

Mechanical Engineering
Annual Program Improvement Report
2011-2012

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1. INTRODUCTION

The *Mechanical Engineering Program Improvement Plan, edition 2* (October 23, 2008) documents the educational objectives, outcomes, and process to make improvements to the Program.

This document, the *Mechanical Engineering Annual Program Improvement Report*, provides a summary of findings and actions for the 2011-2012 academic year resulting primarily from the implementations of the *Mechanical Engineering Program Improvement Plan*. This report is divided into three main sections: actions taken in 2011-2012 to improve the Program, assessment data gathered in 2011-2012, and recommendations for improvements to the Program based on assessment results. While some detailed data are reported here, more complete data can be found in the assessment files in the file cabinet located in the Department storeroom (OCNL 436A) and in the MMEM Department folder on Chico State Bay server.

2. ACTIONS TAKEN IN 2011-2012 TO IMPROVE THE PROGRAM

2.1 Areas Recommended for Improvement in 2010-2011 Annual Improvement Report

The 2010-2011 Annual Program Improvement Report identified five areas to consider for improvements. These areas are faculty performance, FE exam, curriculum, graduating senior survey, and program outcome assessment. Actions taken during 2011-2012 in the recommended areas are described in the following.

2.1.1. Faculty

Sub-areas recommended for improvement in the faculty satisfaction in the 2010-2011 Annual Program Improvement Report include instructional quality, fairness of tests, and consistency of grading.

Teaching effectiveness

It was suggested that some faculty members should be more conscientious about instruction-related practices. There are two sets of data that can be referenced to gauge the change of instructional quality from 2011-2012: Student Evaluation of Teaching (SET) from all mechanical engineering (MECH) and mechatronic engineering (MECA) classes and Graduating Senior Survey of graduating MECH majors; both were conducted in spring 2012.

In spring 2012, the department adopted a new instrument (SIR II) for SET as recommended by the university. As a result, no direct comparison of instructional quality can be made between 2011 and 2012. Also, the average rating on instructional quality in spring 2012 SET was not available due to the poor applicability of survey questions to classes with laboratory and activity components.

The spring 2012 graduating senior survey results show a very small decline from that of 2011 as shown in Table A.

Table A: Averages of responses to the question related to faculty instruction in 2010 to 2012 from Graduating Senior Surveys. (Likert scale of 1-5 with 5 being very satisfied)

Question in Exiting Senior Survey	2010 Rating	2011 Rating	2012 Rating
Quality of teaching by faculty in your department. (Q15)	3.70	4.00	3.95

Tests fairness and grading consistency

It was recommended that some faculty need to exercise better judgment in designing tests and grading. There are no similar critical written comments in the 2012 SET and graduating senior survey. The spring 2012 SET rating mean of *Assignments, Exams, and Grading* was 4.0 on a Likert scale of 1-5 with 5 being very satisfied. Again, no comparison can be made between 2011 and 2012 due to the new instrument adopted in spring 2012.

2.1.2 Fundamentals of Engineering (FE) Exam Requirement

It was recommended that department faculty should consider whether international students should be required to apply for a social security number for the registration of the FE exam. The faculty felt it would be difficult to enforce the requirement.

Considering (i) some students only take the FE exam, without adequate preparation, to meet the graduation requirement, (ii) exam results are not representative of Chico students' learning if some are exempted, and (iii) the rising cost of NCEES FE registration, review courses and material, lodging in Sacramento, and California license fees, the faculty voted unanimously in spring 2012 to change the required FE exam to optional. Students graduating in fall 2012 and after will not be required to take the FE exam, although it is highly recommended.

2.1.3 Curriculum

Dynamics

The 2010-2011 Program Improvement Report suggests that the instructor find a way to enhance student learning in dynamics class and in FE review session. Although outcome of the improved FE review can be partially measured in the 2011-2012 FE exams, the effect on the regular dynamics classes will not be seen until about two years later.

The performance of CSU Chico Mechanical Engineering students in dynamics of the general morning session has caught up with the National and Carnegie 3 averages. (Carnegie 3 universities are comprehensive institutions offering bachelors

and masters but no doctoral degrees and hence are similar to CSUC.) CSU Chico students' performance in dynamics area in the morning general test session from 2009-2010, 2010-2011, and October 2011 are summarized in Table B, with comparison to national and Carnegie 3 averages.

Table B: Summary of CSU, Chico Mechanical Engineering students' performance in Dynamics area of the FE morning session from fall 2009 to fall 2011. The percentages are those of test problems correctly answered.

Subject area	Test Takers	2009-10	2010-11	2011-12
Engineering Mechanics (Dynamics)	CSU Chico	67%	57%	63%
	National Avg.	---	71%	63%
	Carnegie 3 Avg.	70%	69%	61%

Finite element analysis (MECH 308)

In response to students' request for more practical use of commercial software, the new instructor, Dr. Watkins, had included more use of SolidWorks Simulation for finite element analysis in MECH 308 in spring 2012. Dr. Watkins is scheduled to teach MECH 308 again in spring 2013.

Capstone projects

Students expressed dissatisfaction of delayed or cancelled funding for senior design projects in the 2011 graduating senior survey. It was recommended in the 2010-2011 report that the department might consider collecting funds upfront for sponsored projects before projects are assigned in MECH 440A. The department has implemented the recommended practice in 2011-2012. As a result there was only one written comment on the funding in the spring 2012 senior survey.

Engineering economics (CIVL 302)

The Engineering Economics area did not appear to be a weak performance area for CSU Chico mechanical engineering students in the October 2011 FE exam. There was no concern expressed about the course in 2012 senior survey either. The Chair of the Civil Engineering Department did indicate that there would be more emphasis on statistics in CIVL 302 as it is a weak subject area identified in all FE exams in the last few years.

2.1.4 Graduating Senior Survey Process

To raise participation rate of graduating seniors in the exit survey, the 2010-2011 report suggested the survey be started earlier in the spring semester to give students more time and possibly making it a class requirement in MECH 440B.

The survey was started earlier than previous years in spring 2012, but was not made a requirement in MECH 440B. It was also the second time the survey was

conducted online in spring 2012. Despite repeated reminders, the participation rate was still not ideal – 75% of students graduated in 2011-2012 participated in the survey, about the same as last year’s 76%.

