AC 2011-2022: BEST PRACTICES FOR FACULTY MENTORSHIP OF CAPSTONE DESIGN PROJECTS

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Best Practices for Faculty Mentorship of Capstone Design Projects

Abstract

The mechanical and mechatronic engineering programs at California State University Chico utilize a common two-semester capstone course in senior design project. Project work is accomplished in groups, which are assigned a single faculty advisor, or mentor for the duration of the project.

Prior to the 2008/2009 academic year, senior exit surveys, along with substantial anecdotal evidence, repeatedly identified advisement of capstone projects as a problem area in the curriculum. During that time, faculty advising of capstone design projects was unstructured and inconsistent.

A year-long effort was undertaken to improve supervision of capstone design projects. Results of the work included clear definition of the faculty mentor's role, consistent advising across groups, and a collection of best practices for faculty mentorship of capstone design projects

The new paradigm of faculty mentorship was implemented during the 2008-2009 academic year. This paper details the best practices for faculty mentorship of capstone design projects and assesses its effectiveness through review of senior exit survey data.

Overview of Senior Design Project

As with many engineering programs, mechanical and mechatronic engineering students at California State University Chico conclude their degree programs with a two-semester capstone design experience. The intent is for students to utilize competencies developed in the first three years of the curriculum in the solution of a real-world design problem. The fall semester is predominantly spent in design activities, while the spring encompasses prototype building and testing. Projects are typically sponsored by industrial partners, providing a real-world design experience for the students.

During the fall semester, weekly lectures are given that cover many aspects of the design process. Selected topics include customer requirements and specifications, conceptual design, decision making, project management, cost estimating, budgets, documentation, and formal reports. Each project group is required to give three oral presentations during the semester. The presentation topics are *Project Proposal*, *Midterm Review*, and *Final Design*. The semester concludes with submission of a comprehensive design report.

The spring semester includes less time in the classroom and more time spent building and testing the designs. Students are required to develop a comprehensive test plan to prove the specifications developed in the fall semester. They then fabricate and test the design, and in most cases, proceed directly to redesign activities. The semester concludes with a final oral

presentation, a poster session that includes display and demonstration of the prototype, and submission of a comprehensive written report that fully documents the design.

The design projects are accomplished by student groups, as the ability to work as a member of a multi-disciplinary team is one of the measured outcomes of the course. Groups typically number about four, but may vary based on the complexity of the particular project. Groups may be made up entirely of mechanical engineering majors, or may also include mechatronic majors depending on the technical aspects of the project. Individual semesters vary, but the student population in the course averages from 60 to 65 students, which are divided into 15 to 16 project teams. Regardless, each group is assigned a single faculty advisor, or mentor, for the duration of the project, considered by many to be a critical element[1] of the student's design experience.

Past Issues

Prior to the 2008/2009 academic year, faculty mentorship of capstone design projects was generally unstructured and inconsistent. Many advisors took the approach that they were only there to assist the students on an as-needed basis. A common attitude conveyed to the students was "come by if you need anything." Assistance was generally restricted to technical aspects of the project within the expertise areas of the individual faculty members. Other advisors did take a more active role in the projects, with regularly scheduled meetings, required progress reports, and other supervisory activities, but this would be considered the exception rather than the norm. A major problem was that no formal instructions were ever given to faculty mentors; they were just appointed to advise projects and proceeded in whatever fashion they felt was most appropriate. It is safe to say that very little coaching[2] of the groups by the faculty mentor was occurring.

As a part of standard assessment activities, the department administers exit surveys to all graduating seniors. The survey instrument has been very consistent over the years, with only minor changes to selected questions. The survey covers many areas, including job placement, education satisfaction, program outcomes, and other specific topics. While the survey does not ask specifically about advisement of capstone design projects, there are several questions closely correlated to capstone course topics as well as the opportunity to submit written comments. The student comments, whose purpose is to "*help the faculty to improve the quality of the education they provide,*" are the most telling data from the surveys administered prior to the 2008/2009 academic year. The survey instrument is included in Appendix A.

