphasizing important points in class								
Overall Mean								

B. Communication	Omit	Not Applicable	5 Very Effective	4 Effective	3 Moderately Effective	2 Somewhat Ineffective	1 Ineffective	Mean
6. The instructor's ability to make clear and understandable presentations								
7. The instructor's command of spoken English (or the language used in the course)								
8. The instructor's use of examples or illustrations to clarify course material								
9. The instructor's use of challenging questions or problems								
10. The instructor's enthusiasm for the course material								
Overall Mean								

C. Faculty/Student Interaction	Omit	Not Applicable	5 Very Effective	4 Effective	3 Moderately Effective	2 Somewhat Ineffective	1 Ineffective	Mean
11. The instructor's helpfulness and responsiveness to students								
12. The instructor's respect for students								
13. The instructor's concern for student progress								
14. The availability of extra help for this class (taking into account the size of the class)								
15. The instructor's willingness to listen to student questions and opinions								
Overall Mean								

D. Assignments, Exams, and Grading	Omit	Not Applicable	5 Very Effective	4 Effective	3 Moderately Effective	2 Somewhat Ineffective	1 Ineffective	Mean
16. The information given to students about how they would be graded								
17. The clarity of exam questions								
18. The exams' coverage of important aspects of the course								
19. The instructor's comments on assignments and exams								
20. The overall quality of the textbook(s)								
21. The helpfulness of assignments in understanding course material								
Overall Mean								

E. Instructional Methods and Materials	Omit	Not Applicable	5 Very Effective	4 Effective	3 Moderately Effective	2 Somewhat Ineffective	1 Ineffective	Mean
22. Problems or questions presented by the instructor for small group discussions								
23. Term paper(s) or project(s)								
24. Laboratory exercises for understanding important course concepts								
25. Assigned projects in which students worked together								
26. Case studies, simulations, or role playing								
27. Course journals or logs required of students								
28. Instructor's use of computers as aids in instruction								
Means are not reported (***) for Instructional Methods								

F. Course Outcomes	Omit	Not Applicable	5 Very Effective	4 Effective	3 Moderately Effective	2 Somewhat Ineffective	1 Ineffective	Mean
29. My learning increased in this course?								
30. I made progress toward achieving course objectives?								
31. My interest in the subject area has increased?								
32. This course helped me to think independently about the subject matter...								
33. This course actively involved me in what I was learning?								
Overall Mean								