2.1.5 CIVL 495 for Program Outcome Assessment

Despite repeated requests through the Associate Dean, only a partial set of outcome assessment data from CIVL 495 (Professional Issues in Engineering) were made available (fall 2011) to the MMEM department for the 2011-12 report. The MECH faculty considered but found no MECH courses better suited for assessment of program outcomes *f, h, i, and j*.

3. ASSESSMENT DATA GATHERED IN 2011-2012

3.1 Embedded Assessment of Program Outcomes

Methods and results of Program Outcome assessment embedded in selected courses are summarized in Table C. A complete list of identified program outcomes can be found in Appendix A. Sample Program Outcome assessment record sheets are reproduced in Appendix B.

Table C: Results of embedded Program Outcome Assessment instruments and results for 2011-12.

Program Outcome	Course	Assessment Instrument	Demonstration of basic competency above a minimum grade or score	Number of MENG majors failing to demonstrate basic competency / Number of MENG majors enrolled	
				Fall 2011	Spring 2012
a	MECH 340	Quizzes (×8), final exam	Average of C- or better	<i>not taught</i>	10/42
b ₁	MECH 440B	Individual written test plan	Pass/fail assessment	<i>not taught</i>	0/55
b ₂	MECA 380	Lab assignment	C- (1.7/4.0) or better	<i>not taught</i>	14/47
c ₁	MECH 340	Individual design project	Average of C- or better	<i>not taught</i>	5/42
c ₂	MECH 338	Design problems (×2)	At least 70% on one of the two	<i>not taught</i>	3/49
d	CIVL 495	Projects, instructor observation	70% or better	0/18	No Data
	MECH 440A	Individual in group project	Faculty advisor & peer evaluation	0/55	<i>not taught</i>
e ₁	MECH 440A	Individual assignment	Pass/fail grading	0/55	<i>not taught</i>
e ₂	MECA 482	Quizzes (×3) on system design	Average of C- or better	2/65	<i>not taught</i>
f	CIVL 495	Presentation, memorandums	Score of 7 or better out of 10	0/18	No Data
g ₁	MECH 440A	Individual final design review	Pass/fail assessment	0/55	<i>not taught</i>
g ₂	MECH 340	Individual design project memo	Average of C- or better	<i>not taught</i>	7/42
g ₃	MECH 340	Design project drawings	Average of C- or better	<i>not taught</i>	0/42
h	CIVL 495	Reports, instructor observation	Score of 7 or better out of 10	0/18	No Data
i	CIVL 495	Projects, presentations	Score of 7 or better out of 10	0/18	No Data
j	CIVL 495	Reports, instructor observation	Score of 7 or better out of 10	0/18	No Data
k	MECH 306	Test questions (×5)	66%, 66%, 75%, 50%, 60% to pass	18/47	<i>not taught</i>
	MECH 308	Final project	Pass/fail assessment	<i>not taught</i>	4/49
	MECA 380	Programming assignment	12/20 or better	<i>not taught</i>	1/47

3.2 Fundamentals of Engineering (FE) Exam

The performance of CSUC Mechanical Engineering majors in the Fundamentals of Engineering (FE) exam in October 2011 is summarized in Tables D, E and Figures 1, 2, 3 where comparisons are also made with national and Carnegie 3 Universities averages. Typically two FE exams are administered by the National Council of Examiners for Engineering and Surveying (NCEES) every year; one in April and the other in October. For the 2011-12 academic year, the results of the April 2012 FE exam are currently not available from the NCEES.

In comparison, the average pass-rate at the 10/2011 FE exam for Chico's Mechanical Engineering majors is significantly higher than national and Carnegie 3 averages as shown in Table D. The comparison with other universities in California was not made as the NCEES no longer publishes the average statistics.

Table D: CSUC Fundamentals of Engineering exam pass-rates comparing to National and Carnegie 3 comparators averages at October 2011 and April 2012 administrations.

Institution	10/2011 Exam	4/2011 Exam	Combined
CSU, Chico	88%	no data	88%
National Average	79%	no data	79%
Carnegie 3 Average	72%	no data	72%

The fractions of CSUC Mechanical Engineering students taking different afternoon tests and their pass rates are summarized in Table E. The vast majority of CSUC Mechanical Engineering students (94%) opted to take and did very well (88% pass rate) in the 10/2011 FE exam. Although extremely high, the 100% afternoon general exam pass rate is that of only one CSUC student taking the general exam. Nonetheless, the overall performance of CSUC Mechanical Engineering students surpassed that of National and Carnegie 3 comparators' averages.

Table E: Pass-rates in the Mechanical Engineering specific and general PM exams for Mechanical Engineering students who were enrolled at CSUC when taking the exam in October 2011.

Institution	Percent Students Took ME-Specific PM Exam	Pass-rate
CSUC	94%	88%
National Average	80%	79%
Carnegie 3 Average	78%	70%
	Percent Students Took General PM Exam	Pass-rate
CSUC	6%	100%
National Average	20%	80%
Carnegie 3 Average	22%	81%

Performance in all subject areas in the AM session of the FE exam in October 2011 is summarized in Figure 1. The percent problems correctly answered are combined results of those taking discipline-specific and general exams in the PM session of the 10/2011 exam.

It should be noted that at the time of this data the FE exam is a graduation requirement for CSUC Mechanical Engineering students while it is optional for the National Average and Carnegie 3 Average exam takers.

Figure 1 also shows that Mechanical Engineering students from CSUC had average scores higher than National and Carnegie 3 universities' averages in all but three subject areas in the AM exam session. Although lower than national and Carnegie 3 universities' averages, Chico's performance in *Mathematics*, *Engineering Probability & Statics*, and *Chemistry* are fairly close to comparators' averages. Among other test subject areas, Chico's percent correct answers in *Strength of Materials*, *Material Properties*, and *Fluid Mechanics*, are noticeably higher than those of comparators'.