The Department chair is responsible for analyzing the survey data and writing an annual program improvement report. The purpose is to examine the survey data and plan corrective action and program improvement activities. The report also updates the status of improvement initiatives suggested in the previous year's report. A single summary report[3] was generated for the 2003/2004 and 2004/2005 academic years. Surveys for those years were completed by a total of 29 students (15 and 14 in each year respectively). The second most common negative student comment, appearing in 5 of 29 surveys, related to the capstone design course. (The most common negative comment related to graphics instruction and appeared in 8 of the 29 surveys).

Similar results were observed for the subsequent years before implementing the new paradigm. In the 2005/2006 report[4], 3 of 35 surveys contained negative comments relating directly to capstone design. The 2006/2007 report[5] had negative comments specific to capstone design on 4 of 30 surveys, and the 2007/2008 report[6] contained similarly negative comments on 4 of 40 surveys. The 2007/2008 report, the last before implementing the new paradigm, went on to identify faculty supervision of capstone design projects as the most pressing of ten weaknesses identified for corrective action.

Fixing the Problem

In order to address this clear deficiency in the program, the department faculty began what turned out to be a year-long process of improving faculty supervision of capstone design projects. The initial focus in the discussions centered on just what a faculty mentor should (and should not) be responsible for. Primary issues that surfaced during the discussions were:

- Frequency of meetings with student groups
- Content of group meetings
- Project management role
- Overall responsibility for project success
- Grading responsibilities
- Review of student design logbooks
- Approval of milestones
- Attendance at presentations and other events

These discussions yielded two primary results, one expected and one that was not. The expected result was a clear definition of the role of the faculty mentor. The discussions resulted in a document that clearly defines the responsibilities and expectations for faculty mentorship of capstone design projects. That document is made available to students and is also included in Appendix B. Full details of its implementation have already been disseminated[7].

The unexpected result, a collection of best practices for faculty mentorship of capstone design projects, first surfaced as a result of surveys that were designed to assess the students' understanding of the role of the faculty mentor. The survey data was not anonymous, and (unintentionally) allowed comparison of individual faculty mentors. The data plainly showed that some mentors clearly excelled while others were much less effective, at least in the eyes of the students.

Based on that data, the successful mentors were interviewed to discover the methods they felt were the most effective, along with other tips, tricks, and general suggestions for successful mentorship of capstone design projects.

A final source for the best practices presented here was the implementation of the new paradigm itself, which is now in its third year. Soon after the changes were implemented, faculty began to realize the effectiveness of the new paradigm and appreciate how it improved project supervision. Many sensed a renewed stake in the process and were eager to follow the new

guidelines, which led to suggestions for additional tweaks and further facilitated collection of the best practices.

Best Practices for Faculty Mentorship of Capstone Design Projects

During the course of a two-semester capstone design project, there are many different activities a faculty mentor may perform. In addition, project supervision clearly varies widely from project to project and from group to group. But the work here has identified ten fundamental practices that have consistently lead to improved project supervision and improved student satisfaction of capstone design. They are:

1. **Regularly scheduled group meetings**. At the beginning of each semester, faculty mentors and student groups decide on a time for a weekly meeting. The time slot is recorded on the faculty member's door card and the meeting is considered mandatory for all group members. Occasional conflicts are inevitable, but the students need to understand that a portion of their individual grade for participation is based on attendance at the weekly meetings.

2. **Meeting Log Sheets**. Faculty mentors keep notes of each group meeting. A form is provided (sample included in Appendix C) that allows quick recording of attendance, log book content, and project status as detailed by the group's Gantt chart[8], The mentor records notes of discussion items, as well as action items to be accomplished for the next meeting. Reviewing the log sheet from the previous meeting is a great way for the faculty mentor to prepare for the upcoming one, and provides further evidence to the student of the meeting's importance.

3. **Individual Group Member Queries.** During scheduled group meetings, it is common for one or two students to do all the talking, and to answer all the mentor's questions. Experienced advisors have found it beneficial to engage all group members in the conversation. A common approach is to ask each member individually what they plan to accomplish in the next week, and then have them report on the progress at the next meeting. This approach is helpful in identifying the 'tag-alongs" as well as the "producers" in the project team.

