

Program Learning Outcomes Assessment Activities

The process of assessing the outcomes achieved by our students covers the period of study by the students at the University and their professional careers as alumni. The process includes the assessment of outcomes for every engineering course the student takes, junior year assessment, senior year (exit) assessment, alumni assessment, and employer assessment. The process is implemented using five-assessment instruments: Course Survey, Junior Survey, Senior Survey, Alumni Survey and Employer Survey. These are shown in Table 1. Student and faculty perspectives were analyzed and where there were concerns, these concerns were addressed as quickly as was possible in order to facilitate program improvement. The alumni and industry concerns were considered primarily for long-term changes in the program of study.

Table 1 - ChETU Program Assessment Activities Relative to Objectives

Constituency	Assessment Tool	Frequency	Time	Target	Outcomes Assessed
Alumni	Survey	Every third year	Fall semester	Graduates of past eight years	a thru o; ability to work as team and independently
Employer	Survey	Every third year	Fall semester	All employers	a thru o; organizing skills, and overall performance
Advisory Council	Meetings	Annual	Fall and Spring semesters	Department advisory group	objectives and outcomes; strategic plan
Students	Sr. Survey (exit)	Every semester	Fall and Spring semesters	All graduating Seniors	a thru o
	Junior Survey	Annual	Fall semester	Students in ME core	a thru o
	Course Survey	Every semester	Fall/Spring semesters	All courses	a thru o; comparison of faculty expectations with student achievements
	Co-op Survey	Annual	Fall or Spring semester	Active companies	Assessment of student competencies
Students and Faculty	Forum	Annual/Semi-annual	Fall and/or Spring semester	All students in the program	Assessment of learning outcomes

Parameters for Measuring Outcomes Achievement

The parameters used to measure the level of outcome achievement, necessary to produce graduates who will ultimately achieve educational objectives, were the following:

1. Level of student agreement with faculty on expected outcomes of specific courses
2. Degree of satisfaction of alumni with their education on a scale of 1 through 5 (1= least, 5=most satisfied)
3. Degree of satisfaction of companies with our graduates (1=least, 5= most)
4. Success of students in internship program
5. Success of graduating students obtaining jobs in mechanical engineering
6. How successful alumni feel they are

Survey Data

Alumni Survey: The alumni survey will be launched in October 2019. The results should be presented as follow in Table 2.

Table 2 - Alumni Survey (1-Weak ↗ 5-Strong)

a. Rate following items relative to your education at College of Engineering

Parameter	Rating
Overall quality of your education	
Overall quality of your laboratory coursework	
Support, assistance and general help from College of Engineering	
How prepared were you in handling professional tasks after graduation	
If you participated in VIP Coop program, rate quality of your experience	

b. Indicate the degree to which your education provided you with ability to:

Apply knowledge of math, science and engineering	
Design and conduct experiments	
Design a system, component or process to meet desired needs	
Function on multidisciplinary teams	
Identify, formulate and solve technical problems	
Understand professional and ethical responsibility	
Communicate effectively (written and oral)	
Work independently	

Employer Survey: The employer survey provides valuable feedback information on the quality of education received by our graduates and their performance on the job. The Employer Survey form is given in Table 3, together with composite evaluations. Nine local companies employing ChETU graduates responded. These responses are very significant since these are small companies and the quality of each of their employees, especially engineers, is critical to their success.

Table 3 - Employer survey (5-Far above average, 1-Far below average)

Parameter	Rating
Ability to formulate and solve problems	
Ability to conduct experiments	
Ability to work on multi-disciplinary teams or projects	
Ability to work independently	
Ability to communicate effectively (written and oral)	
Ability/desire for self-learning/continuing education	
Ability to use modern technologies and tools necessary for practice	
Leadership and supervisory skills	
Self-confidence and initiative	
Ethical behavior	
Planning and organizing skills	
Understanding of global and contemporary issues	
Overall performance	

Junior Survey: The upcoming Junior survey will be in Spring 2020 semester. The results are supposed to be presented in Table 4.

Table 4 - Junior survey (5=Very important/satisfied ➦ 1=Not important/very dissatisfied)

Program Outcome	How important to BSChE degree	How satisfied with education at TU
a. Apply math concepts to engineering problems		
b. Apply science to engineering problems		
c. Apply analytical skills to engineering problems		
d. Conduct experiments; analyze and present		
e. Apply knowledge to design component/system		
f. Work on multi-discip. projects; leadership skills		
g. Understand ethical & profess. responsibility		
h. Make effective oral presentations		
i. Present tech info effectively in document/report		
j. Communicate with others in team effectively		
k. Incorporate economics, safety & environment		
l. Conduct independent research req. for problem		
m. Participate in tech. and professional societies		
n. Know need for life-long learning		
o. Understand global issues related to engineering		

The assessment of Senior and Exit Surveys should indicate the improvement in the performance of the students. The results of the Junior Survey are going to be shared with the faculty to improve the performance.

Senior Survey: The senior survey of graduating class was administered in Spring 2020 in ChETU. A summary is given in Table 5.