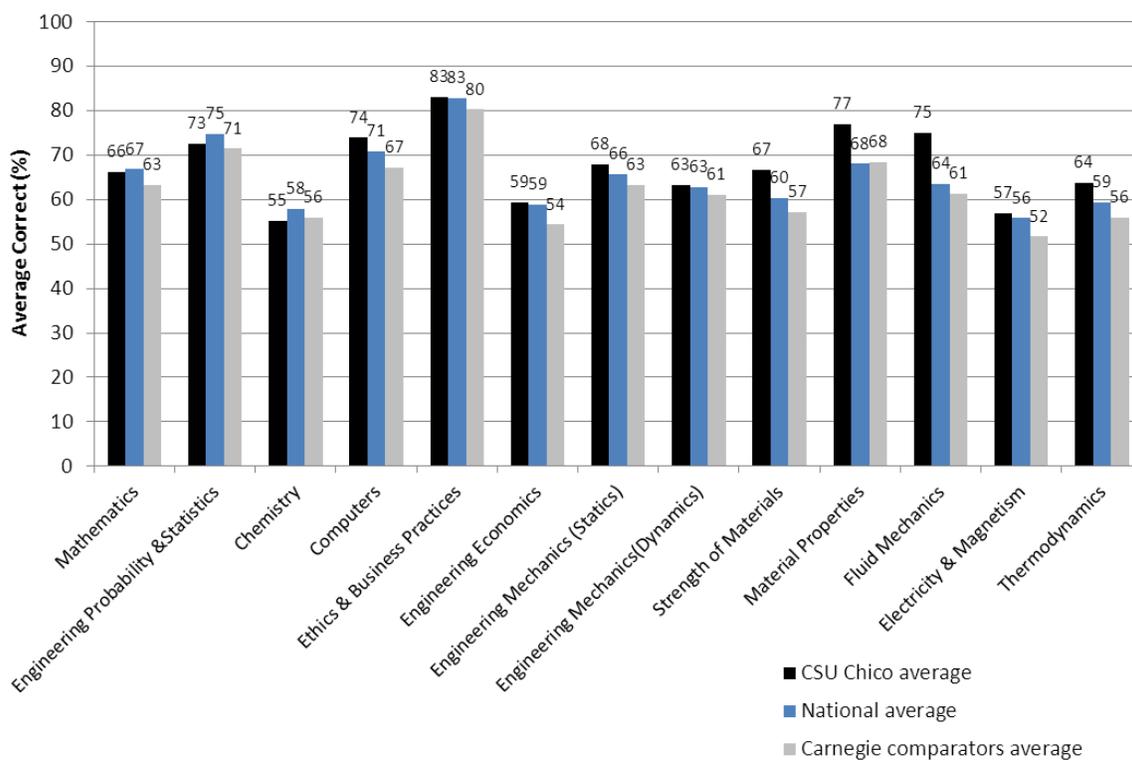


Figure 1- October 2011 FE exam performance by subject area in the morning exam session for Mechanical Engineering majors who were enrolled in CSUC when taking the exam (n =17).

Based on Figures 1, Mechanical Engineering students at CSUC appear to be well prepared in the fundamentals of common engineering subject areas.

Performance of CSUC Mechanical Engineering students in the general afternoon exam session of the October 2011 FE exam is summarized in Figure 2 in which comparison is also made with national and Carnegie 3 universities' averages.

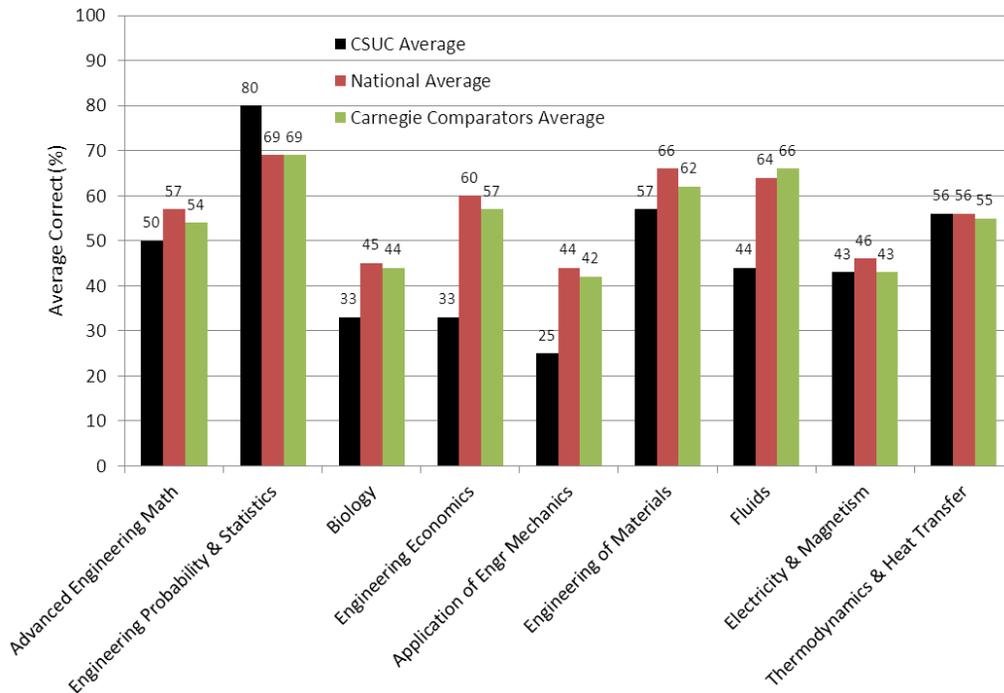


Figure 2 – 10/2011 FE exam performance by subject area in the general pm exam for mechanical engineering majors who were enrolled at CSUC when taking the exam (n = 1).

It should be noted that the results shown in Figure 2 are those of only one CSUC student. As indicated in Figure 2, the particular CSUC Mechanical Engineering student scored higher than National and Carnegie 3 averages only in *Engineering Probability & Statics*; performance in *Biology*, *Engineering Economics*, *Application of Engineering Mechanics*, and *Fluids* are significantly below those of comparators’.

The performance by subject area in the Mechanical Engineering specific afternoon exam of the October 2011 FE exam is shown in Figure 3.

It is encouraging that CSUC Mechanical Engineering students outperformed average National and Carnegie 3 universities test takers in all test subject areas, except in *Mechanical Design & Analysis*, in the discipline-specific afternoon exam session (Figure 3). In particular, the performance in *Heat Transfer* is noticeably better than those of comparators.

