

**School of Chemical Engineering
Undergraduates**

Prepared by R. Russell Rhinehart, School Head

The following table shows the assessment methods used and numbers of individuals assessed for the BS degree programs offered by the School of Chemical Engineering.

Degree Program Assessed	Assessment Methods Used	Numbers of Individuals Assessed
Bachelor's Of Science in Chemical Engineering	Fundamentals of Engineering Exam	68 (5-years)
	Senior Survey in the fall semester	29
	Exit interview fall and spring	12
	End of course survey – student response to objectives	7x25
	End of course evaluation by the faculty	7x25
	Course evaluations	10x25
	Feedback by Celanese visitors on student design problem	1x25
	External academic contests and scholarships	8
	Student activity in School's activities	100
	AIChE National Data	Many
	Semi Structured Alumni Phone Interviews	25 (97 and 99)
	Industrial feedback (IAC and recruiters)	20
	OSU Alumni Survey	28 (96 and 00)
	Employer Survey of Communications	24

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Accreditation

The Accreditation Board for Engineering and Technology (ABET) requires a continuous improvement process for engineering education programs. In preparation, during the past five years (and substantially in the past three) the School has explicitly defined Educational Objectives (what we expect graduates to be able to do/have done by two years after graduation); and, from those, Program Outcomes (skills and assets that students have upon graduation), and the topics and skills that define the essence of chemical engineering. We developed a continuous assessment process, and for the past two years, closed the feedback loop. Most of our efforts for the University Assessment of Instruction are within the ABET activities.

This year ABET will visit to inspect our CQI process in detail.

Assessment Overview

Feedback from both our internal alumni phone interview, OSU Alumni phone interview, and our own survey of employers indicates that our program prepared the alumni well for practically all aspects in their diverse careers. An industry survey indicates that our graduates perform as well or better than those from other schools. Feedback suggests better preparation in computer programming, dealing with ambiguity, integration of business economics, and better preparation for team effectiveness.

While we do an excellent job preparing students for formal oral and written presentations, communication is much broader. Industrial feedback indicates that new employees generally lack listening skill. In addition, since email is the primary communication tool, we need to help students understand that it is neither informal nor personal. Since it forms a public and permanent record, proper English, and carefully considered words are important. Since practically all industrial communication is action-oriented students should be trained to connect technical analysis to recommended action within an enterprise situation.

Employers and graduate advisors are generally well pleased with OSU ChE graduates. This is a continuing finding.

Analysis of performance on the Fundamentals of Engineering Exam indicates that OSU ChE student test-takers are significantly better prepared in the science and engineering fundamentals than the average national student test-taker. We have sustained a 94% pass rate, compared to a national pass rate of 82% for the past ten years. In the last 2.5 years, our students had a 100% pass rate. Only in one category, mathematics, do we frequently test lower (marginally significant) than the national average. This is a continuing finding.

Our students and alumni have a strong utilitarian value, and rate the importance of courses to their perceived or actual utility to a professional's life (career as well as personal). This is a very "engineering" characteristic. Alumni and students generally volunteer that ENGL3233 (Technical Writing) is redundant and inferior to the writing instruction we provide in the CHE 4001/4112 and 4124/4224 courses. Starting in AY04 ENGL3233 will convert from being the required second English course to an option to Composition II.

Also very high on the list of least useful classes was STAT4033 (probability and statistics). Primarily, the problems are the lack of connection to practical application, inability to cover all course topics, no required homework, and several barriers to students obtaining help from the instructor.

Students also had significant complaints about ENSC2613 (Circuits), because of poor teaching.

In the past students, faculty, and alumni in graduate school feel that the mathematics ability of our undergraduates needs to be improved. The students want more "practical math" ability; not math theory. They want engineering analysis skill. The alumni in industry do not suggest additional math training, but recommend that we develop better computer programming skill – a subset of practical math. Along with better computer programming skill, IAC members would like BS engineering graduates in general (not necessarily OSU) to have better ability to apply probability and statistics to design and analysis, and to be better able to judge the veracity of computer output. Our interpretation is that students do not need better math skill in order to perform employment tasks, but that they need greater comfort in the application and interpretation of math-related skills to understand ChE fundamentals, to analyze ChE phenomena, and to design ChE processes. Faculty has accepted the challenge of integrating such experiences into their classes. This is the first year that senior students have not complained about insufficient skill in practical math.

Students, alumni, and IAC members encourage us to replace FORTRAN with VB and prepare students to use Macros in Excel. Because of the inconvenience of access to FORTRAN software, student rarely use it. However, all have Excel, which permits programming in VB macros. Accordingly, we are introducing the mechanics of VB programming in CHE2033 and the ChE section of ENGR1352.

