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Applying systems engineering management to improve undergraduate curriculum

Laura Gay Cohn
San Jose State University

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**APPLYING SYSTEMS ENGINEERING MANAGEMENT TO
IMPROVE UNDERGRADUATE CURRICULUM**

A Project

Presented for

**Interdisciplinary Studies Degree in
Systems Engineering Management**

San José State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

Laura Gay Cohn

August 1998

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**APPROVED FOR THE INTERDISCIPLINARY STUDIES DEGREE IN
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ABSTRACT

APPLYING SYSTEMS ENGINEERING MANAGEMENT TO IMPROVE UNDERGRADUATE CURRICULUM

by Laura G. Cohn

Systems engineering management involves designing and improving the systems used to achieve organizational goals. This research study applied the tools and methods of systems engineering management to the improvement of the San José State University Industrial and Systems Engineering undergraduate program.

The various customers of the undergraduate program and their priority needs were identified. Analysis was performed to determine the gap between the current program and that needed to fully meet customer needs. A specific course sequence (the senior project) was selected for improvement based upon the gap between the current and desired situations. A plan for changing the senior project was developed, which included designing a new two-course sequence, providing the courses, and testing whether the new courses met the intended goals of the study.

This thesis describes the planned effort and its implementation, documents the results, and provides recommendations for future improvement activities.

ACKNOWLEDGMENTS

I wish to acknowledge the invaluable support provided to me in undertaking this project by the faculty of San José State University. In particular, I wish to thank Dr. Ben Knapp, the Chair of the Computer, Information, and Systems Engineering Department, Dr. Ernie Unwin, the Chair of the Industrial and Systems Engineering (ISE) Program, and ISE professors Dr. Robert McQueen, Bill Dunckel, and Ron Murata.

Dr. Ben Knapp assisted in the design and administration of the ISE 195A course, and was responsible for course activities associated with planning student projects. Dr. Robert McQueen reviewed and approved the various course materials developed, and assisted in many of the ISE 195A course sessions.

Dr. Ernie Unwin reviewed and approved the overall design and green sheet for the ISE 195B course, and provided continuing advice and assistance in developing various course modules.

Ron Murata and Bill Dunckel, adjunct ISE professors, assisted in the team teaching of the ISE 195B course. ISE professors Dr. Lou Freund and Dr. Yasser Dessouky provided valuable insights into curriculum improvements, and the motivation and needs of faculty in general.

I would also like to express my gratitude to all the students who participated in both the 195A and 195B courses. Their interest, enthusiasm, feedback, and support helped make this project an enjoyable and valuable experience.

TABLE OF CONTENTS

INTRODUCTION	1-1
PURPOSE: Determining Problem Area to Improve	2-1
PLAN: Deciding How to Achieve the Desired Purpose	3-1
DO: Designing and Giving the New Courses	4-1
CHECK: Determining if the Desired Goals Were Met.....	5-1
ACT (Conclusion): Shifting Into Continuous Improvement.....	6-1
WORKS CITED.....	7-1

APPENDICES

Appendix A: Comments on ISE Program From Graduating Seniors.....	A-1
Appendix B: Syllabus From ISE 195A.....	B-1
Appendix C: Syllabus From ISE 195B	C-1
Appendix D: Notes From Course Sessions	D-1

FIGURES

Figure 1.1: The Learning Cycle.....	1-2
Figure 2.1: Flow Chart of Activities in the “Purpose” Step	2-1
Figure 2.2: Systems Diagram of The SJSU ISE Program	2-1
Figure 3.1: Flow Chart of Activities in the “Plan” Step.....	3-1
Figure 3.2: Schedule for Creating the New Senior Project Courses.....	3-3
Figure 4.1: Flow Chart of Activities in the “Do” Step.....	4-1
Figure 5.1: Flow Chart of Activities in the “Check” Step.....	5-1
Figure 5.2: Results From Course Topic Survey for 195A	5-4
Figure 5.3: Results From Course Topic Survey for 195B.....	5-5
Figure 5.4: Results From Teaching Effectiveness Survey for 195A.....	5-6
Figure 5.5: Results From Teaching Effectiveness Survey for 195B	5-7
Figure 6.1: Flow Chart of Activities in the “Act” Step.....	6-1

TABLES

Table 2.1: Current Senior Project Course Topics.....	2-12
Table 3.1: Activities for Creating the New Senior Project Courses.....	3-2
Table 4.1: Course Topics for ISE 195A.....	4-2
Table 4.2: Course Topics for ISE 195B.....	4-3
Table 4.3: Course Topic Survey for ISE 195A	4-6
Table 4.4: Course Topic Survey for ISE 195B.....	4-7
Table 4.5: Teaching Effectiveness Survey	4-8

SJSU ISE Program Improvement Project: Introduction

“The future belongs to the innovative. Only if we continue to innovate, only if we continue to adapt to changing circumstances, will our institutions continue to prosper (Goldberg 112).”

This report describes the application of systems engineering management tools and methods to the improvement of the Industrial and Systems Engineering (ISE) Program at San José State University (SJSU). W. Edwards Deming, one of the pioneers of quality improvement, emphasized the responsibility of management for the design of the systems used to get work done (Walton 66). Systems engineering management covers the design of the systems used to get work done, and the improvement of these systems.

The SJSU ISE Program can be viewed as an enterprise that transforms inputs into outputs that are valued by customers. The ISE Program consists of a network of systems, including systems that help students learn, and those that help administer the program. This network can be improved using systems engineering management tools and methods.

The broad objective of this project was to use the tools of systems engineering management to identify a high priority area where improvement in the program was required to better meet the needs of customers. A decision was made to focus on academic areas rather than on the Program’s infrastructure.

The basic structure used for this project is known as the “Learning Cycle.” A graphic of the learning cycle model is provided in Figure 1.1. It is basically an extension of the well-known Shewhart PDCA (“Plan-Do-Check-Act”) cycle, later used by Deming (Walton 86). Dr. McQueen of the Organizational Learning Center (OLC) modified the PDCA cycle by adding the step of “purpose” prior to developing the plan (McQueen 20). These five basic steps (PPDCA) provide the framework for the improvement project activities.

SJSU ISE Program Improvement Project: Introduction

Figure 1.1: The Learning Cycle

SJSU ISE Program Improvement Project: Introduction

In the “purpose” step, an assessment was undertaken to understand the needs of customers and to identify the gap between the outputs of the existing ISE Program and those desired by customers. Closing the gap was the purpose of this improvement project.

The second step in the project was to develop a plan for closing the gap. The assessment undertaken in the “purpose” step showed that the most effective way to achieve the desired improvement was to improve the design of the senior project course. This proved to be timely, as recent changes in the College of Engineering structure resulted in the inclusion of the ISE Program in a new department entitled, “Computer, Information, and Systems Engineering.” The effort to bring the three degree programs together included the desire to have a common senior project approach throughout the department.

Each step in this report includes a flow diagram of major activities undertaken in the step, a description of the activities, and the information that was generated as an output of the step. The project involved the creation and assessment of two new courses that, together, formed a new senior project sequence. The project activities included designing measures to assess the effectiveness of the courses, developing course materials, providing the courses, and assessing both the learning achieved and the effectiveness of the teaching methods.

Conclusions are drawn on the overall success of the project, and specific recommendations are provided on ways to further improve the courses developed.

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve

Introduction to “Purpose” Step

This step involves establishing a clear purpose for the project that is shared by all involved in or affected by the improvement effort: in this case, the San José State University Industrial and Systems Engineering faculty.

Figure 2.1 shows the flow of activities completed under the “Purpose” step.

Figure 2.1: Flow Chart of Activities for the “Purpose” Step

Determining ISE Program Inputs, Outputs, and Customers

In order to determine the customers for the SJSU ISE Program, a systems diagram was created. The systems diagram shows the inputs, outputs, and customers of the ISE Program, and is provided in Figure 2.2 below.

Figure 2.2: Systems Diagram of The SJSU ISE Program

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve (Cont'd.)

Many sources were used to collect the needs of ISE Program customers, including periodicals, brainstorming sessions from courses, undergraduate student projects focused on improving the ISE Program, and input from faculty and students. Information was obtained on the new criteria of the Accreditation Board for Engineering and Technology (ABET). Input on the needs of faculty was obtained through discussions with SJSU ISE faculty and personal experience. Input on the needs of students was obtained from discussions with students and through a survey of graduating seniors on ISE courses and the ISE Program as a whole. The survey was developed and provided to students by the author and Dr. McQueen. A blank survey and selected comments from completed surveys are provided in Appendix A.

