Cleveland State University

Department of Chemical and Biomedical Engineering

Fenn College of Engineering

Annual Report

Program Assessment

Bachelor of Chemical Engineering

Academic Year 2004-2005

Prepared by: Orhan Talu/Jorge E. Gatica
Department of Chemical **and** Biomedical Engineering, *May* 2005

A. Background Information

1. Degree Titles

The program assessment below pertains to the Bachelor of Chemical Engineering **(B.S.** ChE). Some of the students majoring in Chemical Engineering also follow the Biotechnology Certificate Program. In addition, students in the program complete the requirements for minors in Chemistry and Physics.

2. Program Modes

The B.S. ChE program is offered in two modes:
- Standard 4-year program option
- Co-op 5-year option

3. Contact Information

Orhan Talu
Professor and Chairman
Department of Chemical and Biomedical Engineering
Cleveland State University
Phone: (216) 687-3539
Office: (216) 687-2571
Fax: (2**16)** 687-9220
Email: o.talu@csuohio.edu

B. Assessment Summary

1. Students

The Fenn College of Engineering has a well-known reputation for providing hands-on education to its students towards preparing them for productive employment as practicing engineers. The Bachelor of Chemical Engineering program is designed with the primary purpose of graduating engineers for immediate employment in industry, in other words, ready to "hit the road running" upon graduation.

Our student body fits the profile of an urban university. Most of the students are commuter students with families and other obligations. The average age of our student body is higher than residential colleges. Most of our students acquire some professional work experience during their studies being either formally involved in co-op, or work while going to school. These additional responsibilities result in a more "mature" student body. They value highly the education they are receiving. Yet, their additional responsibilities also limit the time they can devote to their studies. Faculty are well aware of these limitations and try to help the students as much as possible without sacrificing the quality of education delivered.

Although CSU is an "open" enrollment University, engineering students must apply and be accepted to the engineering college. The evaluation of student applications to the College of Engineering is performed by the Dean's office. Students can be admitted to the College of Engineering in two possible categories: Engineering and Pre-Engineering students. Upon admittance to the College of Engineering, students are advised by the Director of Undergraduate Programs (Ms. Pamela Charity) for General Education requirements, as well as English and Mathematics placement results. Incoming students are provided with "Curriculum Sheets" for all engineering programs. The Director of Undergraduate Programs consults with the Department Undergraduate Advisor for specific program requirements as necessary. The students are required to identify their intended engineering major as early as possible. After they declare their major, the student's file and preliminary advising records are forwarded to the corresponding department.

Students majoring in Chemical Engineering are assigned to the Department Undergraduate Advisor (currently Dr. Jorge E. Gatica) who interviews the incoming students and reviews with him/her the program requirements. Students continue to be advised by the Undergraduate Advisor, on a semester-basis, throughout their tenure at CSU. The advising week (towards the end of each semester) is widely announced throughout the college. The students can register for classes only after they consult with the Undergraduate Advisor and after obtaining his/her signature.

Cleveland State University has transfer credit agreements with regional Community Colleges and most higher education State institutions. Transfer students, a significant portion of Engineering majors at CSU, have four levels of transcript assessment for transfer credit evaluation:

1. University level
2. College level
3. Department level
4. Supporting department level

Following is a description for each level.

1. University level: Transfer credits are identified and classified by areas.
2. College level: Transfer credits in General Education, Mathematics, Physics and General Chemistry are matched with equivalent courses following the State Transfer Module format.
3. Department level: Transfer courses that might fulfill (partial or total) requirements for the Chemical Engineering major are evaluated by the department. Students requesting transfer credit provide catalog descriptions, syllabi, and exams and project materials for the course they took at other institution. The Undergraduate Academic Advisor compares credits and contents with our courses. The material is then forwarded to the appropriate college committee (for Engineering Science Courses), or to the individual faculty responsible for our courses (for Chemical Engineering core courses).
4. Supporting Department level: Courses that might meet Advanced Science or Chemistry requirements for Chemical Engineering majors follow identical process as outlined at Department level; except that the material is forwarded for final assessment to the appropriate department (Chemistry, Physics, Biology, etc.)

Specific courses that have been given credit either in **(3)** or **(4)** are kept on file to serve as standards in future evaluations.

2. Program Educational Objectives

The following description of Chemical Engineering and our specific program educational objectives is quoted from our departmental publications such as brochures, flyers, CSU undergraduate catalog (http://www.csuohio.edu/undergradcatalog/eng/programs/che.htm), web pages, etc.