Freshmen and sophomore students are disengaged from both chemical engineering and the School. The math, science, and ENSC courses misdirect any understanding of ChE, and the joy that awaits them if they stick to the plan. Seniors suggest that seniors talk to Pre-Professional School Students (PPSS), that PPSS tour UOL while it is in session, and that PPSS take field trips to ChE sites.

Computing facilities have improved each year. However, facilities, software, and user instruction on software and hardware are inadequate. There are too few computers, in inconvenient locations. Class use of the "open" labs blocks student use, and is very frustrating. Students need instruction on system and software operation to be proficient. We added a lab section to CHE2033 and have a ChE instructor teaching a lab in ENGR1352 for software training. We need sufficient tabletop workspace in the labs. Software products are limited, and some of primitive version. In spite of substantial improvements in computer facilities in each of the past several years, we are still far behind. Our expectations and desired software products expand, as fast as we improve the facilities. Students want 24-hr access to EN labs where the reference books are located, and where encounters with professors are likely. Being in the labs for long hours, students would like a coffee/snack shop in Cordell. This is the first time students did not have a dozen types of complaints about the technical inadequacy of the computers. These are continuing findings.

We started using a single ChE advisor this academic year. The academic advising process requires experienced advisors to interpret and locate the convoluted rules and conditions. Students cannot effectively advise themselves because the degree requirements are not clearly stated. This is exacerbated for transfer students because credit amount and category of transfer courses often requires interpretation, with multiple OSU departments claiming authority. As a result engaging the entire faculty in advising was inefficient. The single advisor system creates expertise and uniformity. However, as students progress from pre-professional school to professional school, advising shifts from CEAT Student Services to the CHE Faculty, whereupon interpretation of the degree requirements changes. Advisors within any one group give conflicting direction. While this is a continuing finding, the frequency and severity of complaints seem to have lessened.

Students struggle with certain prerequisite material when they enter subsequent courses. Key prerequisite topics that pose subsequent difficulty are computer programming, differential equations, material balances with recycle, and statistical analysis of data. This is a continuing finding.

We need more automation, and larger-scale experiments, piping craft, and safe human space in the Unit Operations Laboratory to make it reflect industrial practice. This is a continuing finding. However, this year, the addition of an industrially fabricated, integrated, multi-heat exchanger unit makes substantial progress. We have redone piping on several experiments to represent craft, and are now seeking industrial help to upgrade the fluid flow experiment.

ChE enrollment cycles with a 13-year period, and all US schools are in phase. We have been in the downward trend of matriculation, but each of the last two year's data showed a slight rise. As indicated by the rate of scholarship applications this year, the freshman ChE class should be about 25-50% larger than last year. In the past low portion of the cycles, freshman matriculation had dropped to about 30. Anticipating, the coming drop, we revised recruiting materials and procedures, and this cycle the freshman class only dropped to about 60.

Instructional changes that have occurred or are planned because of outcomes assessment

We are working well beyond "instructional" changes. This discussion includes all changes.

We have an active EC2000 Accreditation Committee of three faculty members which acts as a steering committee, digesting data, and preparing for semi-annual faculty meetings and annual IAC meetings for curriculum improvement decisions. As a School, we now have formalized criteria to use in exit interviews and end-of-course assessment, and meet each semester to review assessment data and direct curriculum improvement.

Welcome letters to new matriculates, recruiting letters, response to enrollment inquiries, and the Head's address at the first AIChE Student Chapter meeting address the intensity of the curriculum, the need for commitment, and the importance of extra curricular activities in the development of the entire person. It is important to shape the person's perspective to ensure success within the new environment.

We are making greater use of multi media in teaching.

We are making greater use of simulators and CAD packages for student home assignments. CFX was extended to the reaction class this year. We added a discussion section to CHE2033 for instruction on software (MathCAD, Excel, and ChemCAD) use.

VB is introduced in ENGR1352 and CHE2033.

Starting in the spring of 2002, CHE course instructors have been actively looking for ways to integrate "practical math" into the student activities of their courses. Now three semesters later, graduating students are not complaining about practical math skill. The transition from theoretical MATH to its practical application is difficult. Wherever we introduce it the CHE curriculum, students seem to struggle and instructors complain about lack of prerequisite ability. But, the complaints disappear in subsequent courses. This year, transient material and energy balances, leading to ODEs, were covered in CHE2033.

ChE is represented on the CEAT Statistics Oversight Committee which continues to seek a solution to improve course effectiveness.

ENGL3233 was changed from a required to an option as the second ENGL course.

We added an integrated heat-exchanger unit (from industrial donations), re-piped several units, and renovated Unit Operations Lab space to improve safety and functionality. We added two computers to the UOL for student use (there are now 9), with 7 units computer monitored, of which 4 are computer controlled.

Advising materials continue to be carefully edited to provide clear and non-conflicting advice to students. We are considering changing the ChE advising from a shared responsibility to a single person assignment within ChE.