Needs of Students

- Preparation for working in industry
- Ability to be effective engineers
- Ability to understand what industrial engineers do and what their jobs will be like
- Industry experience as an industrial engineer
- Hands-on experience in the courses, preferably in local industry

Needs of Faculty

- Ability to learn from each other and improve teaching styles/methods
- Ability to impart knowledge on industrial and systems engineering topics to students
- Ability to do relevant research to increase knowledge of industrial engineering topics
- Belief that course materials are part of a well-designed curriculum
- Knowledge of how course topics link to other courses in curriculum

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve (Cont'd.)

Needs of Local Industry

The area of industry needs is an important one, particularly as there has been an increasing perception that these needs are not being met. The engineering tools and methods learned in college will quickly become obsolete: some say within three years of graduation (Bemowski 31). As the rate of change increases, this becomes an even more important issue, particularly for universities supplying engineers to Silicon Valley. In response to the rapidly changing environment and the slow response by universities, many large companies have established their own training systems to help their employees keep up (Bemowski 30).

Graduating seniors enrolled in the ISE 195A course in the Spring semester of 1998 brainstormed what they thought local industry wanted from them as prospective employees, creating the following list:

- Technical knowledge
- Ability to work hard
- Teamwork skills
- Communications skills
- Responsible nature
- Business knowledge
- Ability to learn
- A focus on being productive
- Innovative ideas
- Creativity
- Social ability

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve (Cont'd.)

The following quotes from interviews with D. Balzhiser, CEO of the Electric Power Research Institute, and G. Heilmeier, CEO of Bellcore ("Tomorrow's Engineers" 12) give additional insights into the needs of industry.

"We are looking for individuals who leave engineering school with fertile minds, with the anticipatory skills that enable them to look around the corner or beyond the horizon."

"We're looking for students who have the ability to understand the full impact their contributions make. In other words, we're looking for students who have a systems perspective."

"We're also looking for students who have the discipline to support lifelong learning. What we learned in engineering school were tools that we could use [but] these tools rapidly became obsolete. What we took away with us was a passion for learning, a passion that stayed with us all of our lives."

Needs of ABET Board

In the ABET 2000 requirements taking effect in 1998, ABET is requiring engineering programs to meet new criteria based upon studies of the skills students should have upon graduation to enable them to become effective engineers in today's marketplace (Engineering Criteria 2000 4). These are broken into two categories: requirements for all of engineering, and Industrial Engineering-specific requirements.

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve (Cont'd.)

Needs of ABET Board (Cont'd.)

ABET engineering requirements

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

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve (Cont'd.)

Needs of ABET Board (Cont'd.)

ABET industrial engineering-specific requirements

Graduates must have demonstrated the ability to design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and energy. The program must include in-depth instruction to accomplish the integration of systems using appropriate analytical, computational and experimental practices.

Needs of ISE community

The membership of the Institute of Industrial Engineers has been dropping over the last few years. Part of the problem is that many people in industry don't know what an industrial engineer does, or why the role of an industrial engineer is crucial to organizational success.

One way to improve this situation is to increase the visibility of industrial engineers in industry by incorporating industry projects into the SJSU ISE curriculum. The students would help local industry by analyzing the organization and implementing improvements to help the organization's bottom line, thereby increasing the understanding and perceived importance of the industrial engineer's role.

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve (Cont'd.)

Gap Between Customer Needs and Current Situation

The following section lists several of the key customer needs, and describes the gap between those needs and what is currently offered by the SJSU ISE Program.

1. *Integration of ISE topics*

It is clear from the customer needs stated above that an important factor for ISE students is to see how the skills and competencies of industrial engineering and systems engineering can be integrated into the daily work of an engineer. This is not well understood by SJSU ISE students, because the current senior project course, which should be a culminating course, fails to tie these skills together, and in fact, doesn't incorporate *most* of the skills learned in ISE program classes.

2. *People skills*

This area includes skills such as teamwork and communication. It is a requirement of ABET as well as one of the most important needs of industry today. While many of the ISE courses require students to work in teams, nothing is taught about how to do it successfully – students are left to struggle on their own with the many teamwork problems that arise.

3. *Design/improvement/integration of organizational systems*

This is a requirement of ABET under the "IE-specific requirements" section above. Students need to be able to look at the "big picture" of an organization, understand and analyze its key processes and systems, and

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve (Cont'd.)

Gap Between Customer Needs and Current Situation

find improvement opportunities. Currently, the SJSU ISE Program does not address this requirement. Students are taught to use specific analysis/improvement tools for specific situations, but are never taught how to analyze an organization, understand how the organization's systems/processes impact each other, or determine which tools will work best in which situation for improvement.

4. *Project management skills*

Students are required to work in project teams in many of the SJSU ISE courses, but are never taught how to manage a project to ensure success. In addition, industry is looking for students who can be project managers. Currently, this need is not addressed in the SJSU ISE Program.

5. *Industry projects*

Students need experience working on projects in industry. However, this experience will only be truly useful if it can follow the normal project lifecycle, which begins with identification of a need or problem and carries on through implementation of the solution and measurement of results achieved. Currently, this need is not addressed in the SJSU ISE Program, as the projects students undertake usually only provide for contact with a particular organization for one semester, and don't carry on through implementation of any changes or measurement of results.

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve (Cont'd.)

Improvement Area Selection

Given that these customer needs are not met, it is clear that an important area for improvement is the ISE curriculum. If one course is to be selected for improvement first, it should be the senior project culminating course, as it is the last contact the university has with students before they graduate. Also, by this time students have learned all the tools of industrial engineering, and can better undertake a comprehensive industrial project.

There is one additional factor which makes the selection of the senior project course particularly relevant at the current time. The Industrial and Systems Engineering Program, while still maintaining its ISE degree, has recently been merged with other programs into a larger department: the Computer, Information, and Systems Engineering Department. The new department decided to change the structure of the senior project courses, beginning in the Spring semester of 1998.

The change involves making the senior project a two-semester sequence, with the first semester consisting of project planning and team selection, and the second semester involving undertaking the senior project based upon the plan. Therefore, this seemed to be a good time to make improvements to the senior project, while the content and structure of the courses were already in transition.

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve (Cont'd.)

Current and Desired Situations for Improvement Area

The next task is to determine, for the senior project course, the “as is” and “to be” situations in more detail. The “as is” will cover the way the course has been taught in previous semesters, and the “to be” will describe the way it is being improved for the Spring semester of 1998. In the “Act” section of this paper, recommendations will be provided for further improvements to the course based upon lessons learned while giving the courses in the Spring semester.

“As Is” - How the course was taught in previous semesters

A recent syllabus for the existing senior project course was not available, but a schedule of course topics is provided in Table 1.1. It can be seen from the topics listed that the course is focused more on organizational design than organizational improvement. The course is structured around writing a proposal/business plan for a new start-up company, including describing the company’s products, processes, organization charts, and financial statements.

While the course integrates some of the content from the ISE curriculum, it also includes items such as market research and product drawings, which are not covered in the ISE curriculum and which are not typically considered part of an industrial engineer’s role.

One of the main difficulties with this course is that it provides no real-world experience. The research around the company’s design is done from books and articles. Although this is a culminating course, the students do not learn or practice their skills in industry.

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve (Cont'd.)

Current and Desired Situations for Improvement Area

Another problem is that, while industrial engineers can practice in either manufacturing or service industries, the concepts covered in the current senior project course mostly apply to a manufacturing environment, as can be seen from Table 2.1.

In addition, the current course does not help students develop a system for change or improvement, or enable them to develop a measurement system to show bottom-line results of improvement efforts, because it doesn't address improvement at all, but rather organizational design. As recently graduating industrial engineers, most of the students will be working in existing organizations to recommend improvements, rather than designing completely new organizations.

Finally, the course does not help students learn how to be effective team members, nor does it teach project management skills, although the course grade is largely based upon the output of a team project.

The following are a few of the competencies developed in the current course that aren't covered elsewhere in the curriculum:

- How to do market research on competing products and companies
- How to write a business plan
- How to create product drawings, including drawings of sub-assemblies and components

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve (Cont'd.)