"The chemical engineering curriculum prepares the student for a successful career in a dynamic and progressive profession. **A** chemical engineer may pursue a wide scope of projects. Chemical engineers are responsible for the design and operation of processes that accomplish chemical changes. Examples of such processes are the production of antibiotics, detergents, drugs, paints, plastics, petrochemicals, advanced materials, and synthetics. **A** chemical engineer may also work on the research and development preceding or accompanying a given process design, or the management of a plant or an entire enterprise. The CSU chemical engineering curriculum provides a strong foundation to work in energy conservation and utilization, environmental pollution control, as well as the petrochemical industry and many other chemical-related industries. Consistent with mission of the university, college and department, this program has been designed to provide an attractive avenue for students interested in Chemical Engineering, aiming to:"

(Program Educational Objectives)

- Prepare students for careers in the chemical and related ~~industry~~ industries within the Northeast Ohio region and beyond
- Prepare students for practical engineering applications, as well as providing the depth of knowledge required for graduate studies
- Motivate graduates' participation in life-long learning and professional development activities.

Program objectives are mapped into the curriculum following a strict sequence of pre-requisites. Each course has specific course evaluations element to ensure that students are prepared in a manner commensurate with the program objectives (cf. assessment process detailed below). Significant constituencies of Bs. ChE program are; 1) students, 2) employers/companies, 3) alumni, and **4)** faculty.

Students:
Student input to program objectives is primarily sought at senior level through two main mechanisms; 1) senior assessment, and 2) senior exit interview. Senior assessment is explained in section **3.**

The senior exit interview is conducted by the Chairperson every year. This is a group meeting where the Chair solicits free input from the students. The Chair identifies a set of issues before the meeting and leads discussions in that direction. The department secretary takes notes. The

interview results are transcribed later as a summary and distributed. The exit interview transcriptions for the last three years are included in Appendix I.D.

Employers/Companies:
The main mode of soliciting input from external constituencies is through the departmental Visiting Committee. The Visiting Committee is comprised of practicing engineers. We intentionally set up the visiting committee to cover fairly new engineers (about 5 years of school) to higher-ranking individuals with 20-plus years of experience. Some of the members are our own alumni.

The visiting committee members receive 'announcements, news, etc. during the year. The main half-day meeting occurs once a year. There is an agenda set before the meetings and supplementary materials are sent to the members beforehand. The meeting minutes are transcribed and distributed to the committee members, faculty and others (e.g. the Dean) after the meeting. The Visiting Committee charge, current members and minutes from recent meetings are included in Appendix I.E.

Alumni:
Alumni surveys are conducted by the College of Engineering. The results for two major surveys are given in Appendix I.F.

Faculty:
The Program Educational Objectives were initially outlined by departmental faculty after a year of deliberations in 2000. The major ongoing role of the faculty is to analyze and evaluate the input from students (seniors), the Visiting Committee, and alumni survey, and combine these inputs with their own assessment of the program. These are discussed yearly at a faculty retreat. Although many modifications are made to our program as a result of faculty deliberations, we have not seen any reason to change or modify the Program Educational Objectives yet.

3. Program Outcomes and Assessment

Description of Program Outcomes

The Bachelor of Chemical Engineering graduates have the attributes collectively referred to, as the Attributes **of** an Engineer. Consequently, Program Outcomes aims to educating students who has knowledge/understanding of:

(a) Application of Mathematics, Science and Engineering Principles.
(b) Experimental Design and Experimental Data Collection and Analysis
(c) Engineering Design (Chemical Systems, Units & Processes)
(d) Multidisciplinary Team Work
(e) Identification, Formulation and Solution of Engineering Problems
(f) Professional and Ethical Responsibilities, including Safety and Environmental aspects related to Chemical Systems, Units and Processes.
(g) Effective Communication Skills
(h) Contemporary Issue & Global/Social Impact of Engineering Solutions.
(i) Need and Ability to engage in Lifelong Learning

(j) Techniques, skills and tools common in modern Engineering practice
(k) Principles and Working Knowledge of subject areas as defined by the Program Criteria of the American Institute of Chemical Engineers (AIChE).

According to AIChE, following program criteria apply to engineering programs including "chemical" and similar modifiers in their titles:

"The program must demonstrate that graduates have: thorough grounding in chemistry and a working knowledge of advanced chemistry such as organic, inorganic, physical, analytical, materials chemistry, or biochemistry, selected as appropriate to the goals of the program; working knowledge, including safety and environmental aspects, of material and energy balances applied to chemical processes; thermodynamics of physical and chemical equilibria; heat, mass, and momentum transfer; chemical reaction engineering; continuous and stage-wise separation operations; process dynamics and control; process design; and appropriate modem experimental and computing techniques."