Table 5 - Senior survey (5=Very important/satisfied ➡ 1=Not important/very dissatisfied)

Program Outcome	How important to BSChE degree	How satisfied with education at TU
a. Apply math concepts to engineering problems		
b. Apply science to engineering problems		
c. Apply analytical skills to engineering problems		
d. Conduct experiments; analyze and present results		
e. Apply knowledge to design component/system		
f. Work on multi-discip. projects; leadership skills		
g. Understand ethical & profess. responsibility		
h. Make effective oral presentations		
i. Present tech info effectively in document/report		
j. Communicate with others in team effectively		
k. Incorporate economics, safety & environment		
l. Conduct indep. research required for problem		
m. Participate in tech. and professional societies		
n. Know need for life-long learning		
o. Understand global issues related to engineering		

Table 6 is going to show us how satisfied each group is with the education that they received from TU, as applied to each outcome.

Table 6 - Junior and Senior Survey Comparisons (5=Satisfied 1 ↗ 1=Very dissatisfied)

Program Outcomes	How satisfied with education at TU (Junior)	How satisfied with education at TU (Senior)
d. Conduct experiments; analyze and present results		
e. Apply knowledge to design component/system		
f. Work on multi-discip. projects; on leadership skills		
h. Make effective oral presentation		
i. Present technical info effectively in document/report		
j. Communicate with others effectively in a team/group		
k. Incorporate economics, safety and environmental		
o. Gain an understanding of global issues in engr.		

The primary inference that may be drawn from the comparison of Junior and Senior surveys is that students are learning (improving) in all expected program outcomes. These trends indicate that there is a progressive development in the preparation of our students to become successful engineers. This also indicates the ME program of study is successful in its mission.

Senior Exit Interview: The exit interview was a meeting of the department faculty with the graduating seniors where comments on their education experience at the University were solicited were solicited from the students. A summary of comments is presented in Table 7.

Table 7 - Summary of exit interview of graduating Seniors

Topic	Response
a. Curriculum	
b. Instruction received	
c. Lab/Project experience	
d. Availability of courses	
e. Accessibility of faculty	
f. Participation in professional activities	
g. Overall experience	
h. Plans after graduation	

Comments by the graduating students are important to faculty and provide valuable input on how well the program outcomes are attained. They also pointed out some shortcoming in the program that will be addressed. These inputs are going to be a factor in the changes made in the ChETU program of study.

Course Surveys. These surveys were instituted in order to have the faculty define which outcomes a course should satisfy and obtain feedback from the students on how well they feel

that these outcomes have been achieved. The results of the course outcomes survey are going to be summarized in Table 8. This table was obtained by a survey of the faculty, who were asked to list what outcomes were desired and whether each was Very Strong (VS) or Strong (S). The same survey was given to the students, who were asked to use a 5 (Strong) to 1 (Weak) rating.

The results of the survey show that ChETU students feel that all of the educational outcomes are achieved. The weakest outcomes were **m**, **n** and **o**, awareness of need for participation in professional societies for professional growth, in understanding need for life-long learning, and in understanding global issues related to engineering.

Table 8 Student assessment summary by course

[illegible]

Student/Faculty Forum: The student/faculty forum is a semi-annual event in the ME Department that gives the students and faculty an opportunity to discuss education issues and suggest improvements.

Process to Ensure Achievement of Objectives

The foregoing described the objectives and how they are achieved through required courses in the ME curriculum. The process is summarized in this section. To ensure that the objectives of the program are achieved through the courses offered in the program, the Department of Chemical Engineering in conjunction with the University and College mission prepared its own mission statement based on the input from its constituencies. Next, program objectives that would fulfill the mission statement were developed by the department faculty. The mission statement and program objectives were presented at the Department Scientific Council meetings and at student forums, held annually. The final version of the mission statement and program objectives, accepted by the faculty, became an official document that was published. The department then prepared a set of outcomes (a through o) that must be achieved by the courses in the curriculum, each course covering specific outcomes. For each course, the outcomes were identified in the course outline distributed to the students. Survey instruments were constructed for assessment and serve two purposes: 1) to verify that the courses in the curriculum are providing the necessary knowledge base to meet the program objectives and mission (internal surveys), and 2) to verify that the knowledge provided to our graduates is appropriate to the changing needs of industry based on input from alumni and the employers hiring our graduates (external surveys). Internal surveys are given semi-annually and/or annually; the external surveys are given every 3 to 6 years. Addressing the changing needs of the mechanical engineering profession and making the necessary changes to our curriculum in a timely manner creates a continuous process of improvement of the program. The next step in the process is the evaluation of program outcome surveys. The survey results are tallied and compared with the norms established by the department faculty. The discrepancies are discussed and changes are made to comply with program objectives and program outcomes. In addition to the changes based on the surveys, the University and/or College may impose mandatory restrictions, such as a reduction in units required for graduation. Any changes that affect the ChETU program are discussed at the Advisory Council meetings and Student Forums. Thus a feedback loop, that provides a corrective mechanism to the changing needs of the program, is established. This feedback process is illustrated in Figure 1.

Figure 1 - Program improvement and assessment process