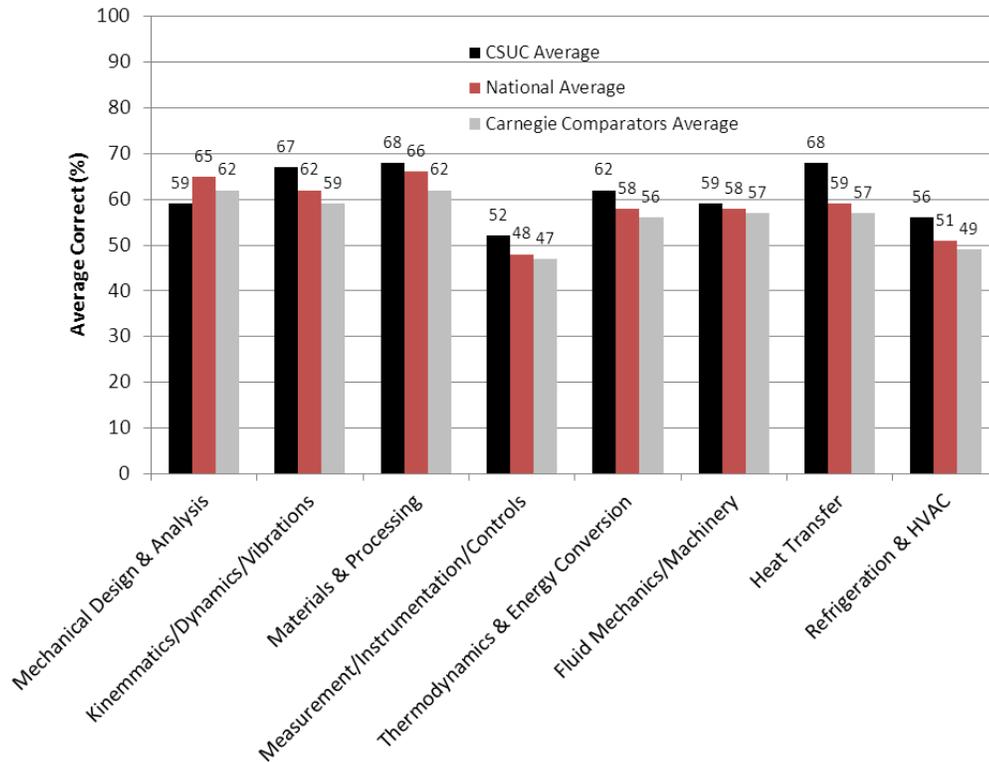


Figure 3 – Performance by subject area in the mechanical engineering specific afternoon exam of the 10/2011 Fundamentals of Engineering exam for Mechanical Engineering students who were enrolled at CSUC when taking the exam (n = 16).

3.3 Graduating Senior Survey

In spring 2012 an anonymous online survey of graduating Mechanical Engineering seniors was conducted. The survey questions are reproduced in Appendix C. The responses of 44 of the 59 Mechanical Engineering majors who actually graduated in 2011-2012 are documented in the College of Engineering, Computer Science, and Construction Management assessment report – ECC Senior Exit Survey Results, AY 2011-2012. The survey questions can be grouped into those relating to (1) demographics and post-graduate plans (which will not be discussed further in this report), (2) educational satisfaction, (3) Program Outcomes, (4) project management skills, and (5) other outcomes.

3.3.1 Educational Satisfaction

Survey results on educational satisfaction from 2007 to 2012 and changes from 2011 to 2012 are summarized in Table F and Figure 4, respectively.

Table F: Means of responses to survey questions regarding educational satisfaction

(5 level Likert scale: 1 = very dissatisfied and 5 = very satisfied; for question 44 only, 1 = strongly disagree and 5 = strongly agree.)

No.	At Chico State, how satisfied were you with the ...	2007	2008	2009	2010	2011	2012
15	Quality of teaching by faculty in your department	3.83	3.60	3.75	3.70	4.00	3.95
16	Quality of teaching by other faculty	3.50	3.46	3.63	3.60	3.45	3.48
17	Access to faculty in your department	4.10	4.30	4.19	4.10	4.27	4.41
18	Availability of courses in your department	3.50	3.53	2.81	3.13	3.52	3.70
19	Quality of courses in your department	3.93	3.74	3.69	3.62	3.88	4.14
20	Access to lab facilities and equipment	3.33	3.62	3.75	3.38	3.97	3.68
21	Quality of laboratories and equipment	3.37	3.33	3.25	3.35	3.70	3.73
22	Access to computer facilities	4.20	4.15	4.13	3.87	4.15	3.66
23	Quality of computer facilities	3.67	3.68	3.41	3.30	3.27	3.05
24	Academic advising from your major advisor	3.53	3.55	3.84	3.60	3.94	3.98
25	Academic advising from the Advising Office	2.97	3.13	3.13	3.32	3.24	3.18
26	Career information from your department	3.23	3.43	2.77	2.80	3.36	3.37
27	Availability of GE courses	3.73	3.90	3.69	3.65	3.45	3.59
28	Quality of GE courses	3.17	3.23	3.13	3.20	2.85	3.05
29	Overall quality of your education	3.90	3.90	3.88	3.90	4.18	4.18
30	Your overall experience at Chico State	4.17	4.23	4.16	4.20	4.30	4.18
44	I would recommend my major at CSU, Chico to others	4.24	4.28	4.22	4.08	4.39	4.30

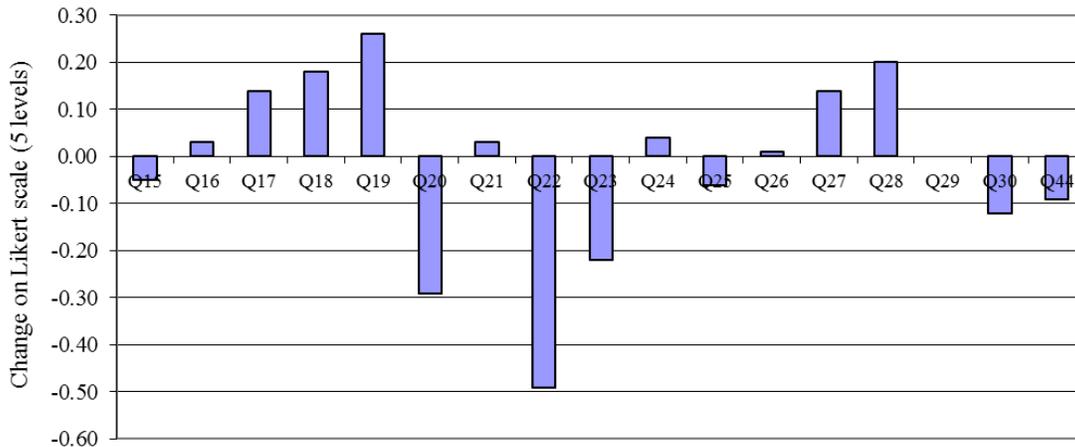


Figure 4: Changes of responses to survey questions regarding educational satisfaction from 2011 to 2012.