The following table shows the relevance of Attributes of an Engineer to the specific Program Educational Objectives.

	a	b	c	d	e	f	g	h	i	j	k
Provides a sound education in Chemical Engineering fundamentals and related topics.	■	■	■	■	■	■	■	■	■	■	■
Trains students to design, analyze, and operate manufacturing processes involving physical and chemical changes.	■	■	■		■					■	■
Trains students to design and operate chemical processes satisfying social, environmental, and economical constraints.				■	■	■	■	■			■
Prepares students for careers in the Chemical and related industries within the Northeast Ohio region and beyond.	■	■	■	■	■	■	■	■	■	■	■
Prepares students for practical engineering applications, as well as provides the depth of knowledge required for graduate studies.	■	■	■		■		■	■	■	■	■
Motivates graduates' participation in life-long learning and professional development activities.						■	■	■	■	■	

4. Description of Assessment Tools

A number of assessment instruments are used for Program Outcomes, which are collections of responses from. faculty, students and external constituencies. A dedicated web site (http://www.csuohio.edu/chemical engineering/EC2000/) is used to collect most of initial data.

Curriculum Assessment (a.k.a. *"Course Reflections")*
This activity is performed at the end of each semester. The results are compiled via the department website. The form used for each course is provided in Appendix I.H. Instructors assess the performance of students in eleven (11) specific fields (directly correlated with the Program Outcomes). Forms also contain space for comments and recommendations. A table indicating level of significance on each Program Outcome for each course in the curriculum is also included in Appendix I.H. This relevance table is reviewed for appropriateness at each Annual Department Retreat. The results for each course are used to compile a weighted average for each Program Outcome.

Senior Design Instructor Assessment
Senior Design Instructor performs this activity at the end of each semester only. The format is similar to the Course Assessment form.

Laboratory Instructors Assessment
This activity is performed at the end of each semester. The instructors of courses with a laboratory component complete this form only. The format is similar to the Course Assessment form. Special attention is given to outcomes related to teamwork, experimental design and ability to work in laboratory environments.

Senior Assessment
All the students of each graduating class fill this questionnaire at the end **of** the academic year. The format is similar to the Course Assessment form and it is included in Appendix I.H.

Senior Exit Interview
As explained above, this is a meeting with the senior students by the Chairperson and the Secretary. It is meant to be an open forum where students can voice their concerns and provide feedback on the program. Special attention is given to the students' perception of the Chemical Engineering core courses. Students are also requested to identify the weakest and strongest elements of the curriculum. Comments are recorded (anonymously) by the Department Secretary, transcribed and distributed. Copies for the last three years are provided in Appendix I.D.

Professional Student (AIChE) Chapter Activities
Activities carried out by the American Institute of Chemical Engineers Student Chapter are compiled and classified into two major categories: (i) Student participation (membership, membership by levels, etc.) and (ii) Participation in activities sponsored. by the Regional and National Professional Societies (Seminars, Competitions, Workshops, etc.).

Alumni Survey
This survey is conducted every five years. Alumni are asked a series of questions aligned with the Program Outcomes and Program Objectives. Results for 1998 and **2003** surveys are included in Appendix I.F.