4. **Signature Approval for Project Specifications.** Getting student groups to adequately define their problem at the beginning of the project has long been a thorny issue for the program. Increased emphasis on specification writing has helped, but this important, first task for the student groups has long been problematic. Before the groups can proceed with their projects, the faculty mentor must sign off of their customer requirements and specifications. This milestone must be achieved before the group is allowed to present at the project proposal presentation, which occurs about a month into the semester. The prospect of not presenting, and receiving a zero for that portion of their grade, properly emphasizes the importance of writing a good set of specifications.

5. **Grade Input.** When one faculty member is the course instructor and another is the faculty mentor, the overall importance of the faculty mentor can be unclear to the student.

A key to the empowerment of the faculty mentor is the responsibility of assigning a significant portion of the student's grade. In addition to controlling milestones such as project specifications, the faculty mentor assigns individual grades for "contribution to the project" which count 25% of each semester grade in our model. Advisors also assign a team grade for "overall project quality" (which counts 20%) at the end of the second semester. This important element empowers the faculty mentor and clearly communicates his/her importance to the students.

6. **Midterm Peer Review.** To assist faculty mentors with assigning individual grades for contribution, the course instructor administers peer reviews at the end of each semester. The students confidentially evaluate their group mates (and themselves) for their performance on the project. The peer review instrument is shown in Appendix D. While this is not unusual, a key wrinkle that has been highly effective is to administer a "dry run" of the surveys about half-way through the first semester. This ungraded exercise not only benefits the students, giving them advanced warning about how they will be evaluated at the end of the term, but it also provides valuable feedback to the faculty mentor. The surveys often reveal personnel (or personal) problems that may not have been apparent, and provide this information early enough so that corrective action can be taken, if necessary.

7. **Review of Draft Design Report.** Groups are required to submit a comprehensive design report at the conclusion of each semester. For many students, this is the most comprehensive writing assignment they have ever attempted. It is also typically a true group effort, where different sections are written by different group members and then assembled into a final document. Our practice is to require a draft report that is due about two weeks before the end of the first semester. The report is thoroughly reviewed by the faculty mentor but is graded only for completeness. The completeness grade (5%) provides incentive for the students to submit a reasonably complete work, and the mark up by the faculty mentor provides valuable feedback for their final report. Anecdotally, the quality of final reports has increased significantly since instituting this requirement.

8. **Bill of Material Sign-off.** Similar to the signature approval required for project specifications, the faculty mentor must approve the group's final bill of material before any parts can be ordered. This provides a needed emphasis on the correctness of the groups' working drawings, and also avoids any costly mistakes where scarce project funds are misspent on items that are ultimately not used in project fabrication.

9. **Grade Input for Testing**. Student groups are required to develop a formal, comprehensive document to test their designs against the customer requirements developed at the beginning of the project. Faculty mentors not only grade these test plans, but are required to witness some portion of the physical testing and provide an overall group grade for testing, which counts 10%. Prior to instituting this requirement, students often didn't understand the importance of testing to a capstone design project.

10. **Regular Contact with Project Sponsor**. Although there is no formal mechanism in place to ensure it, regular contact between the industrial sponsor and the faculty mentor is

of great importance. Mentors learn of the students' contact with the sponsor through the weekly group meetings, but information gleaned in that setting is second hand, and experience has shown, is often not completely accurate, especially when problems have arisen. It is practice in our program for faculty mentors to contact the sponsors about twice a month to gauge their impressions of the progress and the evolving design solution. Keeping abreast of the sponsor's perspective on the design project is an important function of the faculty mentor.

The Results

As detailed earlier, the department administers exit surveys to all graduating seniors. While the survey does not ask specifically about advisement of capstone design projects, there are several questions related to course topics as well as the opportunity to submit written comments. Survey data (particularly the written comments) from the five academic years prior to implementation consistently identified supervision of capstone design projects as a problem area in the curriculum.

As shown in Figure 1, the two years of data available since implementation (academic years 08/09[9] and 09/10[10]) do not contain a single negative comment pertaining to supervision of capstone design projects, or even to capstone design in general. This is in stark contrast to the data from the earlier years.