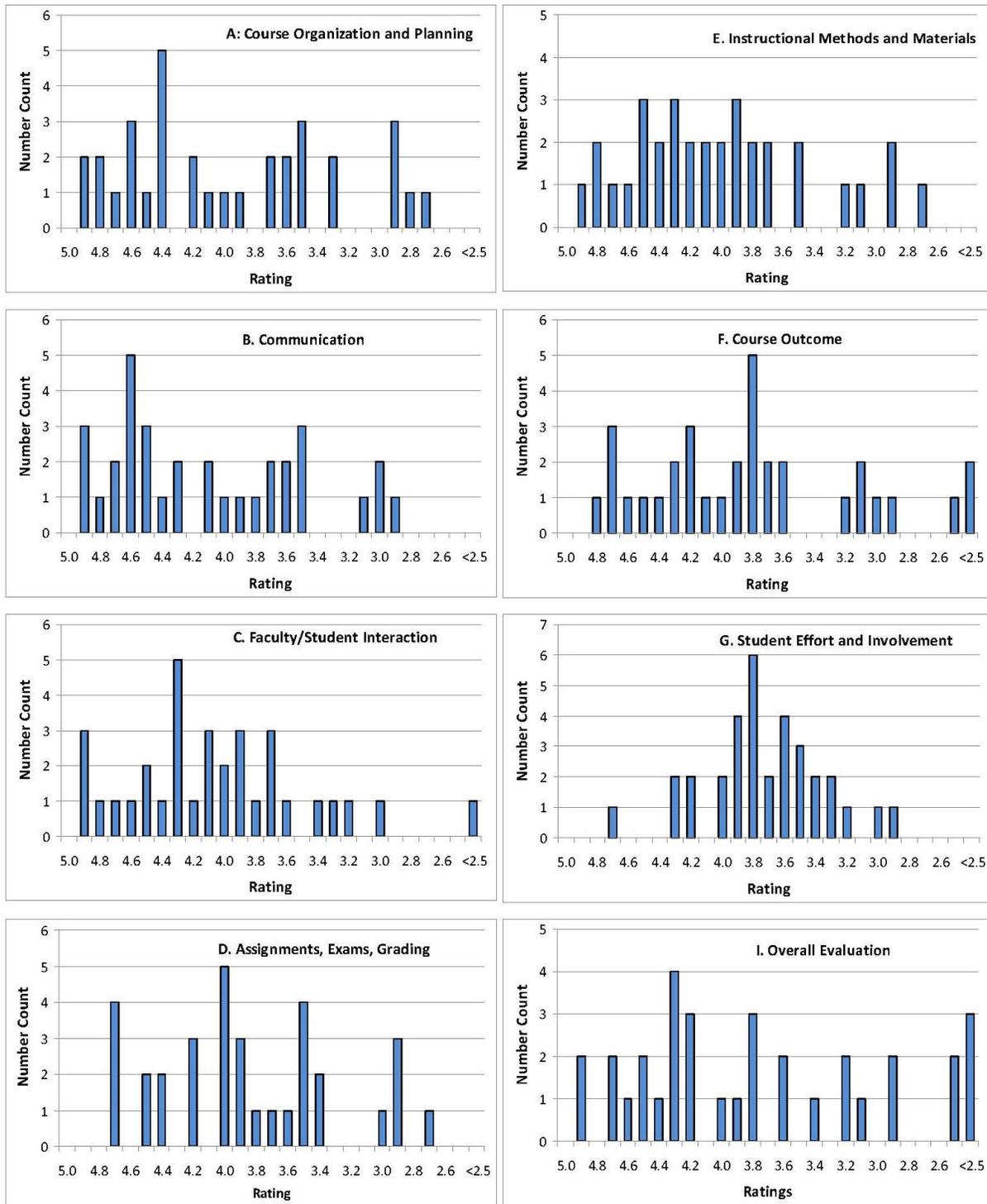
G. Student Effort and Involvement	Omit	Not Applicable	5 Very Effective	4 Effective	3 Moderately Effective	2 Somewhat Ineffective	1 Ineffective	Mean
34. I studied and put effort into the course?								
35. I was prepared for each class [writing and reading assignments]?								
36. I was challenged by this course?								
Overall Mean								

H. Course Difficulty, Work Load, and Pace	Omit	Very difficult	Somewhat difficult	About right	Somewhat elementary	Very elementary
37. For my preparation and ability, the level of difficulty of this course was?						
	Omit	Much heavier	Heavier	About the same	Lighter	Much lighter
38. The workload for this course in relation to other courses of equal credit was?						
	Omit	Very fast	Somewhat fast	Just about right	Somewhat slow	Very slow
39. For me, the pace at which the instructor covered the material during the term was?						

I. Overall Evaluation	Omit	5 Very Effective	4 Effective	3 Moderately Effective	2 Somewhat Ineffective	1 Ineffective	Mean
40. Rate the quality of instruction in this course as it contributed to your learning (try to set aside your feelings about the course content):							
Overall Mean							

J. Student Information	Omit	A major/minor requirement	A college requirement	An elective	Other			
41. Which one of the following best describes this course for you?								
	Omit	Freshman/1st year	Sophomore/2nd year	Junior/3rd year	Senior/4th year	Graduate	Other	
42. What is your class level?								
	Omit	Better in English		Better in another language		Equally well in English and another language		
43. Do you communicate better in English or another language?								
	Omit	Female		Male				
44. Sex								
	Omit	A	A-	B+	B	B-	C+	Below C
45. What grade do you expect to receive in this course?								

MMEM SET (SIRI) Results Summary for Spring 2015



150611 C. Hsu

Figure 1 – MMEM rating summary by evaluation category of SET conducted in spring 2015.