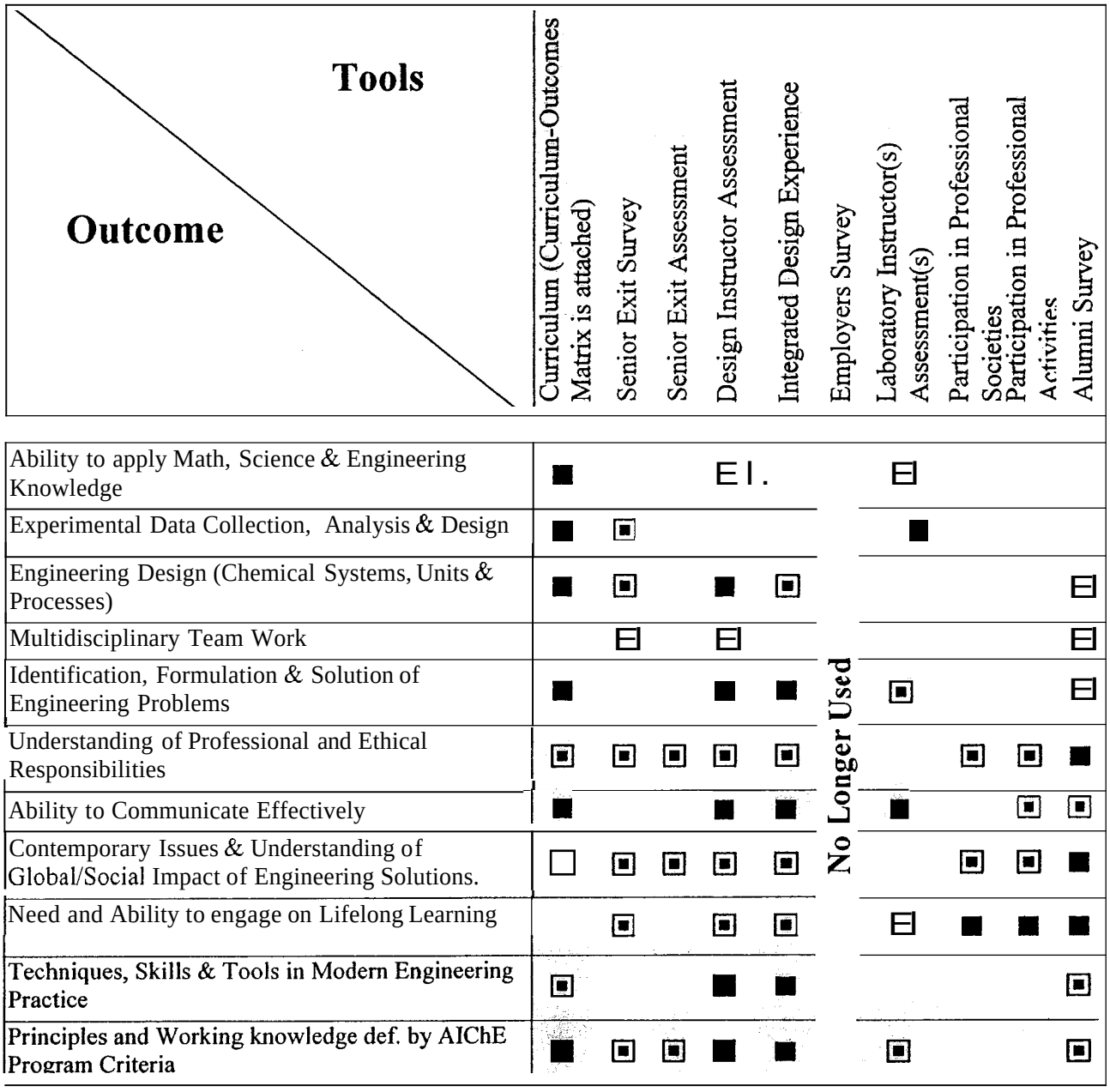
Employers Survey/Visiting Committee
Originally intended to be conducted every five years, this survey requested the employers' opinion and assessment of graduates from the program. The questionnaire had questions aimed to assess the graduates' skills in areas directly related to the Program Outcomes. This survey was abandoned in 2002 due to lack of response. Instead, the feedback gathered at Annual Visiting Committee meetings is being used. The meeting minutes are included in Appendix I.E.

5. Description of Assessment Methodology

The results of each assessment tool are selectively used for weight average and final tally against Program Educational Objectives and Outcomes. The weights for Program Educational Objectives is shown in the below table.

Objectives \ Tools	Curriculum (Curriculum-Outcomes Matrix is presented separately, attached)	Senior Exit Survey	Senior Exit Assessment	Design Instructor Assessment	Fundamentals of Engineering	Annual Advisory Committee Visit	Laboratory Instructor(s) Assessment(s)	Participation in Professional Soc.	Participation in Professional Act.	Visiting/Advisory Committee	Alumni Survey
1. Provides a sound education in Chemical Engineering fundamentals and related topics.	■			■	▣		■				■
2. Trains students to design, analyze, and operate manufacturing processes involving physical and chemical changes.	■			■			■				■
3. Trains students to design and operate chemical processes satisfying social, environmental, and economical constraints.	■			▣		▣				▣	▣
4. Prepares students for careers in the Chemical and related Industry within the Northeast Ohio region and beyond.	■					■				■	■
5. Prepares students for practical engineering applications, as well as providing the depth of knowledge required for graduate studies.	■										▣
6. Motivates graduates' participation in life-long learning and professional development activities.								▣	▣		▣

Following table shows the weights used to map Assessment Tools to Program Objectives.



All results are compiled and analyzed by the Engineering Criteria Department Coordinator. The results are normalized between 0 to **3.** Results are compiled separately for each Assessment Method and affected by a weight factor (according to the above correspondence table). Results below 1.5 are highlighted as areas requiring action; results below 2.0 are identified as areas requiring attention, while results above 2.0 are considered satisfactory.

The compiled results are presented to the department faculty at the Department Annual Retreat (in November). The areas identified as critical are analyzed again and any discrepancies

(stemming from results from different methods) are resolved. The Department Retreat is where possible actions are recommended and approved, with specific decision about timelines and responsibilities for implementation.

A summary of the Department Retreat is compiled by the Engineering Criteria Department Coordinator and circulated among faculty for accuracy. Curriculum changes are then officially brought before the Department, College and University committees for approval and implementation.