According to Figure 4, in the spring 2012 survey, questions directly related to educational satisfaction had mixed results comparing with those in the spring 2011 survey. The most significant negative changes are in “access to lab facilities & equipment (Q20)”, access to computer facilities (Q22)”, and “Quality of computer facilities (Q23)”. The message is quite clear that students are particularly dissatisfied with lab and computer facilities. On the other hand, students appreciate the continuing improvement of availability and quality of courses offered by the department (Q18 and Q19).

3.3.2 Program Outcomes

Response means for survey questions relating to Program Outcomes are tabulated in Table G, and the some changes from 2011 to 2012 are summarized in Figure 5.

Table G: Means of responses to survey questions relating to Program Outcomes
(5 level Likert scale: 1 = very unprepared and 5 = very well prepared)

No.	Based on your educational experience here at Chico State, how well prepared are you to ...	2006	2007	2008	2009	2010	2011	2012
31	Apply knowledge of math, science, engineering, or technology to solve problems	4.26	4.30	4.23	4.13	4.15	4.36	4.43
32	Design and conduct experiments	4.17	4.20	4.00	3.69	3.80	4.15	4.36
33	Analyze and interpret data	4.09	4.30	4.10	4.03	3.93	4.21	4.30
34	Design a component or system to meet desired needs	4.34	4.37	4.15	4.31	4.25	4.36	4.34
35	Function on a multidisciplinary team	4.49	4.57	4.23	4.28	4.42	4.36	4.39
36	Identify, formulate, and solve technical problems	4.40	4.33	4.20	4.31	4.30	4.33	4.36
37	Communicate technical matters in writing	4.23	3.90	3.98	3.94	3.82	4.27	4.07
38	Communicate technical matters orally	3.94	4.07	4.13	3.94	3.95	4.27	4.11
39	Understand & apply professional & ethical principles	3.91	4.00	4.15	4.35	3.80	4.21	4.07
40	Understand contemporary issues facing society	3.51	3.60	3.95	3.84	3.70	3.82	4.02
41	Use modern tools and technology	3.94	4.00	3.85	4.03	3.85	4.06	4.16
42	Enter the workplace (I)	4.06	4.27	3.95	3.90	3.77	4.15	4.30
43	Continue learning	4.26	4.37	4.23	4.25	4.36	4.48	4.52
S1	Communicate manufacturing needs to a technician	3.83	4.07	3.83	<i>no data</i>		4.30	4.02
S2	Write verifiable engineering specifications based customer needs	<i>not surveyed</i>						4.30
S6	Present information for a design review	4.17	4.24	3.80	<i>no data</i>		4.21	4.21
S7	Prepare and execute an experimental plan	3.89	4.21	3.63	<i>no data</i>		4.21	4.23
S8	Select hardware and develop software for automated data collection	<i>not surveyed</i>						3.60
S9	Analyze pressure drop and select a pump for a piping system	<i>not surveyed</i>						4.12
S10	Select a material for a specific application	<i>not surveyed</i>						4.30
S11	Use simulation software for stress or heat transfer analysis	<i>not surveyed</i>						4.29
S12	Verify finite element analysis results through traditional analysis techniques	<i>not surveyed</i>						4.05
S13	Solve equations using numerical techniques	<i>not surveyed</i>						4.19
S14	Simulation or write equations of the performance of a system	<i>not surveyed</i>						4.00
S15	Select machine parts and lubrication for a particular application	<i>not surveyed</i>						3.77
S16	Analyze a thermal problem and select a suitable heat exchanger or heat sink	<i>not surveyed</i>						4.47
S17	Solve a heat transfer problem using thermal resistances	<i>not surveyed</i>						4.53
S18	Select a motor for a particular application	<i>not surveyed</i>						3.77

(I) Question number 42 is not a defined Program Outcome

In spring 2012 the Mechanical Engineering specific supplemental questions were revised to better survey a broader range of program outcomes. Two of the new Program Outcome survey areas (S6 and S7) are very close to those in previous years', and can be used for comparison.



Figure 5: Changes of responses to survey questions relating to Program Outcomes from 2011 to 2012. New survey questions in 2012 with no 2011 survey data to compare with are not presented in the figure.

It is quite clear that graduating Mechanical Engineering seniors are satisfied with their learning in the major as they felt well prepared in most surveyed areas having ratings above 4.0 on the Likert scale of 1-5 with 5 being very well prepared. The survey did also point out that 2012 graduating seniors are not as confident about their ability to communicate technical matters in writing or orally (Q37 and Q38). They are also not as confident as 2011 graduates in communicating manufacturing needs to a technician (S1).

On the other hand, the confidence of 2012 graduating seniors is the highest since 2007 in several areas surveyed in questions Q31, Q32, Q33, Q40, Q41, Q42, Q43, and supplemental question S7.

On average, the 2012 graduating seniors are the least confident in their ability to select hardware and develop software for automated data collection (S8). The rating of 3.60 for this area is the lowest of all survey areas since 2006.

3.3.3 Project Management Skills

Responses to questions on management skills are tabulated in Table F.

Table H: Means of responses to survey questions relating to project management skills
(5 level Likert scale: 1 = very unprepared and 5 = very well prepared)

No.	Based on your educational experience here at Chico State, how well prepared are you to	2006	2007	2008	2009	2010	2011	2012
S3	Create a Gantt chart for a project	3.57	3.45	3.53	<i>no data</i>		3.91	3.93
S4	Identify the critical path for a project	<i>no data</i>		3.78	<i>no data</i>		4.09	4.26
S5	Develop a detailed project budget	3.60	4.00	3.70	<i>no data</i>		4.18	4.12

The ratings for all three areas on management skills in 2012 survey are either close to the highest or higher than those from all previous years since 2006. A steady trend of improvement can be observed in all three surveyed areas despite the lack of data from 2009 and 2010.

3.3.4 Written Comments

Parts of written responses to the open-ended question “please provide additional comments that will help faculty to improve the quality of the education they provide” in the Mechanical Engineering supplemental questions are categorized and summarized in the following. The comments presented here are direct quotes, including possible spelling and grammatical errors.