Week	Content
1	Introduction
2	Your company's mission, vision, goals, objectives, and critical success factors Product development: market research, quality function deployment
3	Product design and drawings Product/process life cycle
4	Financial statements Financial accounting, analysis, and activity-based costing systems
5	Cost/volume/profit relationships Manufacturing processes and automation
6	Production charts and production systems Manpower assignments and line balancing
7	MIDTERM #1 Machine selection, yield and cost models
8	Labor requirement Machine coupling
9	Building, organization, communication, and support requirements Quality assurance and ISO 9000
	SPRING BREAK
10	Master planning and inventory management
11	Material and capacity requirements planning Production planning and control systems
12	MIDTERM #2 System simulation
13	Computer information systems Computerized manufacturing systems
14	Material handling Plant and office layout
15	Plant site selection and service considerations Integrated manufacturing production systems
16	PROJECT PRESENTATIONS

Table 2.1: Current Senior Project Course Topics

SJSU ISE Program Improvement Project: Purpose

Establishing Purpose: Determining Problem Area to Improve (Cont'd.)

“To Be” - How the course will be improved for Spring 1998

As mentioned earlier, the new CISE department has decided that all senior project courses should be a two-semester sequence, with the first semester involving developing a plan for the project, and the second semester implementing the plan. Therefore, the “to be” description of the senior project course will include descriptions of both of these courses.

ISE 195A: Senior Project I

This course will help students establish project teams, learn effective teamwork and interpersonal skills, select a project focus area, and create a project plan while developing their project management skills. The course should allow time during class sessions for students to work in teams to develop their project plans.

ISE 195B: Senior Project II

This course will be the culminating project for graduating seniors. It will provide students with an opportunity to work on a project in industry. This project should enable students to use many of their industrial and systems engineering skills to analyze various aspects of an organization and recommend improvements.

The course should integrate the competencies learned throughout the ISE curriculum in undertaking the project. The new course should also help students gain a “big picture” view of how an organization operates, and how its various processes/systems integrate with each other to provide products or services to customers.

SJSU ISE Program Improvement Project: Plan

Planning the Changes: Deciding How to Achieve the Desired Purpose

Introduction to “Plan” Step

This section describes how a plan for designing and testing the new courses was developed. There are several components involved in planning how to achieve the desired purpose stated in section 1 of this paper. First, a pathway must be charted from the “as is” (current) situation to the “to be” (desired) situation. Next, a time frame must be determined for making the change. Finally, any support needed must be determined and arranged.

Figure 3.1 shows the flow of activities completed under the “Plan” step.

Figure 3.1: Flow Chart of Activities for the “Plan” Step

Activities and Schedule

The activities in Table 3.1 describe the pathway from the “as is” senior project course to the “to be” senior project courses. These activities will be completed during the Spring semester of 1998, as shown in the schedule in Figure 3.2.

SJSU ISE Program Improvement Project: Plan

Planning the Changes: Deciding How to Achieve the Desired Purpose (Cont'd.)

Project Stage	Activities
Design courses	<ul style="list-style-type: none">• Determine course content to meet customer needs that were previously unmet• Determine time needed for each course content segment• Establish sequence of segments• Create green sheets for courses
Design measures	<ul style="list-style-type: none">• Determine which customer needs the courses should meet• Design a measurement system to measure whether the courses meet these needs• Design a measurement system to determine how effective course was in increasing student learning
Provide courses	<ul style="list-style-type: none">• Create course materials for each session• Provide both courses during the Spring semester of 1998
Document instructor learning	<ul style="list-style-type: none">• Based on the how the course sessions go, document any learning to improve content or delivery methods
Measure effective-ness	<ul style="list-style-type: none">• Collect information to determine whether or not the courses were effective in increasing student learning• Collect information using measures designed above to determine whether or not customer needs are being met
Document modifica-tions	<ul style="list-style-type: none">• Based upon the results of the measures collected above, document modifications needed to ensure the courses meet customer needs
Write up improve-ment recommen-dations	<ul style="list-style-type: none">• Write up improvements recommended for the two courses based upon all the information documented above

Table 3.1: Activities for Creating the New Senior Project Courses

SJSU ISE Program Improvement Project: Plan

Planning the Changes: Deciding How to Achieve the Desired Purpose (Cont'd.)

ACTIVITY	WEEK BEGINNING				
	Jan. '98	February	March	April	May
DESIGN COURSES					
Determine course content	■				
Determine time needed for each topic	■				
Establish topic sequence	■				
Create syllabus for each course	■				
DESIGN MEASURES					
Determine needs to be met		■			
Design measures for needs		■			
Design measures for student learning		■			
PROVIDE COURSES					
Create course materials		■	■	■	
Provide courses		■	■	■	■
DOCUMENT LEARNING		■	■	■	■
MEASURE EFFECTIVENESS					
Measure student learning		■	■	■	■
Measure whether needs were met					■
DOCUMENT MODIFICATIONS					■
WRITE UP RECOMMENDATIONS					■

Figure 3.2: Schedule for Creating the New Senior Project Courses

Resources Needed

Some resources were required to accomplish the activities in this plan. These included access to a computer on which to create course materials, access to the duplicating center on campus for printing the materials, review by ISE faculty on course content, and co-instructors to help teach the courses.

SJSU ISE Program Improvement Project: Do

Making the Changes: Designing and Giving the New Courses

Introduction to “Do” Step

This step involves designing the new courses, designing measures of success, preparing course materials, and giving the course sessions. Figure 4.1 shows the flow of activities completed under the “Do” step.

Figure 4.1: Flow Chart of Activities for the “Do” Step

Designing the Courses

Table 4.1 includes the course topics for “ISE 195A: Senior Project I.” Table 4.2 includes the course topics for “ISE 195B: Senior Project II.” A syllabus for ISE 195A is provided in Appendix B, and a syllabus for ISE 195B (previously named ISE 190) is provided in Appendix C. It is important to note that the design for the ISE 195B course includes some content overlap with the ISE 195A course. This is due to the problem caused by introducing a new two-semester sequence at the beginning of the second semester. This meant that graduating seniors who only had one semester left signed up for the second course, unaware of the newly-required first course. Therefore, both semesters of content needed to be covered to some extent in ISE 195B.

SJSU ISE Program Improvement Project: Do
Making the Changes: Designing and Giving the New Courses (Cont'd.)

Designing the Courses (Cont'd.)

Week	Topic
1/23	<ul style="list-style-type: none"> • Introduction and Review of Green Sheet • Success Factors for Engineers in Industry
1/30 and 2/6	<ul style="list-style-type: none"> • Presentations by Faculty: Available Project Focus Areas
2/13	<ul style="list-style-type: none"> • Project Management/Dynamic Systems Engineering
2/20	<ul style="list-style-type: none"> • Resumes and Interviewing • Lifelong Learning
2/27	<ul style="list-style-type: none"> • Individual and Organizational Learning • Team Selection
3/6	<ul style="list-style-type: none"> • Designing and Preparing Proposals • Project Group Work
3/13	<ul style="list-style-type: none"> • Teamwork Skills/Tools/Measures
3/20	<ul style="list-style-type: none"> • Research Skills/Library Skills
4/3	<ul style="list-style-type: none"> • Communication Skills/Tools/Methods
4/10	<ul style="list-style-type: none"> • Measuring Project Progress and Performance • Project Group Work
4/17	<ul style="list-style-type: none"> • Engineering Ethics • Project Group Work
4/24	<ul style="list-style-type: none"> • Entrepreneurship • Project Group Work
5/1	<ul style="list-style-type: none"> • Proposal Presentations: All Oral and Written Proposals Due
5/8	<ul style="list-style-type: none"> • Proposal Presentations

Table 4.1: Course topics for "ISE 195A: Senior Project I"

SJSU ISE Program Improvement Project: Do
Making the Changes: Designing and Giving the New Courses (Cont'd.)

Designing the Courses (Cont'd.)