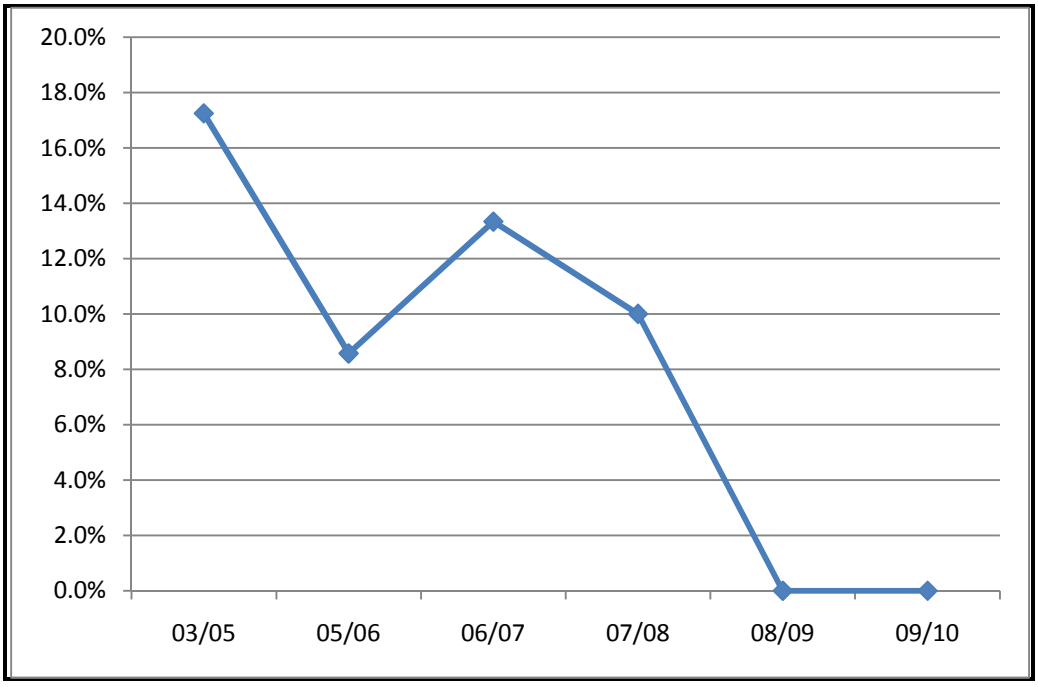

Figure 1 – Percentage of Negative Student Comments Regarding Capstone Design

In addition, key survey questions relating to program outcomes, which are closely correlated to content covered in the course, have shown substantial improvement. The program outcomes

section of the exit survey (Q31-Q43 of Appendix A) asks students to rate their preparation in specific areas via a Likert[11] scale. The data are scored from 1 to 5 with 1 = *Very Unprepared* and 5 = *Very Well Prepared*. The three questions most closely related to capstone design course topics are:

- Q34 – Design component or system to meet needs
- Q35 – Function on multidisciplinary team
- Q36 – Identify, formulate, and solve technical problems

As illustrated in Figure 2, the Likert scores for those three questions show a modest but consistent improvement in the student's self assessment of their preparation in the two years (08/09 and 09/10) since implementation of the paradigm.