6. History of Significant Changes Implemented

Implementation of EC2000 started during AY 2000/01. During that year, 1) the Program Educational Objectives, 2) Outcomes, 3) Assessment Tools, and 4) logistics/methodology were developed by the faculty. Although some of the mechanisms were already in place (e.g. senior exit interview, course evaluations, departmental retreats, etc.), full data collection and implementation started in AY 2001/02 and has been ongoing since. ***So*** far, one complete cycle of changes has been implemented and already some improvement is observed in assessment results.

The 2001/02 Annual Report, as the first full report, identified several shortcomings of our assessment strategy, which are now corrected. There were three significant changes implemented:

1. The correlation classification "Remote" was removed from the weight matrix mapping Tools to Objectives.
2. **A** new assessment tool, IDE Evaluations, was added (see below for the description of IDE). The input is collected from all faculty after final senior design presentations. **All** faculty is required to attend these presentations.
3. Employer Survey was eliminated as an assessment tool due to lack of statistically meaningful response and by the recommendation of the Visiting Committee. They agreed that Employer Survey's would not provide any meaningful data because of confidentiality and liability issues. Instead we decided to use the discussions/minutes of Visiting Committee meetings to collect this feedback.

In addition, 2001/02 Annual Report identified two main program shortcomings, which can be summarized as:

1. Student's lack of basic engineering laboratory skills before they are exposed to the first major ChE lab in the Reaction Engineering course, and
2. Student's lack of integration of different subject matters in senior design and laboratory courses.

Two major changes were implemented in our curriculum in response to these findings.

1. **A** new laboratory course was added in the fall semester of Junior year, "CHE 308 – Junior Chemical Engineering Laboratory." This course concentrates on basic statistics, experimental design, report writing/presentation skills, lab safety procedures, and simple lab techniques such as calibrations. With this new course, the students have engineering laboratory courses throughout junior and senior years.

This lab course was first taught in Fall 2003 after approval by appropriate committees. There is not enough assessment data to measure its impact yet. We expect to observe a significant improvement in *outcome b: Ability to design experiments, collect and analyze experimental datu* similar to the improvement described below for IDE.

2. Integrated Design Experience (IDE) was implemented to help students integrate the information included in different courses. The IDE outline is given in Appendix I.G. It basically involves all ChE core courses. The students are given a design problem in CHE **300 –** Chemical Engineering Principles in the sophomore year. They perform relevant parts of the design problem at that course and all subsequent core courses (i.e. Thermodynamics, Transport Phenomena, Separations, Reaction Engineering, Process Control and Design I). The reports produced at each course are filed in the department. The final design is performed in the fall of the senior year in Design I course. The students can revisit/change/modify their previous work as necessary throughout this experience. The purpose is to help students understand that real problems are not bounded by specific course contents. Working on a single problem at different levels **and** from the perspective of different courses helps them understand the inter-relations that exist in real problems.

   The IDE was immediately implemented in Fall **2002** in all core courses simultaneously. (It did not need any approvals outside of the department). Although there is limited assessment data **(2002-03** and **2003-04** Annual Reports **and** Department Retreat Analysis) to measure its impact, students seem to graduate with a better overall background. Senior presentations show that students have a clear awareness of the interrelation among the principles learnt throughout the curriculum, which suggests a significant improvement. Most notably, the *outcome c: Ability to design chemical units, systems andprocesses* assessment improved from 1.75 to **2.41** average (out of **3)** in the two assessment tools with direct relation to the outcome. Some improvement is also observed in other outcomes somewhat related to integration of knowledge (e.g. outcomes (a) and (e))

At present, all our assessment tools are in place and working. The faculty is committed to the assessment process and understands its importance in bettering our programs in the future.

Program:	Bachelor of Chemical Engineering (B. Ch. E.)	**Completed By:**	Orhan Talu/Jorge E. Gatica
Department:	Chemical and Biomedical Engineering	**Date:**	05/10/05

Goal 1 (a): Students have an understanding of the application of Mathematics, Science and Engineering Principles.