Week	Topic
1/26	<ul style="list-style-type: none"> • Introduction and Review of Green Sheet • Organizational Characteristics • Enterprise Model
2/2	<ul style="list-style-type: none"> • Systems Engineering Skills and Methods • Project Team Structure
2/9	<ul style="list-style-type: none"> • Organizational Assessment • Project Team Focus Areas/Project Team Formation
2/16	<ul style="list-style-type: none"> • Teamwork Skills • Project Management Skills
2/23	<ul style="list-style-type: none"> • Performance Measurement • Process Measurement
3/2	<ul style="list-style-type: none"> • Measuring Culture and Human Effectiveness Skills • Measuring Improvement Processes
3/9	<ul style="list-style-type: none"> • Key Objectives/Hoshin Planning
3/16	<ul style="list-style-type: none"> • Aligning Organizational Goals With Performance Measures
3/30	<ul style="list-style-type: none"> • Identifying Improvement Opportunities
4/6	<ul style="list-style-type: none"> • Project Work Supported by Instructors/Visiting Host Company
4/13	<ul style="list-style-type: none"> • Project Work Supported by Instructors/Visiting Host Company
4/20	<ul style="list-style-type: none"> • Project Work Supported by Instructors/Visiting Host Company
4/27	<ul style="list-style-type: none"> • Project Work Supported by Instructors/Visiting Host Company
5/4	<ul style="list-style-type: none"> • Project Work Supported by Instructors/Visiting Host Company
5/11	<ul style="list-style-type: none"> • Project Presentations

Table 4.2: Course topics for "ISE 195B: Senior Project II"

SJSU ISE Program Improvement Project: Do

Making the Changes: Designing and Giving the New Courses (Cont'd.)

Designing Measures of Success

Several methods were designed to measure the success of the courses. It was decided that the course design should meet the needs of most of the customers mentioned in section 1 of this paper. To determine whether or not this was the case, measures of success were developed for each of these customer groups.

To measure whether the course met the needs of ABET and industry, data was collected on whether students had increased their capabilities in key areas important to these two customers. In particular, homework, tests, and projects were graded to determine the capability of students throughout the course and at the end of the course. In addition, a student survey was designed by the author and Dr. McQueen to measure whether individual students felt they had increased their knowledge of the course topic areas. Tables 4.3 and 4.4 provide a list of questions from the Course Topic Surveys for the two courses. The questions for these surveys were divided into two sections, with the first section measuring whether or not students believed they had gained knowledge in a particular area, and the second section measuring whether or not students believed they had acquired skills in a particular area. These areas were selected based upon the course goals and objectives established in the "Plan" phase.

SJSU ISE Program Improvement Project: Do

Making the Changes: Designing and Giving the New Courses (Cont'd.)

The student survey also measured the students' knowledge of course topics at the beginning of the course. For each area where students listed their knowledge as "medium" to "high" *before* taking the course, it was requested that information be provided on where this knowledge was gained (in other courses, at work, through life experience, etc.). This information met the needs of two customer groups, as it was good input to faculty interested in eliminating duplication of topics from one course to another, and helped improve the curriculum for students.

Finally, to further understand the needs of students as customers, a survey was designed by the author and Dr. McQueen to measure the effectiveness of the teaching style. Table 4.5 provides a list of questions from the Teaching Effectiveness Survey, which was tailored for use in both courses.

Preparing Course Materials

The course materials were prepared in conjunction with Dr. Robert McQueen, a professor in the Industrial Engineering Program at San José State University. Dr. McQueen taught several of the undergraduate and graduate courses in the ISE Program over the past ten years, and provided valuable insights into course design and student needs. One feature designed into the ISE 195A course was the availability online of all course materials.

Giving the Course Sessions

The course sessions were facilitated by Dr. McQueen and Laura Cohn. In addition, some class sessions of the ISE 195B course were facilitated by Dr. Ben Knapp, the Chair of the Computer, Information, and Systems Engineering Department at San José State University. Dr. Knapp was listed as co-instructor for this course with Dr. McQueen for the Spring semester of 1998.

SJSU ISE Program Improvement Project: Do
Making the Changes: Designing and Giving the New Courses (Cont'd.)

Designing Measures of Success (Cont'd.)

COURSE TOPIC SURVEY FOR "ISE 195A: SENIOR PROJECT I"
My knowledge of:
1. The process (steps) involved in managing engineering projects
2. The human skills important to the success of multidisciplinary project teams
3. What a "learning organization" is
4. How organizations learn
5. What systems engineering is and why it's important to the success of engineering projects
6. Factors that influence the success of interpersonal communications
7. How to plan and track the progress of an engineering project
My ability to:
8. Use teamwork tools and methods to achieve project team success
9. Establish good measures for tracking engineering project performance
10. Identify and analyze an ethical dilemma
11. Analyze and address the causes of project problems
12. Successfully manage changes that occur during an engineering project
13. Establish an effective project work breakdown structure
14. Assess and address risks in a project plan

Table 4.3: Course Topic Survey for "ISE 195A: Senior Project I"

SJSU ISE Program Improvement Project: Do

Making the Changes: Designing and Giving the New Courses (Cont'd.)

Designing Measures of Success (Cont'd.)

COURSE TOPIC SURVEY FOR "ISE 195B: SENIOR PROJECT II"
My knowledge of:
1. How the various ISE program course topics integrate to form a body of knowledge and skills valued by industry
2. How industrial and systems engineers contribute to the competitiveness of their organizations
3. What systems engineering is and how it is used in industry
4. The skills needed by engineering project managers in industry
5. Good measures of the effectiveness of an engineering project
6. An enterprise model of an organization
7. How to measure an organization's culture and human effectiveness skills
8. The teamwork skills necessary to be an effective member of a project team
My ability to:
9. Use the skills necessary to manage an engineering project
10. Use the skills of systems engineering in undertaking an engineering project
11. Create an enterprise model of a specific company
12. Assess how an organization is performing in the various segments of the enterprise model
13. Identify high-leverage improvement opportunities at the organizational level
14. Establish goals for and measure the level of success of engineering projects
15. Measure an organization's human effectiveness skills and culture
16. Analyze organizational goals and align them with performance measures to determine whether or not the goals are being met

Table 4.4: Course Topic Survey for "ISE 195B: Senior Project II"

SJSU ISE Program Improvement Project: Do

Making the Changes: Designing and Giving the New Courses (Cont'd.)

Designing Measures of Success (Cont'd.)

TEACHING EFFECTIVENESS SURVEY FOR ISE 195A AND ISE 195B
1. I feel free to ask questions without fear of being embarrassed or being made to look bad by the instructor.
2. The instructor has a good knowledge of the course subject matter and is able to answer students' questions.
3. The instructor is enthusiastic about the course topic.
4. The instructor helps students see how the course topics apply to the work they will do in industry.
5. My learning of course topics is supported by applying the topics in a variety of "hands on" ways using labs, course projects, breakout sessions, and case studies.
6. The purpose of and topics for each class meeting are made clear at the beginning of class.
7. The course sessions are interesting and motivate me to learn.
8. The instructor's expectations for homework and tests are clear and understandable.
9. The instructor is flexible and is willing to adjust the class activities/schedule to enhance learning.
10. The instructor explains how the various course topics relate to each other to form a body of knowledge.
11. The instructor is able to admit mistakes and learn.
12. I am given chances to participate and talk in class, to be an active learner.
13. The course topics usually cover areas I haven't learned before.
14. In grading my tests and assignments, the instructor gives me enough details in the feedback that I can use it to learn and improve.
15. The instructor gives both positive and negative feedback to help me understand my strengths as well as weaknesses.
16. My grade so far in the class accurately reflects my ability and/or the effort I put into the class.

Table 4.5: Teaching Effectiveness Survey for ISE 195A and ISE 195B Courses

SJSU ISE Program Improvement Project: Check

Checking the Changes: Determining If The Desired Goals Were Met

Introduction to “Check” Step

This step involves using those measures planned for in the “Plan” step and established in the “Do” step to determine whether or not the intended goals were met. Figure 5.1 shows the flow of activities completed under the “Check” step.

Figure 5.1: Flow Chart of Activities for the “Check” Step

Collecting the Measures

Two approaches were used to measure student learning. These involved: 1) the normal activities associated with grading homework, project assignments, and exams, and 2) using a survey to assess students’ perceptions of the degree to which they had learned the topics the course was intended to convey. The results from the Course Topic Surveys for ISE 195A and ISE 195B are provided in Figures 5.2 and 5.3.

In addition, a teaching effectiveness survey previously developed by ISE faculty was tailored for each course and used to collect data at the end of the semester. The results from the Teaching Effectiveness Surveys for ISE 195A and ISE 195B are provided in Figures 5.4 and 5.5.

SJSU ISE Program Improvement Project: Check

Checking the Changes: Determining If The Desired Goals Were Met (Cont'd.)