Courses

- “The overall quality of the MECH classes was very good. I expecially thought that the lab based courses we took helped prepare us for real world applications. It’s a shame to reduce the number of lab based courses.”
- “Mechanical Engineering courses were overall quite effective in preparing myself for the workforce.”
- “Machine design needs to be evaluated. I took the class of fall 2011 to find that most of the class was a review of statics and strength of materials. I feel more time needs to be spend teaching fatigue and hardware analysis.”
- “I think replacing some general ed with business would be extremely beneficial.”
- “...Upper Division themes don’t improve the quality of my education or help me in the real world. It would be more useful to use those units for a specialization or thrust into fluids, heat transfer, FEA, or manufacturing.”

Instruction

- “Classes should include at least one project to better enforce the concepts that have been learned. For me, the application of theories helps develop a better understanding of them.”

- “Continue to use design projects, I learned from the group projects the best.”
- “ I’d like to see more hands-on teaching for students who learn more effectively that way.”
- “More projects that encourage creativity would be good to see.”
- “Don’t waste class time for an example worked out explicitly in our texts.”
- “The use of projects as learning tools allows for excellent hands on engineering practice.”
- “There are a couple professors that should consider revamping there education strategies.”
- “The department already tries to be very hands on but I would always like to see more practical application of book learning.”

Faculty

- “The quality of teaching of some of my professors was top notch and others very poor.”
- “Some of the professors are very bad at teaching and they provide low education for students.”
- “There is a hug dichotomy between teaching abilities in this department.”
- “In my opinion, the faculty in the Mechanical engineering department are awesome. They are great professors that taught me a lot while I was attending the college.”
- “I had a good experience with some professors ...I would say quality could be improved if some teachers were replaced ...”

Capstone Project

- “The capstone design project along with the mechanical Engineering Design class (MECH340 and MECH440) were excellent in preparing us for real world applications of engineering.”
- “For the capstone design project I felt like we wasted too much time in the early parts of the project and too much work piled up towards the end. We should rush through some of the earlier material to allow for better use of our time overall.”
- “Mechanical Engineering courses were overall quite effective Especially Mech 440A-B, Dr. Watkins is a wonderful instructor that knows and conveys the material in a concise and understandable way that promote learning.”

Tests and Grading

- “Midterms should be announced way ahead of time, along with any other projects or deadlines.”

- “The curriculum could be more rigorous. I’ve been given Bs in classes that I probably deserved a C in.”

Lab Experience

- “The circuit lab equipment and lab teachers are less than adequate.”
- “Don’t take away the labs; labs are the number one thing going for CSU Chico.”
- “Have more access to facilities for manufacturing.”
- “update lab equipment. Working with equipment that is older than myself doesn’t seem practical.”

3.4 Student Evaluation of Teaching (SET)

Mechanical Engineering students take courses taught by the MEM department as well as those by other academic departments. Besides an optional SET in fall semesters, the mandatory SET is conducted in all classes containing lecture component in spring semesters. In spring 2012 the department adopted a new evaluation instrument, SIR II which is more comprehensive comparing with the one used in the years past. The SIR II questionnaire contains ten categories that each comes with a set of related questions. The ten sets of questions can be found in Appendix E.

Here the average ratings for seven of the ten question sets for MECH and MECA courses in the spring 2012 SET are summarized in Figure 6. The remaining three question sets did not generate meaningful data and department means for evaluation purpose. Rating distribution for each of the seven categories is also collected in Appendix F.

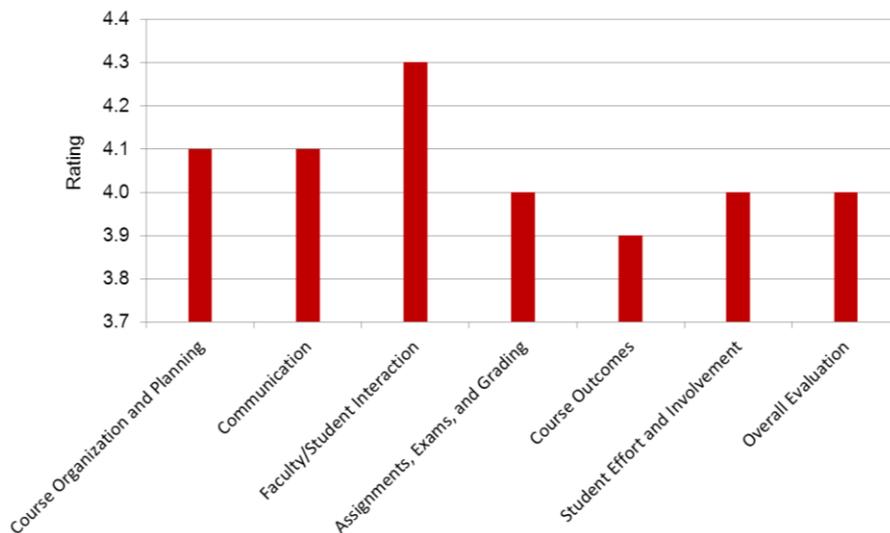
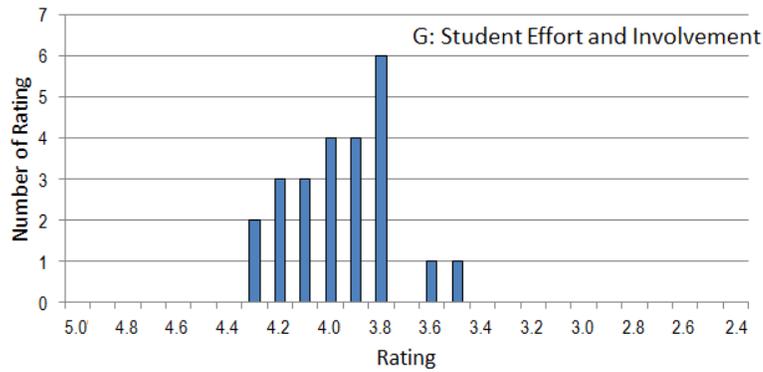


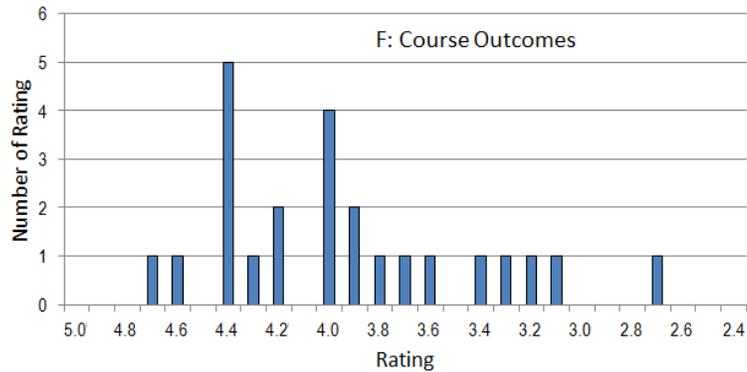
Figure 6 – Average ratings for seven surveyed categories in MECH and MECA courses from spring 2012. The rating scale is 1 to 5 with 5 being the most effective.