Outcomes	Research Methods	Findings	Review	Actions
	Curriculum Assessment	2.33	(*)	
	Senior Design Instructor Assessment	1&7	(**)	
	Laboratory Instructors Assessment	1.87	Ibbid.	
	Senior Assessment	2.6≤	(*	
	Senior Exit Interview	N/A	N/A	
	Professional Student Chapter Activities	N/A	N/A	
	Alumni Survey	><5	(*	
				None (*) required, this goal seems to satisfactorily met.
				(**) Warning signs in some assessment metrics

Program:	Bachelor of Chemical Engineering (B. Ch. E.)	**Completed By:**	Orhan Talu/Jorge E. Gatica
Department:	Chemical and Biomedical Engineering	**Date:**	05/31/05

Goal 2 (b): Students have an understanding of the application of techniques of Experimental Design and Experimental Data Collection and Analysis

Outcomes	Research Methods	Findings	Review	Actions
	Curriculum Assessment	1.75	(**)	
	Senior Design Instructor Assessment	1.50	(**)	
	Laboratory Instructors Assessment	1.50	Ibbid.	
	Senior Assessment	2.74	(	
	Senior Exit Interview	N/A	N/A	
	Professional Student Chapter Activities	N/A	N/A	
	Alumni Survey	2.28	(	
				None (*) required, this goal seems to satisfactorily met
				(**) Warning signs in some assessment metrics

Program: Bachelor of Chemical Engineering (B. Ch. E.) **Completed By:** Orhan Talu/Jorge E. Gatica

Department: Chemical and Biomedical Engineering **Date:** 05/31/05

Goal 3 (c): Students have an understanding of Engineering Design principles (applied to Chemical Systems, Units, and Processes)

Outcomes	Research Methods	Findings	Review	Actions
	Curriculum Assessment	1.75	(**)	
	Senior Design Instructor Assessment	1.98	(*)	
	Laboratory Instructors Assessment	1.98	(*)	
	Senior Assessment	2.49	(*)	
	Senior Exit Interview	N/A	N/A	
	Professional Student Chapter Activities	N/A	N/A	
	Alumni Survey	2.06	(*)	
				None (*) required, this goal seems to satisfactorily met.
				(**) Warning signs in some assessment metrics

Program: Bachelor of Chemical Engineering (B. Ch. E.) **Completed By:** Orhan Talu/Jorge E. Gatica

Department: Chemical and Biomedical Engineering **Date:**

Goal 4 (d): Students have an understanding of principles and importance of multidisciplinary team work

Outcomes	Research Methods	Findings	Review	Actions
	Curriculum Assessment	2.33	(**)	
	Senior Design Instructor Assessment	A	(* *)	
	Laboratory Instructors Assessment	N/A	(* *)	
	Senior Assessment	2.66	(*)	
	Senior Exit Interview	N/A	N/A	
	Professional Student Chapter Activities	N/A	N/A	
	Alumni Survey	2.25	(*)	
				(*) Only measurement available, seems to indicate no concerns.
				(**) Degree of correlation between assessment. & goal is remote,
				(***) Not enough information to draw significant conclusions.

Program:	Bachelor of Chemical Engineering (B. Ch. E.)	**Completed By:**	Orhan Talu/Jorge E. Gatica
Department:	Chemical and Biomedical Engineering	**Date:**	05/31/05

Goal 5 (e): Students can identify, formulate and solve Engineering Problems

Outcomes	Research Methods	Findings	Review	Actions
	Curriculum Assessment	2.24	(*)	
	Senior Design Instructor Assessment	1.74	(**)	
	Laboratory Instructors Assessment	1.74	(**)	
	Senior Assessment	2.74	(*)	
	Senior Exit Interview	N/A	N/A	
	Professional Student Chapter Activities	N/A	N/A	
	Alumni Survey	2.25	(*)	
				None (*) required, this goal seems to satisfactorily met.
				(**) Warning signs in some assessment metrics

Program: Bachelor of Chemical Engineering (B. Ch. E.)

Completed By: Orhan Talu/Jorge E. Gatica

Department: Chemical and Biomedical Engineering

Date: 05/31/05

Goal 6 (f): Students have an understanding of Professional and Ethical Responsibilities, including Safety and Environmental aspects related to Chemical Systems, Units and Processes.

Outcomes	Research Methods	Findings	Review	Actions
	Curriculum Assessment	2.75	(*)	
	Senior Design Instructor Assessment	2.33	(*)	
	Laboratory Instructors Assessment	2.33	(*)	
	Senior Assessment	2.66	(*)	
	Senior Exit Interview	N/A	N/A	
	Professional Student Chapter Activities	2.50	(*)	
	Alumni Survey	2.00	(*)	
				None ( ) required, this goal seems to satisfactorily met.

Program:	Bachelor of Chemical Engineering (B. Ch. E.)	**Completed By:**	Orhan Talu/Jorge E. Gatica
Department:	Chemical and Biomedical Engineering	**Date:**	05/31/05

Goal 7 (g): Students have developed effective communication skills

Outcomes	Research Methods	Findings	Review	Actions
	Curriculum Assessment	**2.10**	(*)	
	Senior Design Instructor Assessment	**1.87**	(**)	
	Laboratory Instructors Assessment	**1.87**	(**)	
	Senior Assessment	**2.91**	(*)	
	Senior Exit Interview	**N/A**	N/A	
	Professional Student Chapter Activities	**N/A**	N/A	
	Alumni Survey	**2.29**	(*)	
				None (*) required, this goal seems to satisfactorily met.
				(**) Warning signs in some assessment metrics

Program: Bachelor of Chemical Engineering (B. Ch. E.)