My knowledge of:

1. The process (steps) involved in managing engineering projects
2. The human skills important to the success of multidisciplinary project teams
3. What a "learning organization" is
4. How organizations learn
5. What systems engineering is and why it's important to the success of engineering projects
6. Factors that influence the success of interpersonal communications
7. How to plan and track the progress of an engineering project

My ability to:

8. Use teamwork tools and methods to achieve project team success
9. Establish good measures for tracking engineering project performance
10. Identify and analyze an ethical dilemma
11. Analyze and address the causes of project problems
12. Successfully manage changes that occur during an engineering project
13. Establish an effective project work breakdown structure
14. Assess and address risks in a project plan

Figure 5.2: Results From Course Topics Survey for ISE 195A

SJSU ISE Program Improvement Project: Check

Checking the Changes: Determining If The Desired Goals Were Met (Cont'd.)

My knowledge of:

1. How the various ISE program course topics integrate to form a body of knowledge and skills valued by industry
2. How industrial and systems engineers contribute to the competitiveness of their organizations
3. What systems engineering is and how it is used in industry
4. The skills needed by engineering project managers in industry
5. Good measures of the effectiveness of an engineering project
6. An enterprise model of an organization
7. How to measure an organization's culture and human effectiveness skills
8. The teamwork skills necessary to be an effective member of a project team

My ability to:

9. Use the skills necessary to manage an engineering project
10. Use the skills of systems engineering in undertaking an engineering project
11. Create an enterprise model of a specific company
12. Assess how an organization is performing in the various segments of the enterprise model
13. Identify high-leverage improvement opportunities at the organizational level
14. Establish goals for and measure the level of success of engineering projects
15. Measure an organization's human effectiveness skills and culture
16. Analyze organizational goals and align them with performance measures to determine whether or not the goals are being met

Figure 5.2: Results From Course Topics Survey for ISE 195B

SJSU ISE Program Improvement Project: Check

Checking the Changes: Determining If The Desired Goals Were Met (Cont'd.)

1. I feel free to ask questions without fear of being embarrassed or being made to look bad by the instructor.
2. The instructor has a good knowledge of the course subject matter and is able to answer students' questions.
3. The instructor is enthusiastic about the course topic.
4. The instructor helps students see how the course topics apply to the work they will do in industry.
5. The purpose of and topics for each class meeting are made clear at the beginning of class.
6. The course sessions are interesting and motivate me to learn.
7. The instructor is flexible and is willing to adjust the class activities/schedule to enhance learning.
8. The instructor explains how the various course topics relate to each other to form a body of knowledge.
9. I am given chances to participate and talk in class, to be an active learner.
10. The course topics usually cover areas I haven't learned before.

Figure 5.3: Results From Teaching Effectiveness Survey for ISE 195A

SJSU ISE Program Improvement Project: Check

Checking the Changes: Determining If The Desired Goals Were Met (Cont'd.)

1. I feel free to ask questions without fear of being embarrassed or being made to look bad by the instructor.
2. The instructor has a good knowledge of the course subject matter and is able to answer students' questions.
3. The instructor is enthusiastic about the course topic.
4. The instructor helps students see how the course topics apply to the work they will do in industry.
5. My learning of course topics is supported by applying the topics in a variety of "hands on" ways using labs, course projects, breakout sessions, and case studies.
6. The purpose of and topics for each class meeting are made clear at the beginning of class.
7. The course sessions are interesting and motivate me to learn.
8. The instructor's expectations for homework and tests are clear and understandable.
9. The instructor is flexible and is willing to adjust the class activities/schedule to enhance learning.
10. The instructor explains how the various course topics relate to each other to form a body of knowledge.
11. The instructor is able to admit mistakes and learn.
12. I am given chances to participate and talk in class, to be an active learner.
13. The course topics usually cover areas I haven't learned before.
14. In grading my tests and assignments, the instructor gives me enough details in the feedback that I can use it to learn and improve.
15. The instructor gives both positive and negative feedback to help me understand my strengths as well as weaknesses.
16. My grade so far in the class accurately reflects my ability and/or the effort I put into the class.

Figure 5.4: Results From Teaching Effectiveness Survey for ISE 195B

SJSU ISE Program Improvement Project: Check

Checking the Changes: Determining If The Desired Goals Were Met (Cont'd.)

Analyzing the Data

Course Topic Surveys

It can be seen that, in general, students believed they significantly increased their knowledge of the course topics, and their ability to accomplish the various tasks intended to be taught by the course.

It is interesting to note that both the 195A and 195B students felt they had a medium level of knowledge in the areas of communication and human skills before the courses began, so the increase in knowledge in these areas is less than the average increase for all course topics. In the students' comments on these questions, it was found that some other courses taught in the engineering curriculum touched on these topics, so that seniors coming into the 195A and 195B courses had already gained some knowledge in these areas.

Teaching Effectiveness Surveys

The scores were high for teaching effectiveness in both courses. It is apparent that, in general, students felt the teaching style used by instructors was effective in helping them learn the course topics. In particular, questions with the following subjects scored high in both courses: lack of fear, instructor knowledge of the topic, instructor enthusiasm, and student participation.

There are also areas for potential improvement which can be determined from the survey results. For example, the question, "The course topics are interesting and motivate me to learn" scored low in the ISE 195A course. In talking to students, it became clear that they had difficulty understanding why they needed to learn about topics related to teamwork and human skills, as most of their training had historically been in technical areas.

SJSU ISE Program Improvement Project: Check

Checking the Changes: Determining If The Desired Goals Were Met (Cont'd.)

Another area for improvement is for the score for the ISE 195B question, "The instructor's expectations for homework and tests are clear and understandable." Again, discussions were held with students to understand the low score, which resulted from confusion about some of the project assignments in the ISE 195B course. This problem was caused by the lack of preparation time to establish a valuable project experience with an industry partner, which led to mid-semester changes in the course project.

Instructor Learning

At the end of each class session, a set of notes was made. These notes include items such as how the session went in general, how long the various segment took to deliver, student questions that arose during the session that should be made more clear in the future, and any other improvements that could improve course delivery. An excerpt from the notes for the ISE 195A course is provided in Appendix D.

SJSU ISE Program Improvement Project: Act

Acting Based on the Measures: Conclusion and Recommendations (Shifting Into Continuous Improvement)

Introduction to the "Act" Step

This step involves using the information collected in the "Check" step to determine future actions. In particular, this is where recommendations are made and plans are created for future improvements, and a "continuous improvement" philosophy is established that includes regular assessments of ISE Program effectiveness. As of the writing of this paper, only some of the necessary activities for this step were finished. Before the entire step can be completed, the ISE faculty must have a review to determine which, if any, improvement recommendations they wish to implement. Figure 6.1 shows the flow of activities completed under the "Act" step: activities not yet completed are shown in gray.

Figure 6.1: Flow Chart of Activities for the "Act" Step

SJSU ISE Program Improvement Project: Act

Acting Based on the Measures: Conclusion and Recommendations (Cont'd.)

Conclusion

There were many factors that resulted in the project being successful, both as a learning experience on methods for improving an undergraduate curriculum, and in achieving improved course designs that effectively met the needs of ISE Program customers. An important factor in the project's success was the use of a systematic design based upon the "Purpose-Plan-Do-Check-Act" cycle. The clear documentation of the project steps and related activities was helpful in gaining the support needed from ISE faculty, who have the overall responsibility for reviewing and approving the overall course design and course materials.

The project was timely, in that a decision had already been made to establish a common approach to all senior projects in the Computer, Information, and Systems Engineering Department, which includes the ISE Program. The needs assessment information from industry and ABET had broad applicability to all CISE seniors, and was particularly useful in identifying ISE 195A topics. The 195A course enhances the ISE Program by filling the gap in course topic areas such as people skills, project management skills, and how to develop plans for industry projects.

The ISE 195B course provided an excellent framework for helping students understand how ISE competencies are used to help improve industry performance, and ways in which to design and improve the integration of organizational systems.

SJSU ISE Program Improvement Project: Act

Acting Based on the Measures: Conclusion and Recommendations (Cont'd.)

Although there is room for continually improving the ISE 195A and 195B courses designed in this project, the courses were very successful in achieving their intended learning goals, so it is recommended that the ISE 195A/B format and content be used in future senior project offerings. It is also recommended that ISE 195B be offered each semester, based upon the Enterprise Competency Assessment Model developed and tested in this project.