As can be seen in Figure 6, most evaluated categories received ratings around or above 4.0 on a scale of 1 to 5 with 5 being most effective. The highest rating is for the interaction between faculty and students – a tradition the department is well known for.

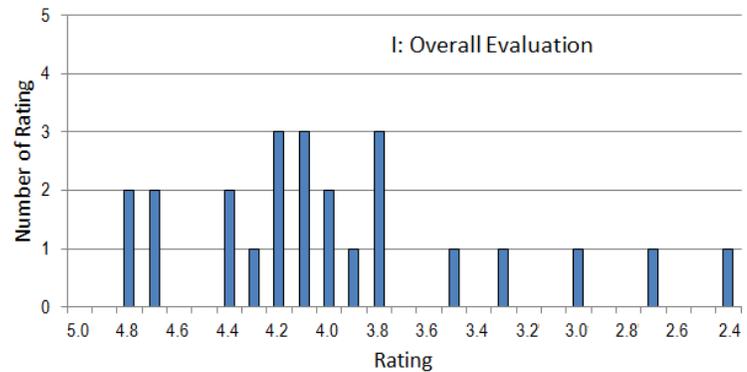
Of the seven reported evaluation categories, the ratings for *Student Effort and Involvement* has the narrowest distribution (Figure 7a) while the *Overall Evaluation* has the widest distribution ranging from 2.4 to 4.8 (Figure 7c). The wide distribution of ratings for *Course Outcomes* (Figure 7b) and *Overall Evaluation* (Figure 7c) points to an undesirably large variation in instructional skills and effectiveness of faculty.



(a)



(b)



(c)

Figure 7 – Distribution of ratings for three categories of the spring 2012 SET.

4. RECOMMENDATIONS

4.1 Faculty

4.1.1 Instructional Effectiveness

Several written comments in the graduating senior survey were fairly critical of the large variation of faculty teaching skills and effectiveness. The comments were also supported by the wide distribution curve in the *Course Outcomes* and *Overall Evaluation* categories of the spring 2012 SET. It is important that all faculty members should be more conscientious about instruction-related practice.

4.2 Fundamentals of Engineering (FE) Exam Requirement

Although the faculty have voted unanimously to remove the FE exam as a graduation requirement for Mechanical Engineering students starting in fall 2012, students should still be encouraged to take the FE exam before leaving Chico.

4.3 Curriculum

4.3.1 Lab experience

As stated in the student written comments in the graduating senior survey, lab exercises can serve to enhance learning. Lab or activity component was removed from a number of courses in the previous run of unit reduction. If possible, faculty may consider adding or restoring lab component in courses such as *Control System Design* (MECA 482) and *Finite Element Analysis* (MECH 308).

4.3.2 Lab and equipment upgrade

It has been known for quite some time that the department's labs and equipment are gradually outdated. Students also frequently expressed dissatisfaction about the situation. It is a very challenging task to upgrade lab facility and equipment in the current and foreseeable future state of diminishing state funding. The department and faculty will need to be more creative in locating resources for equipment upgrade.

4.3.3 Capstone Projects

As in the last few years, students are quite pleased with the capstone design course (MECH 440 A/B). Also as in the past, there is one student complaint about cancelled or delayed funding for senior projects in the spring 2012 senior survey. As the upfront collection of funds has been implemented in 2011-12, the MEM department should continue the practice in MECH 440A/B.

4.4 Graduating Senior Survey Process

Following some of the suggestions from the 2010-2011 Program Improvement Report in spring 2012, there was virtually no improvement in the participant rate of graduating senior survey by graduating seniors. Perhaps the department can try making it a course requirement in MECH 440B.

4.5 CIVL 495 for Program Outcome Assessment

The course outcome assessment data from CIVL 495 (Professional Issues in Engineering) continues to be a missing major piece for completing the Mechanical Engineering program outcome assessments. There was no assessment data provided to the MEM department in 2010-2011 and only a partial set of data (fall 2011) provided in 2011-2012. Since five of the Program Outcomes are assessed in CIVL 495, the voids left in the outcome assessments may adversely affect the next round of ABET accreditation. As the MEM faculty tried but unable to identify a suitable MECH course to replace CIVL 495, the department should try again request help of the Associate Dean or Dean to obtain the data.

Appendix A

Statement of Mechanical Engineering Program Outcomes*

Mechanical Engineering Program graduates must have:

- a. An ability to apply knowledge of mathematics, science, and engineering*
- b₁. An ability to design experiments to evaluate the performance of a mechanical/thermal system or component with respect to specifications*
- b₂. An ability to conduct experiments, as well as analyze and interpret data*
- c₁. An ability to design a mechanical system, component, or process to meet desired needs*
- c₂. An ability to design a thermal 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 mechanical engineering tools necessary for engineering practice*

* From Mechanical Engineering Program Improvement Plan, edition 2 (October 23, 2008)

Appendix B

Sample Program Outcome Assessment Record Sheet

Mechanical Engineering Program Outcome Record-Sheet

Course:		Semester:	
ME Program Outcome:		Instructor:	
Description of instruments used in this course to measure attainment of program outcome:	1		
	2		
	3		
	4		
	5		
	6		

How instruments are used to measure achievement of program outcome:	1		
	2		
	3		
	4		
	5		
	6		

Number of ME students in class achieving program outcome:	0	#DIV/0!
Number of ME students in class not achieving program outcome:	0	#DIV/0!

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:

Note: Shaded fields are to be fill-in.