Completed By: Orhan Talu/Jorge E. Gatica

Department: Chemical and Biomedical Engineering

Date: 05/31/05

Goal 8 (h): Students have an understanding of contemporary issues and global/social impact of engineering solutions.

Outcomes	Research Methods	Findings	Review	Actions
	Curriculum Assessment	2.67	(***)	
	Senior Design Instructor Assessment	1.63	(***)	
	Laboratory Instructors Assessment	1.63	(***)	
	Senior Assessment	2.91	(***)	
	Senior Exit Interview	N/A	N/A	
	Professional Student Chapter Activities	2.25	(***)	
	Alumni Survey	1.97	(**)	
				(**) Warning signs in some assessment metrics
				(***) This goal relies heavily on General Education classes.

Program:	Bachelor of Chemical Engineering (B. Ch. E.)	**Completed By:**	Orhan Talu/Jorge E. Gatica
Department:	Chemical and Biomedical Engineering	**Date:**	05/31/05

Goal 9 (i): Students have an understanding of the need to engage in lifelong learning

Outcomes	Research Methods	Findings	Review	Actions
	Curriculum Assessment	2.50	(*)	
	Senior Design Instructor Assessment	2.13	(*)	
	Laboratory Instructors Assessment	2.13	(*)	
	Senior Assessment	2.91	(*)	
	Senior Exit Interview	2.5	(**)	
	Professional Student Chapter Activities	2.5	(*)	
	Alumni Survey	2.67	(*)	
				None (*) required, this goal seems to satisfactorily met.
				(***) This assmt metric is difficult to translate into a numeric equiv.

Program: Bachelor of Chemical Engineering (B. Ch. E.) ılu/Jorge E. Gatica

Department: Chemical and Biomedical Engineering **Date:** 05/31/05

Goal 10 (j): Students have the understanding and knowledge of techniques, skills and tools common in modern Engineering practice

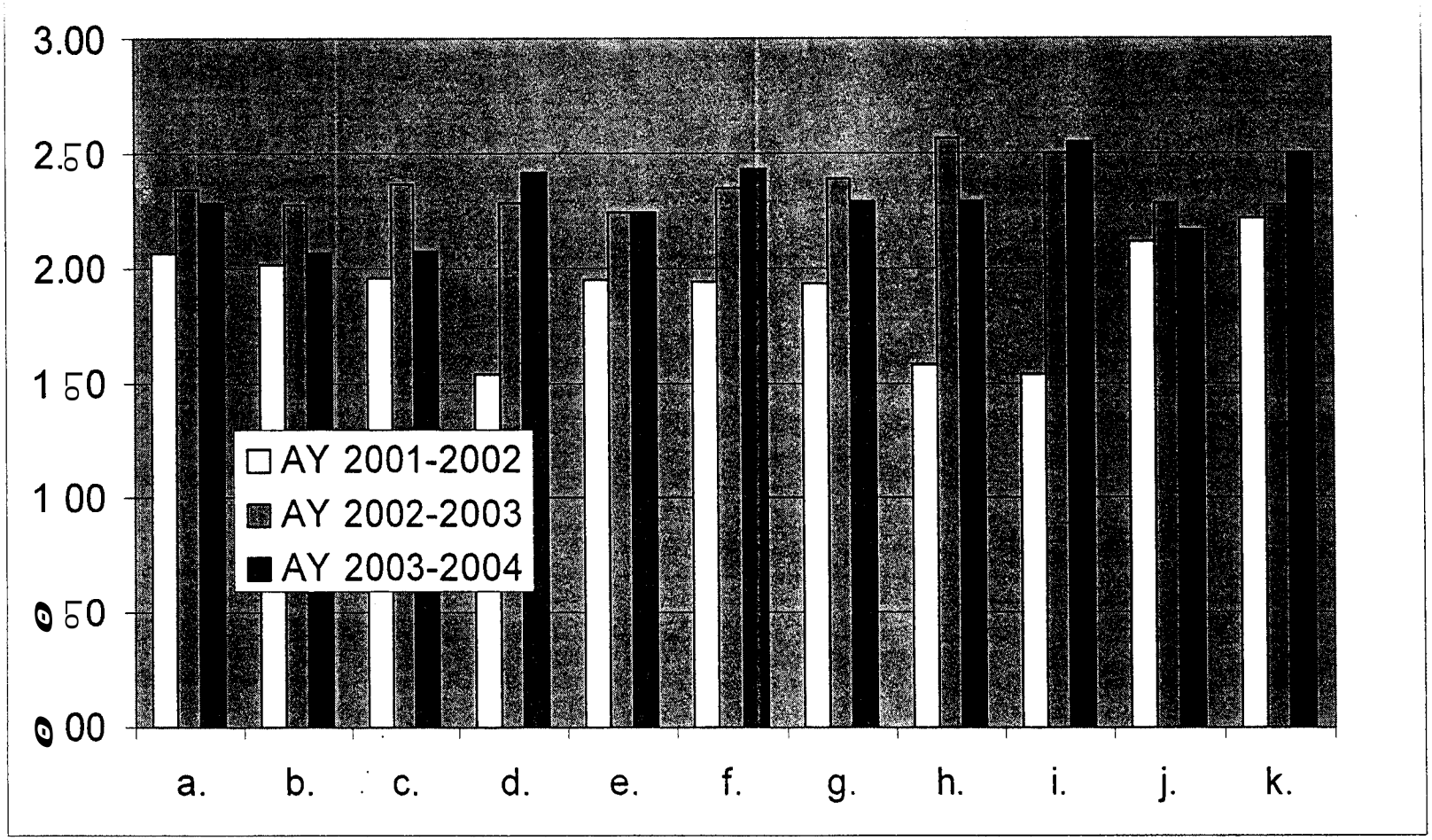
Outcomes	Research Methods	Findings	Review	Actions
	Curriculum Assessment	**1.67**	(**)	
	Senior Design Instructor Assessment	**2.13**	(*)	
	Laboratory Instructors Assessment	**2.13**	(*)	
	Senior Assessment	**2.74**	(*)	
	Senior Exit Interview	**N/A**	N/A	
	Professional Student Chapter Activities	**N/A**	N/A	
	Alumni Survey	**2.12**	(*)	
				None (*) required, this goal seems to satisfactorily met.
				(**) Warning signs in some assessment metrics