The one major problem associated with the effectiveness of the ISE 195B course in this project was associated with the time it took to identify a host company and initiate data collection. This will not be a problem in the future, as the host company will be identified during ISE 195A, leaving the fall semester to undertake the ISE 195B assessment activities.

ISE 195A Recommendations

Recommendation 1: Class size

The current departmental plans call for merging the 195A courses from all three disciplines (Computer Engineering, Information/General Engineering, and Industrial and Systems Engineering). This would mean that future ISE 195A courses would have in excess of 100 participants. The topics covered in the course are learned most effectively as a result of experiential exercises, where students work in their project teams to try out new skills and see how they work (for example, exercises in teamwork or communications).

SJSU ISE Program Improvement Project: Act

Acting Based on the Measures: Conclusion and Recommendations (Cont'd.)

Due to the unusual format of the class, it is recommended that the class be conducted in separate sections of not more than fifty students, and that the instructor be supported by teaching assistants who help facilitate breakout sessions to enable experiential learning.

Recommendation 2: Class meeting time

The Friday afternoon time period used in the Spring semester of 1998 does not encourage full student participation and attention, particularly as this is a "seminar" course. It is recommended that the class be taught either in the morning on Fridays, or alternatively, in an evening session.

Recommendation 3: Additional course topic area

Many students were interested in entrepreneurship. It is recommended that a guest speaker be identified for this particular session. It is also recommended that, as this is near the end of their educational process, students be encouraged to identify additional topic areas of interest for possible inclusion in the course. This requires leaving one open session on the syllabus.

Recommendation 4: Project team formation

Some difficulty was experienced in the ability of students interested in similar topics to link in with each other early enough to establish a project team. This was made more difficult by the lateness of some faculty in defining their interest areas for possible student projects. It is recommended that a more specific process be developed for establishing project teams, and that this include faculty identification of interest areas before the semester begins.

SJSU ISE Program Improvement Project: Act

Acting Based on the Measures: Conclusion and Recommendations (Cont'd.)

ISE 195B Recommendations

Recommendation 1: Increase understanding of course project

It is recommended that, early in the course, a review be provided of a typical enterprise assessment project, enabling students to better understand the role of the various project groups, the activities involved, and the outputs to be developed.

Recommendation 2: Start on-site project activities early

It is recommended that on-site activities be initiated as early as possible in the semester, and that these activities involve building a shared vision of the project goals with host company representatives.

Recommendation 3: Project group size and roles

It is suggested that project groups have no more than five participants. It is also recommended that project roles be clearly defined, particularly for those acting as liaison between the Project Integration Team and other project teams.

Recommendation 4: Prerequisite courses

It is recommended that students enrolled in the ISE 195B project on Enterprise Assessment have completed ISE 131 course and the ISE 155 course, which cover process analysis/improvement and the Enterprise Competencies Model. This background information will enable the project activities to be initiated earlier in the course schedule.

SJSU ISE Program Improvement Project: Act

Acting Based on the Measures: Conclusion and Recommendations (Cont'd.)

Recommendation 5: Final presentations

It is recommended that a firm timing be established for presenting the project results to the host companies at the end of the course.

Recommendation 6: Alumni panel

It is recommended that, early in the course, a panel be established of students who have previously taken the ISE 195B project, and that this panel answer questions from students to clarify the project's purpose, approach, and value.

Recommendation 7: ISE Program competencies

It is recommended that one of the early course sessions be used to review the ISE Program learning structure developed by students in the ISE 195B course in the Spring of 1998. This process description can be a starting point for the student group responsible for updating ISE Program competencies and identifying how they can be used to address host company problems identified by the other project teams.

SJSU ISE Program Improvement Project: Works Cited

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SJSU ISE Program Improvement Project: Appendix A

Comments on the ISE Program From Graduating Seniors

What Students Liked About Current ISE Program/Courses

- Material learned is very valuable to preparation for real life situations
- First class where I understood the importance of clear objectives, purpose, teamwork skills
- I use the skills the class taught at work a lot
- Material was interesting and could be applied
- I particularly liked these classes because they were hands-on
- I liked the logistical challenges of the class
- Most of the instructors have real world experience and use examples
- Quality control and improvement are very important topics
- Every topic was covered thoroughly
- Companies showed interest when they saw this course on my resume
- Actual hands-on experience through course project
- Effective teaching skills
- Able to connect what is being taught to the real world
- Teacher offered information not found in books
- Culture and the “people factor” are very important to industrial engineers
- Professor made the class very interesting
- Management skills important for industry

SJSU ISE Program Improvement Project: Appendix A

Comments on the ISE Program From Graduating Seniors (Cont'd.)

What Students Didn't Like About Current ISE Program/Courses

- Lab and lecture portions of class not integrated - don't cover same topics
- Need to increase the exposure to high-tech industries in course projects
- Lecture not effective
- There was limited exposure in the program to culture and the human side
- Course needs to be more realistic and show how concepts are applied
- Need to focus more on systems engineering
- Some faculty members not focused on developing the courses they teach
- Find someone with passion for the course
- Things were covered too lightly
- Some professors should show more interest in the students
- More class participation and interaction between teachers and students should be considered
- Don't see how the project applies to industry
- Collect more individual assignments for fair grading
- Need more lab time and better explanations
- Need clearly defined project goals and objectives
- Theoretical concepts *only* won't work for students' careers
- Too much information to cover in one semester
- Not geared toward industrial engineers
- Need more systems analysis, less manufacturing emphasis
- Need more practice with the problems/homework

SJSU ISE Program Improvement Project: Appendix B
Syllabus From ISE 195A

**SAN JOSE STATE UNIVERSITY
COLLEGE OF ENGINEERING
DEPARTMENT OF COMPUTER, INFORMATION, and SYSTEMS ENGINEERING**

CompE / ISE / GenE 195A SENIOR PROJECT I

Coordinators: R. Benjamin Knapp, Robert McQueen

Spring 1998

Offices: Knapp 294
McQueen E283D

Office Hours: Knapp T, W, Th 4 PM - 6 PM
McQueen TBD

Email: Knapp rbknapp@email.sjsu.edu
McQueen rmqueen@email.sjsu.edu

Course Description: This course is the first course in a two-semester sequence in which each student will work in a group of 2-3 on a specific design project in Computer Engineering, Industrial and Systems Engineering, or Software and Information Engineering. The focus of this course will be on creating an initial design and a proposal for the project. This is a three-unit course. The web page for this course is www.engr.sjsu.edu/~knapp/195A.html.

Prerequisites: (1) Senior standing,
(2) 100W,
(3) CompE 46, EE 98, ISE 130 , and
(4) approved Major Form on file.

- CompE and SIE Majors must also have: CompE 125, CompE 127, and CompE 130
- ISE Majors must also have: ISE 105 and ISE 120

You must show proof of meeting these prerequisites or you will be either dropped from this course or given an "F" depending on when the CISE Department discovers the deficiency

Co-requisites: As listed in the following table corresponding to the specific project area or instructor consent.

Project Area	Co-requisites
Software Engineering	CompE 150
Digital Circuit Design / Computer Architecture	CompE 140
Multimedia	CompE 140, Math 129, EE110
Human Computer Interface	CompE 140
Database	CompE 138
Networking	CompE 148
Intelligent Manufacturing / Simulation	ISE 130, CompE 150

- Requirements:**
- 1) Attend weekly meetings on Fridays 1:30 - 3:30 in room E387.
 - 2) Bring a scantron form each week and turn it in at the end of the class
 - 3) Complete a project signup sheet by **March 6**.
 - 4) Meet with your advisor regularly as per his or her instructions.
 - 5) Complete a written proposal by **May 1**.
 - 6) Give an oral presentation of the proposal (presentations will begin on **May 1**)

Grading:

- 20% **Class Participation and Attendance.** You may miss one seminar without affecting your grade. For each additional absence, 5% of your grade will be deducted from this 20%. One missed presentation may be made up by attending an IEEE / ACM / IIE sponsored talk and submitting a one-page report to Dr. Knapp.
- 30% **Written proposal.** Your project advisor and one other CISE faculty member will judge your proposal.
- 20% **Oral presentation.** Your project advisor, one other CISE faculty member, and your fellow students will judge your presentation.
- 30% **Advisor evaluation.**

Class schedule:

Date	Presentation/meeting
1/23	1:30 - 2:00 Introduction and Review of Green Sheet 2:00 - 3:30 Overview of the Course and Engineering
1/30	1:30 - 3:30 CISE Faculty Advisor Presentations
2/6	1:30 - 3:30 CISE Faculty Advisor Presentations
2/13	1:30 - 2:30 Resumes and Interviewing 2:30 - 3:30 Life-Long Learning
2/20	1:30 - 3:00 Proposal Writing / Project Planning 3:00- 3:30 Project Team Breakout
2/27	1:30 - 3:00 Proposal Writing / Project Planning 3:00- 3:30 Project Team Breakout
3/6 Split Session	1:30 - 2:30 Project Research Skills - Team Signups Due 2:30- 3:30 Group Work
3/13 Split Session	1:30 - 2:30 Teamwork 2:30- 3:30 Communication
3/20 Split Session	1:30 - 2:30 Teamwork 2:30- 3:30 Communication
4/3 Split Session	1:30 - 2:30 Measuring Project Goals and Team Performance 2:30- 3:30 Group Work / Status Reports
4/10 Split Session	1:30 - 2:30 Measuring Project Goals and Team Performance 2:30- 3:30 Group Work / Status Reports
4/17 Split Session	1:30 - 2:30 Engineering Ethics 2:30- 3:30 Group Work / Status Reports
4/24 Split Session	1:30 - 2:30 TBD 2:30- 3:30 Group Work / Status Reports
5/1	1:30 - 3:30 Proposal Presentations - All Oral and Written Proposals Due
5/8	1:30 - 3:30 Proposal Presentations

SJSU ISE Program Improvement Project: Appendix C
Syllabus From ISE 195B

SAN JOSE STATE UNIVERSITY - SPRING 1998
ISE 190: INDUSTRIAL ENGINEERING DESIGN (SENIOR PROJECT)

Instructors: Bill Dunckel (408) 924-4144 **Office:** Engineering Bldg., Room 292
Laura Cohn (408) 924-4155 Engineering Bldg., Room 292

Office Hours: Monday, Wednesday 10:00 - 11:00, Room 292 or by appointment

Textbook: Currently, no text is assigned. However, instructors reserve the right to find and assign an appropriate text in the future.

Course Approach:

This course is intended to be the culmination of the Industrial and Systems Engineering education at SJSU. This will be accomplished by means of a course project, and a number of lectures/workshops which provide participants with knowledge and skills important to the success of the project.

Graded course assignments will be used to support the course objectives. The course project scope will enable students to apply and integrate many of the concepts and skills learned throughout the college experience. The course project will be explained in detail in a separate handout. Project teams will normally consist of three to five students. Project activities will provide participants with an opportunity to develop teamwork skills.

General Information:

Course assignments must be typed and submitted on schedule. The final exam will be closed book. Student participation is mandatory to achieving the course objectives. Participation includes both the quality and the quantity of participation in class and project activities.

<u>Grading:</u>	Course Assignments	300
	Course Project	500
	Participation	100
	Final Exam	<u>100</u>
	Total	1000

SAN JOSE STATE UNIVERSITY - SPRING 1998
ISE 190: INDUSTRIAL ENGINEERING DESIGN (SENIOR PROJECT)

<u>SESSION</u>	<u>DATE</u>	<u>TOPIC</u>
Week 1	1/21	Course approach, brainstorming organizational characteristics
Week 2	1/26	Review green sheet and grading/discuss course project The enterprise model of an organization
Week 3	2/2	Systems engineering skills and methods Project team structure
Week 4	2/9	The process of organizational assessment, clarifying team outputs Establish project teams, begin project work
Week 5	2/16	Teamwork skills, project management skills Brief overview of three main project team areas (BP, IP, HES)
	2/23	SPRING BREAK
Week 6	3/2	Performance measurement, process measurement review Family of measures approach, Key Objectives Planning
Week 7	3/9	Measuring culture, human effect. skills, improvement processes Aligning organizational goals with performance & process measures
Week 8	3/16	Identifying improvement opportunities
Week 9	3/23	Project work supported by instructors
Week 10	3/30	Project work supported by instructors
Week 11	4/6	Project work supported by instructors
Week 12	4/13	Project work supported by instructors
Week 13	4/20	Project work supported by instructors
Week 14	4/27	Project work supported by instructors
Week 15	5/4	Project work supported by instructors
Week 16	5/11	Project presentations (20 min. each * 5 groups, plus 20 min. each * 2 service groups)
	5/18	FINAL EXAM (5:15 - 7:30)

SJSU ISE Program Improvement Project: Appendix D

Notes From Course Sessions

Session 1 Notes: General

1. Class started with Ben introducing himself, taking roll, explaining what course we were about to teach, etc., and introducing Bob. Bob then introduced himself and Laura.

SEGMENT 1.1: 15 minutes, including late start due to looking for add roster

2. Laura then covered the course approach, discussing that we intended to conduct the class like a workshop, with much participation by students. She explained that this meant that we would be breaking the class in half for many of the semester's sessions, because it would be difficult to get good participation with 70 students. Laura also mentioned in this segment that the course would include learning in the areas of teamwork, project management, and communications.

Laura then conducted a brief discussion session, which had the purpose of getting shared vision around the green sheet topics. She started the discussion by asking the students why they were here (to graduate), why they wanted to graduate (to get a job), what they needed to get hired (qualifications), and finally what qualifications industry required. Students participated fairly well in this segment, as they began to see that we did, in fact, want them to participate, and that they wouldn't get in trouble for speaking out in class.

This last portion of the segment was intended to help students see that industry wants engineers that can work in teams and communicate well, and that these skills aren't traditionally taught in universities. This led into an explanation of why we were covering these items in the course, to help get a shared vision with the students of the subjects listed on the green sheet.

SEGMENT 1.2: 10 minutes

SJSU ISE Program Improvement Project: Appendix D

Notes From Course Sessions (Cont'd.)

Session 1 Notes: General (Cont'd.)

3. Laura then started the session on "What is needed to be successful in your senior project?" She began by explaining what brainstorming was, and telling students that it was one of the teamwork tools they would be learning this semester. She then gave the students the brainstorming request, asking them what they needed in order to have successful senior projects. She asked them think about their answers for a few minutes, and make a list of 5 or so items they needed to be successful. One improvement to this segment would be to word the brainstorming question better, i.e., "What do you need internally (skills, competencies) in order to be successful ..."

Laura then started the brainstorming session, and collected quite a few items students needed to be successful. The participation really began to pick up at this point, and students were enthusiastic and laughing at the truth of some of the items (e.g., "good advisors").

SEGMENT 1.3: 30 MINUTES

4. Next, Laura presented the last page of the brainstorming request presentation, which explained the three categories of goals we believed the course needed to meet to be successful for the students. She asked the students to help categorize their brainstorming output into one (or more) of the three areas, and we did this by a show of hands. It was a bit difficult aligning some of the items, and in the end, some items were aligned with more than one of the three goal areas. Ron Murata collected all of the aligned output and typed it up over the next few segments, and a final list was handed out to the class at the end.

SEGMENT 1.4: 25 MINUTES

5. Bob then conducted a shared vision segment, which included an excerpt from the "Power of Vision" video by Joel Barker, and some discussion at the end on the importance of a shared vision, whether in industry or in a senior project.

SEGMENT 1.5: 20 MINUTES

SJSU ISE Program Improvement Project: Appendix D

Notes From Course Sessions (Cont'd.)

Session 1 Notes: General (Cont'd.)

6. Ben presented the green sheet, going over the various items in detail and explaining them to the students (for example, how we would collect attendance by use of Scantron forms). Prerequisites were discussed, and there was apparently a problem with the ISE 130 prerequisite, so Ben waived that for this semester only, with a promise to update all forms to show it as a prerequisite in the future.

SEGMENT 1.6: 50 MINUTES

7. Laura closed by discussing several brief items with the students. She first reiterated that we intended to run the class like a workshop, and therefore had prepared handouts of their brainstorming and alignment results from segment 1.4, which she handed out.

She then discussed that, since there was no text for the class in the bookstore, we would be purchasing the "Team Memory Jogger" and would have students buy it from us. She explained briefly what the book's content was.

Laura then talked about how we viewed ourselves as in a partnership with the students, one which had the goal of having successful senior projects and increasing learning in the areas of teamwork and communications. Laura said that this partnership was an adult-adult relationship, and that we needed them to give to the partnership too, by coming to class and participating fully.