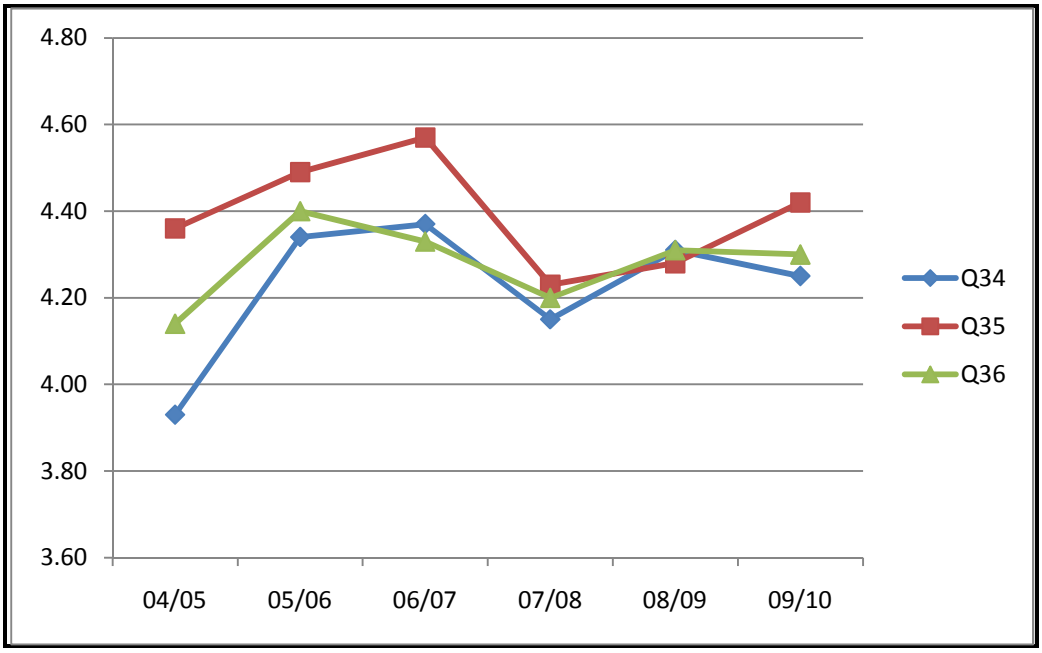

Figure 2 – Student Preparation for Selected Program Outcome Questions

Conclusion

While taking a significant amount of time and effort, development and implementation of the best practices for faculty mentorship of capstone design projects has had clear and measurable benefits. Faculty mentors (and students) have a much better understanding of responsibilities, project advisement has become more consistent, and student satisfaction has increased significantly as evidenced by senior exit survey data.

If these best practices are considered for implementation at other institutions, it is expected that specific responsibilities would vary based on individual programs. But replicating the intent of the best practices presented here would hopefully produce similar positive results in other capstone design programs.

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Appendix A – Graduating Senior Survey Instrument

Graduating Senior Survey

College of Engineering, Computer Science, and Construction Management
CSU, Chico

Dear Graduating Senior,

The College of ECC has developed the enclosed 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

- ☐ APCG ☐ CMGT ☐ MENG
- ☐ CINS ☐ CMPE ☐ MECA
- ☐ CIMT ☐ CSCI ☐ MFGT
- ☐ CIVL ☐ EENG

2. Graduation date

Semester	Year
☐ Spring	☐ 2008
☐ Summer	☐ 2009
☐ Fall	☐ 2010
	☐ 2011

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 ☐ 3.00 - 3.24
- ☐ 2.25 - 2.49 ☐ 3.25 - 3.50
- ☐ 2.50 - 2.74 ☐ 3.51 - 3.74
- ☐ 2.75 - 2.99 ☐ 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

If 'Yes,' please provide:

Company name_____

Your job title _____

Starting annual salary

- ☐ Less than $30K ☐ $51-60$
- ☐ $30-40K ☐ $61-70K
- ☐ $41-50K ☐ $71K or more

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, CMfgT, 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

If 'Yes,' how valuable was the course?

- ☐ Very valuable
- ☐ Valuable
- ☐ Somewhat valuable
- ☐ Not valuable

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

Program Outcomes Questions

Based on your educational experience here at Chico State how well prepared are you to...	Very Unprepared				Very Well Prepared
31. Apply knowledge of math, science, engineering, or technology to solve problems	○	○	○	○	○
32. Design and conduct experiments	○	○	○	○	○
33. Analyze and interpret experimental data	○	○	○	○	○
34. Design a component or system to meet desired needs	○	○	○	○	○
35. Function on a multidisciplinary team	○	○	○	○	○
36. Identify, formulate, and solve technical problems	○	○	○	○	○
37. Communicate technical matters in writing	○	○	○	○	○
38. Communicate technical matters orally	○	○	○	○	○
39. Understand and apply professional and ethical principles	○	○	○	○	○
40. Understand contemporary issues facing society	○	○	○	○	○
41. Use modern tools and technology	○	○	○	○	○
42. Appreciate impact of your solutions on society and environment	○	○	○	○	○
43. Continue learning	○	○	○	○	○

	Strongly Disagree				Strongly Agree
44. I would recommend my major program at CSU, Chico to others.	○	○	○	○	○

Supplemental Questions
Please locate the supplemental questions on the sheet provided. Enter your responses to the right.

Q1. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	Q6. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	Q11. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
Q2. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	Q7. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	Q12. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
Q3. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	Q8. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	Q13. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
Q4. Ⓐ Ⓑ Ⓒ Ⓓ Ⓕ	Q9. Ⓐ Ⓑ Ⓒ Ⓓ Ⓕ	Q14. Ⓐ Ⓑ Ⓒ Ⓓ Ⓕ
Q5. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	Q10. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	Q15. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

Thank you for completing the survey, and please stay in touch with us!