Program:	Bachelor of Chemical Engineering (B. Ch. E.)	**Completed By:**	Orhan Talu/Jorge E. Gatica
Department:	Chemical and Biomedical Engineering	**Date:**	05/31/05

Goal 11 (k): Students have an understanding of the Principles and Working Knowledge of subject areas as defined by the Program Criteria of the American Institute of Chemical Engineers (AIChE).

Outcomes	Research Methods	Findings	Review	Actions
	Curriculum Assessment	**2.50**	(*)	
	Senior Design Instructor Assessment	**2.31**	(*)	
	Laboratory Instructors Assessment	**2.31**	(*)	
	Senior Assessment	**2.40**	(*)	
	Senior Exit Interview	**N/A**	N/A	
	Professional Student Chapter Activities	**N/A**	N/A	
	Alumni Survey	**2.78**	(*)	
				None (*) required, this goal seems to satisfactorily met.

Trends


3.00
2.50
2.00
1.50
1.00
0.50
0.00
AY 2001-2002
AY 2002-2003
AY 2003-2004
a.
b.
c.
d.
e.
f.
g.
h.
i.
j.
k.

Summary of Findings and Corrective Actions

Only one area of concern was identified

Goal (d), "Ability to work in Multidisciplinary Teams." This concern will be addressed in Sophomore and Junior-level courses by assigning teams in such a way that students from different majors are required to cooperate in group projects. This applies to some of the Engineering Science Course (ESC), most noticeably ESC 120, ESC 301, ESC 321.

Several areas of attention were identified

Goals

(b) Ability to plan an Experimental Design, perform Data Collection and their Analysis

(c) Ability to perform Engineering Design (Chemical Units & Processes)

(e) Ability to Identify, Formulate and Solve Engineering Problems

(f) Understanding of Professional and Ethical Responsibilities, including Safety and Environmental aspects related to Chemical Systems, Units and Processes.

(h) Understanding of Contemporary Issues & Global/Social Impact of Engineering Solutions.

Goals (b), (c), and (e) show an increasing trend in the average assessment score; which suggests that no action is required at this time. Similar trends can be seen for goals (f) and (h). It was concluded, however; that these goals will receive additional assessment feedback once assessment practices are adopted throughout the CSU community. These goals rely heavily on General Education courses, and thus input from support departments is required.

Closure and Final Comments

The Bachelor of Chemical Engineering Program, along with all Engineering Programs, was evaluated by the Accreditation Board for Engineering and Technology (ABET) during the Fall 2004 term. A preliminary report found no deficiencies or weaknesses.

The assessment methodology presented above is part of the continuous assessment/improvement of student learning approach followed by Engineering programs.