Laura told the students that they had, with this course, an opportunity to create a starfish, to do something really meaningful and important, something that would help them learn the team skills and project management skills important to their career. She suggested that they take advantage of this opportunity, and do what was necessary to really focus on this and the 195B courses as the culmination of their college experience. Laura closed by mentioning that we had a form for those that needed to add the class, so students should see us after class to add.

SJSU ISE Program Improvement Project: Appendix D

Notes From Course Sessions (Cont'd.)

Session 1 Notes: Personal (From Laura)

1. I was concerned about how the class would go, particularly with so many students, but it seemed to be fine.
2. I was unsure how our participative learning methods would work with Computer Engineers, who weren't used to this teaching style. The students seemed to really enjoy it, and we received several comments at the end of the class like, "You guys did a really good job - thanks!" or "I attended this same class in a previous year, but I withdrew after the first two sessions, because I didn't feel like I could ask questions or talk in class. I like the environment you are creating here."
3. I felt very energized after the class, partly because the students *had* become involved and seemed happy to be there. It was definitely not the kind of classroom setting they were used to.

SJSU ISE Program Improvement Project: Appendix D

Notes From Course Sessions (Cont'd.)

Session 6 Notes

1. Ben started class by asking if there were any questions or issues he needed to answer. The students asked several questions about due dates for major forms, etc. Ben answered them (some of them two or three times, as some of the students weren't listening). Ben asked how many students had signed off project sheets, and about 75% of them did. Started the actual class session by covering the agenda for this session, mentioning that Professor Hambaba was supposed to be there to discuss his project, but it looked like he wasn't going to make it. (Recommendation for future semesters: let the professors know a few weeks ahead about their presentations to the class. If they can't make it or don't show up, then they don't get another opportunity.) Also in this segment, handed out the generic "Senior project systems diagram" created in session 4, told students this would be input to their project reports.

SEGMENT 6.1: 18 minutes

2. In this segment, discussed why learning was necessary for the rest of our lives, and that it was one of the requirements industry was looking for in recent graduates (gave some quotes from CEO's). Covered the difference between individual and organizational learning, and how people and organizations learn.

Identified some of the barriers to organizational learning, and discussed how important it was in selecting a company to work for upon graduation, that students find an organization that encourages learning. Told students that this would help them build their career paths and would increase the likelihood that the organization would remain competitive into the future given the changing business environment. Kept the discussion fairly interactive, but had no breakout sessions or brainstorming.

SEGMENT 6.2: 27 minutes

SJSU ISE Program Improvement Project: Appendix D

Notes From Course Sessions (Cont'd.)

Session 6 Notes (Cont'd.)

3. This session connected to the last, beginning with a discussion of how organizations should respond to the change business environment. Discussed that the only way to stay competitive was to be a learning organization, and that a learning organization required a learning environment, where people felt safe and encouraged to try new things.

Covered the concept of culture, and how a learning culture was needed to create a learning environment. Showed results from brainstorming sessions with industry on what a learning environment was and separately, on what a high performance organization would look like, indicating that they were one and the same. Discussed what a culture supportive of learning would look like, and how culture can be changed. Finished the segment by connecting this and the previous presentation to the students' senior projects and their futures after graduation.

SEGMENT 6.3: 17 minutes

TOOK A SHORT BREAK (8 minutes)

4. Began this segment by discussing that we were now moving into team and project area selection. Gave a short presentation on "What is needed for project team success?" This covered a list of items that were necessary for successful teamwork, and told the students which of them would be sorted out during team selection (e.g., common technical interests) as opposed to later in this course (e.g., teamwork skills).

Discussed the process for team selection, indicating the different paths for those who had received signoff on a project from a professor and those who hadn't.

Had the students complete a style diagnosis, indicating which of four personal styles they had. The students really enjoyed this exercise, asking questions about what the styles meant and talking to each other about how they were. This information was filled in by students on personal team member sheets.

SJSU ISE Program Improvement Project: Appendix D

Notes From Course Sessions (Cont'd.)

Session 6 Notes (Cont'd.)

Handed out a list of all currently offered projects for the students to select from. The document listed projects by professor, and was lettered from "A" to "CC." Told the students who had a project area signed off by an instructor to put the letter for that project under "interest areas" on the team member sheets. For those students without a signoff, told them to select two areas of interest and fill out two team member sheets.

SEGMENT 6.4: 25 minutes

5. In this segment, had students with approved (signed off) projects go to the room next door, where flipchart pages were hung on the wall with the various projects listed. Asked the students to put their team member sheets on the page under their approved project letters, and to show Dr. McQueen their signoff sheets. The rest of the students stayed in the classroom - many of them used this time to purchase the course text and turn in their attendance forms.

When the first group was done next door, the remaining students went next door and put up their two sheets next to their interest areas. We then used a process to get students closer to selecting their final project area, by having them stand by their first choice and talk to others interested in that area, and then shift to their second choice and talk to those interested in that area, and then shift as needed to make a final decision. By the end of the session, most of the students had made a final selection of project area and teammates.

SEGMENT 6.5: 30 minutes

6. We had planned to have the students work in their teams on the assignment from session 4, but there was no time left, so we postponed it to the next session.

SEGMENT 6.6: 0 minutes

SJSU ISE Program Improvement Project: Appendix D

Notes From Course Sessions (Cont'd.)

Session 8 Notes

1. Ben began the session by answering questions about the projects. He mentioned that students should discuss exactly what's needed in their proposals with their project advisors. Ben told students that the course materials were now up on the web page, and reminded students that next week's session would be held in the library.

Laura handed out some job search materials and went over the agenda. Spent some time discussing with students the problem of their talking in class. She explained that she was treating them with respect, and that she expected the same in return. She told them that there were specific times allocated for students to talk to each other in every session of class, but they should be talking while she was explaining something to them. She told them it was fine to ask questions of her anytime, but that talking to each other was disruptive for the class and wouldn't be allowed. Laura mentioned that if there were any further problems with this, she would ask the disruptive students to leave, and they wouldn't get credit for attending that session.

SEGMENT 8.1: 20 minutes

2. Began teamwork session. Asked students to move to sit with their teams, as we would be working in teams the rest of the day. Presented the breakout group request, which indicates that the instructor will not be available for questions. This breakout request was made intentionally vague so as to cause some tension in groups to see how they dealt with the tension. At the end of the exercise, asked students to hand in their suggestions to be typed up. (Note: need to add to the request that students should write their answers on a sheet of paper.)

SEGMENT 8.2a: 20 minutes

SJSU ISE Program Improvement Project: Appendix D

Notes From Course Sessions (Cont'd.)

Session 8 Notes (Cont'd.)

Asked the students what the purpose of the exercise had been. Most of them answered that we wanted to see how they would improve the CISE department. Asked the students to look at the title of today's session, and see if they had another answer for the purpose of the exercise. Asked them why I purposely stayed uninvolved and unavailable. They mentioned that it was to see how they worked in teams, which was correct. Then handed out "Questions about the exercise" and asked each student to fill it in. When they were done, the handouts were collected. (Note: next time, add a question to the "Questions about the exercise" handout - "Did your team spend time talking about the team's process [e.g., roles, problems] or did you spend all your time answering the request?")

SEGMENT 8.2b: 10 minutes

Presented "Teamwork Tools" presentation. Covered the dynamic team tools (Hill of Influence and the Team Meeting Performance Survey). Had students fill them out, asked them to fill them out for the meeting they just had completed above.

SEGMENT 8.2c: 30 minutes

Asked students to get out the Style Diagnosis they had done in session 6. Covered the presentation on team roles, explaining how team roles aligned nicely with the four styles on the diagnosis. Asked students to use this input when selecting their team roles, discussing that there might not be perfect alignment, as on teams with one or two people, or on teams where everyone is a driver. Handed out the team sign-up sheet, which includes name, team roles, and contact information. Told students to take a 5 minute break after this, as we were going to watch a video next.

SEGMENT 8.2d: 15 minutes

SJSU ISE Program Improvement Project: Appendix D

Notes From Course Sessions (Cont'd.)

Session 8 Notes (Cont'd.)

Showed the Lou Holz video on "Teamwork, Pride and Professionalism." The students seemed to like it, and laughed at various times when something funny was said. They seemed fairly attentive. Handed out the questions on the video for them to think about - didn't have time to do a breakout on this during class.

SEGMENT 8.2e: 25 minutes

Note for future improvement: add a segment that discusses the difference between a group (a collection of people) and a team (a collection of people working together toward a common purpose).

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