Graduating Senior Survey
ME and MECA Supplemental Questions 2007-08

College of Engineering, Computer Science, and Construction Management, CSU Chico

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Please answer Q1 thru Q15 on the scantron form.

Q1. How satisfied are you with the department support you received while enrolled at Chico State?

A. very dissatisfied
B. somewhat dissatisfied
C. neutral
D. somewhat satisfied
E. very satisfied

Q2. How often did you meet with someone in the University Advising Office?

A. more than once a semester
B. once a semester
C. once a year
D. occasionally
E. never

Q3. How often did you meet with your major (departmental) advisor?

A. more than once a semester
B. once a semester
C. once a year
D. occasionally
E. never

CSU, Chico is considering a new graduate program, a Master of Science in Engineering/Technical Management. The degree would be based on recent changes that have been, or are expected to be, enacted by national engineering professional societies for partial fulfillment of requirements for obtaining an engineering license. The Chico degree would be an interdisciplinary program not tied to any particular type of engineering. It is anticipated that the degree would be open to non-engineering BS degree holders and could be completed in two semesters. Upon completion of the proposed degree graduates would be expected to:

Understand elements of project and asset management
Understand business, public policy and administration fundamentals
Understand the role of leader and leadership principles and attitudes

Your responses to the following questions will help in the development of such a program.

Q4. If this program currently existed, how likely would you be to enroll in the MSEM program shortly after completing your BS degree?

A. highly likely
B. possibly
C. uncertain
D. unlikely
E. definitely not

Q5. Assuming that you were to enter this program, what format would you prefer for the course work associated with the MSEM degree?

A. weekday
B. evening
C. on-line
D. televised
E. no preference

Based on your educational experience at Chico State, how well prepared are you to:	Very Unprepared				Very Well Prepared
Q6. Produce a set of dimensioned engineering drawings	A	B	C	D	E
Q7. Communicate manufacturing needs to a technician	A	B	C	D	E
Q8. Create a Gantt chart for a project	A	B	C	D	E
Q9. Discuss tolerances on manufactured parts	A	B	C	D	E
Q10. Identify the critical path for a project	A	B	C	D	E
Q11. Develop a detailed project budget	A	B	C	D	E
Q12. Integrate a number of parts into a subsystem	A	B	C	D	E
Q13. Prepare a design review	A	B	C	D	E
Q14. Plan a test and verification program	A	B	C	D	E
Q15. Order parts from a vendor	A	B	C	D	E

Appendix B – Responsibilities for Senior Project Faculty Mentors

Responsibilities for Senior Project Faculty Mentors

It is expected that faculty members will meet with their project groups on a weekly basis. General progress should be discussed at each meeting, including a review of each student's design logbook and updates of the Gantt chart once it has been developed. *Meeting Log Sheets* shall be completed and kept as a record of the meetings. Milestone approvals as detailed below shall be recorded on the *Faculty Advisor Approval Form*. Other duties may include general project management advising, counseling individual group members on teamwork skills, and other activities in support of the learning outcomes of the course. In addition to these general duties, the following activities specific to the fall semester is expected:

1. Project definition
    a. Meets department standard for Senior Project
    b. Approve before project can move forward
2. Project Proposal presentation (~ week 5)
    a. Objective – Demonstrate that design problem is understood, well defined, and justified
    b. Approve before presentation
        i. Project title
        ii. Team member names and pictures
        iii. Name of faculty advisor
        iv. Acknowledgement of sponsor
        v. Project justification
        vi. Project definition
        vii. List of deliverables
        viii. Key resources
    c. Attend presentations and participate in evaluation of all groups
        i. Rubric scores for each group
        ii. Written individual/group comments
3. Assist with preliminary design activities (~ weeks 5 through 9)
    a. Following defined steps of the design process
    b. Generating concepts (Brainstorming, Analogies, TRIZ)
    c. Choosing between concepts (Pugh Analysis)
    d. Project Planning (Tasks, Scheduling, Milestones, Gantt Chart)
    e. Approval of *.stl file for Rapid Prototyping