Appendix C

ECC Graduating Senior Survey Instrument Spring 2012

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

1. Major:

2. Graduation Date

Semester

Spring Summer Fall

Year

2011 2012 2013 2014

3. Did you come to Chico State as a ...

First-time freshman Transfer

4. How many semesters did you attend Chico State?

1-3 4-6 7-9 10-12 13+

5. What is your Overall GPA?

Below 2.25

2.25-2.49

2.50-2.74

2.75-2.99

3.00-3.24

3.25-3.49

3.50-3.74

3.75-4.00

6. If you had an internship, co-op, or job related to your major while in school, how valuable was the experience?

Did not have internship, co-op, or job

Very Valuable

Valuable

Somewhat Valuable

Not Valuable

7. If you were involved in any student/professional society, activities, or clubs, how valuable was the experience?

Was not involved in societies, activities, or clubs

Very Valuable

Valuable

Somewhat Valuable

Not Valuable

8. Immediately after graduating are you planning to...

Attend graduate School

Yes No

Begin Working

Yes 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.

9. How many job offers have you received?

None One Two Three Four +

10. Do you currently have a job offer that you are likely to accept?

Yes

No

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

Did not interview through campus office

Very Helpful

Helpful

Somewhat Helpful

Not Helpful

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

Campus Career Planning & Placement Office

Faculty/department referral

Online Posting

Mailed resume

Personal Connections

Other

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

No, did not take

Yes, and passed

Yes and did not pass

Yes and waiting for results

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

Yes

No

Next

For Survey Content Questions,
contact Lynn Abbiati: labbati@csuchico.edu

For Technical Questions,
contact Paul Weatherby: pweatherby@csuchico.edu

Educational Satisfaction Questions

At Chico State, how satisfied were you with the...

	Very Dissatisfied				Very Satisfied
15. Quality of teaching by faculty in your department	<input type="radio"/>				
16. Quality of teaching by other faculty	<input type="radio"/>				
17. Access to faculty in your department	<input type="radio"/>				
18. Availability of courses in your department	<input type="radio"/>				
19. Quality of courses in your department	<input type="radio"/>				
20. Access to laboratory facilities and equipment	<input type="radio"/>				
21. Quality of laboratories and equipment	<input type="radio"/>				
22. Access to computer facilities	<input type="radio"/>				
23. Quality of computer facilities	<input type="radio"/>				
24. Academic Advising from your major advisor	<input type="radio"/>				
25. Academic Advising from the University Advising Office	<input type="radio"/>				
26. Career information from your department	<input type="radio"/>				
27. Availability of General Education courses	<input type="radio"/>				
28. Quality of General Education courses	<input type="radio"/>				
29. The overall quality of your education	<input type="radio"/>				
30. Your overall experience at Chico State	<input type="radio"/>				

Program Outcomes Questions

Based on your educational experience here at Chico State, how well prepared are you to...

	Very Unprepared				Very Prepared
31. Apply knowledge of math, science, engineering, or technology to solve problems	<input type="radio"/>				
32. Design and conduct experiments	<input type="radio"/>				
33. Analyze and interpret experimental data	<input type="radio"/>				
34. Design a component or system to meet desired needs	<input type="radio"/>				
35. Function in a multidisciplinary team	<input type="radio"/>				
36. Identify, formulate and solve technical problems	<input type="radio"/>				
37. Communicate technical matters in writing	<input type="radio"/>				
38. Communicate technical matters orally	<input type="radio"/>				
39. Understand and apply professional and ethical principles	<input type="radio"/>				
40. Understand contemporary issues facing society	<input type="radio"/>				
41. Use modern tools and technology	<input type="radio"/>				
42. Appreciate impact of your solutions on society and environment	<input type="radio"/>				
43. Continue learning	<input type="radio"/>				
	Strongly Disagree				Strongly Agree
44. I would recommend my major program at CSU, Chico to others.	<input type="radio"/>				

[Next](#)

For Survey Content Questions,
contact Lynn Abbiati: labbati@csuchico.edu

For Technical Questions,
contact Paul Weatherby: pweatherby@csuchico.edu

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

- Very dissatisfied
- Somewhat dissatisfied
- Neutral
- Somewhat satisfied
- Very satisfied

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

- 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?

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

48. How would a requirement for your major to purchase a laptop have impacted your decision to come to Chico State?

- Would not have impacted my decision to come
- Minor financial difficulty, but I would have still come
- Major financial difficulty, but I would have still come
- May have prevented me from coming
- Would have definitely prevented me from coming

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

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

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

You Have 3500 Characters Remaining.

For Survey Content Questions,
contact Lynn Abbiati: labbati@csuchico.edu

For Technical Questions,
contact Paul Weatherby: pweatherby@csuchico.edu

Appendix D

Mechanical Engineering Specific Supplemental Survey Questions

ECC Graduating Senior Survey Spring 2012



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[Reset Survey](#)

MENG Supplemental Questions

Based on your educational experience at Chico State, how well prepared are you to:

	Very Unprepared			Very Prepared	
1. Communicate manufacturing needs, including tolerances, to a technician	<input type="radio"/>				
2. Write verifiable engineering specifications based on customer needs	<input type="radio"/>				
3. Create a Gantt chart for a project	<input type="radio"/>				
4. Identify the critical path for a project	<input type="radio"/>				
5. Develop a detailed project budget	<input type="radio"/>				
6. Present information for a design review	<input type="radio"/>				
7. Prepare and execute an experimental test plan	<input type="radio"/>				
8. Select hardware and develop software for automated data collection	<input type="radio"/>				
9. Analyze pressure drop and select a pump for a piping system	<input type="radio"/>				
10. Select a material for a specific application	<input type="radio"/>				
11. Use simulation software for stress or heat transfer analysis	<input type="radio"/>				
12. Verify finite element analysis results through traditional analysis techniques	<input type="radio"/>				
13. Solve equations using numerical techniques	<input type="radio"/>				
14. Simulate or write equations of the performance of a system	<input type="radio"/>				
15. Select machine parts and lubrication for a particular application	<input type="radio"/>				
16. Analyze a thermal problem and select a suitable heat exchanger or heat sink	<input type="radio"/>				
17. Solve a heat transfer problem using thermal resistances	<input type="radio"/>				
18. Select a motor for a particular application	<input type="radio"/>				
19. In the space provided, please provide additional comments that will help faculty to improve the quality of the education they provide.					

You Have 3500 Characters Remaining.

Appendix E

Student Evaluation of Teaching (SET) Instrument Spring 2012

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?								

Appendix F

Summary of MECH-MECA Student Evaluation of Teaching (SET) Data

Spring 2012