4. Midterm peer reviews administered by course coordinator (~ week 7)

    a. Review peer review surveys
    b. Corrective action with group members as needed

5. Preliminary Design Review presentation (~ week 9)

    a. Objective – Demonstrate that a valid concept has been developed; convince customer to proceed with detailed design
    b. Approve before presentation
        i. Introduction
        ii. Project justification
        iii. Project definition
        iv. Overview of concepts developed and considered
        v. Selection criteria (must include Pugh Analysis)
        vi. Winning concept
        vii. Critical (highest risk) element and backup (plan B)
        viii. Planning (separate slide for fall and spring, list 5 to 10 tasks, give hours for each, give total hours)
        ix. Budget Summary (estimated, links to hours on previous slide)
        x. Attend presentations and participate in evaluation of all groups
        xi. Rubric scores for each group
        xii. Written individual/group comments

6. Assist with detailed design activities (~ weeks 10 through 15)

    a. Component selection, Calculations, Fabricate vs. Purchase
    b. Cost estimating and budget
    c. Documentation (working drawings)
    d. Utilization of resources

7. Draft Design Report (due ~ week 14)

    a. Check for completeness
        xiii. Letter of transmittal
        xiv. Executive summary
        xv. Background and introduction
        xvi. Complete problem statement
        xvii. Discussion of alternative concepts
        xviii. Evaluation of concepts
        xix. Details of final solution
        xx. Working drawings (top level assembly plus minimum 2 detail drawings)
        xxi. Gantt Chart

xxii. Budget
xxiii. References
xxiv. Appendices

b. Each group member has proofread
c. Assess grade for completeness
d. Mark-up for technical content
e. Forward to course coordinator for format review

8. Final Design Review presentation (~ week 15)

   a. Objective – Demonstrate that the solution will meet the requirements and solve the problem; convince customer to proceed with prototype construction
   b. Approve before presentation
      i. Introduction
      ii. Project definition
      iii. Design solution
      iv. Engineering analysis
      v. Why design will work
      vi. Budget
      vii. Plans for spring
   c. Attend presentations and participate in evaluation of all groups
      i. Rubric scores for each group
      ii. Written individual/group comments

9. Final Design Report from another team's project (exam period)

   a. Complete grade rubric
   b. Mark-up, comment as needed

10. Assign each student's "Contribution to the Project" grade

    a. Midterm peer evaluations
    b. Final peer evaluations
    c. Other observations

11. Assess each student on program outcome MECH/MECA d: An ability to function effectively as members of multidisciplinary teams.

Appendix C – Faculty Advisor Meeting Log Sheet

Faculty Advisor _____ Date _____

Project Title _____

Students & Logbooks:			
Student Name1	*Student Name2*	*Student Name3*	*Student Name4*
☐ Present at Meeting ☐ Logbook Checked	☐ Present at Meeting ☐ Logbook Checked	☐ Present at Meeting ☐ Logbook Checked	☐ Present at Meeting ☐ Logbook Checked
Comments:	Comments:	Comments:	Comments:

Planning / Gantt Chart:
☐ Checked by Faculty Advisor ☐ Updated since last meeting Comments:

Outstanding Issues and Comments:

Appendix D – Peer Review Instrument

Student Being Evaluated _____

Student Doing the Evaluating _____

Project Name _____

Circle your responses for the questions below. Feel free to add comments to clarify your answers as needed. **These results will remain strictly confidential**.

1. The group member did his/her "fair share" of the project work.

Strongly Agree *Agree* *Neutral* *Disagree* *Strongly Disagree*

Comments:

2. The group member attended scheduled group meetings.

Strongly Agree *Agree* *Neutral* *Disagree* *Strongly Disagree*

Comments:

3. The group member was a "team player" and worked well with other group members.

Strongly Agree *Agree* *Neutral* *Disagree* *Strongly Disagree*

Comments:

4. The group member contributed significantly to the overall success of the project.

Strongly Agree *Agree* *Neutral* *Disagree* *Strongly Disagree*

Comments:

5. I were awarding a grade for *Project Contribution*, the group member would receive a:

A+ *A* *A-* *B+* *B* *B-* *C+* *C* *C-* *D+* *D* *D-* *F*

Comments: