School of Chemical Engineering/CEAT

Chemical Engineering, BS degree

Assessment Report Form for 2016-2017 Academic Year

Date of Report: 2/7/2017

Name of Person Submitting Report: Sundararajan V. Madihally/James R. Whiteley

A. Program Information:

Assessment Coordinator's Name: Sundararajan V. Madihally/James R. Whiteley

Assessment Coordinator's Email Address: sundar.madihally@okstate.edu

Number of students enrolled in the program 2016-2017: 438

Number of students graduated in 2016-2017: 82

B. Program Mission Statement

In the box below, provide the mission statement for the program.

The mission statement, educational objectives, and goals for program should guide the assessment process. The mission statement should align with department, college, and institutional mission statements.

The mission of the School of Chemical Engineering at Oklahoma State University is to develop human resources, professional knowledge, and the infrastructure through which chemical engineering can contribute to human welfare. We expect to maintain national recognition for our contributions.

C. University Assessment Funds

Were university assessment funds used by the department/program for assessment activities? ☒ Yes ☐ No

If university assessment funds were used by the department or program, describe how university assessment funds were used and the contribution the funds had on the assessment process. Funding requests for the next academic year have a separate process and should not be included here.

This is the first year we used university assessment funds to incentivize our undergraduates to take the nationally administered Fundamentals of Engineering examination prior to leaving OSU. For students, it is the first step to becoming a licensed engineer while we can assess our student performance in comparison to national chemical engineering student performance. We receive performance data for each of the two six-month periods from the national administrators (the National Council for the Examination of Engineers and Surveyors, NCEES) on various fundamental topics that students learn in our curriculum. We assess several student learning objectives with the exam which is utilized as a measure in the Accrediting Board for Engineering and Technology (ABET) accreditation process (see the flow chart). This assessment is also useful in understanding strengths and weaknesses of the curriculum and then address changes required for our program. Previous years when the cost was low ($70) many of our students use to take the exam. However, we see that with the recent increased cost ($225), that percentage of students taking the exam has declined. In order to encourage students to take the FE exam, we reimburse the entire exam costs when they submit their notification that they have passed the exam. Assessment funds have really helped us in this regard.

D. Student Learning Outcomes

On the pages that follow, list the Student Learning Outcomes associated with the program identified in this assessment form.

D1) Student Learning Outcome #1: We are following the ABET (Accreditation Board for Engineering and Technology) procedures for continuous quality improvement and assessment methods. There are eleven "Student Outcomes", and each year we assess and evaluate and adjust for each. Upon graduation, students will have:

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 within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) An ability to function on multidisciplinary 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, economic, environmental, 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

Identify opportunities for students to learn this outcome during the 2015-2016 academic year:
For example, include a curriculum map that lists the courses or other learning experiences in which the student learning outcome is taught. Another example is a written narrative that describes how the learning outcome is integrated into the program.
Each course taught in the program is designed and delivered around a set of objectives defined by the faculty in the department. These course objectives are assessed periodically both directly from the instructor-feedback and indirectly from student surveys and performance to understand the effectiveness. Both student feedback and instructor feedback are compiled and discussed in faculty meetings.

How many students were included in the assessment of this outcome?
All sophomore level and above ChE students – about 150 in the past year.

How were students selected to participate in the assessment of this outcome?

Click here to describe how students were selected.

Assessment Methods
Identify the method(s) used to assess this learning outcome. Check all that apply.

☒Survey
☒Rating of skills (e.g., rubrics)
☒Analysis of written artifacts
☒Comprehensive, certification, or professional exam(s)
☒Oral presentation
☒Course project
☐Satisfaction Survey
☐Benchmarking
☐Measuring effectiveness relative to professional standards
☐ Review of thesis/dissertation/ creative component
☒Capstone project
☐Internship
☒Interviews
☐Performance or jury
☐Visual collection (photos, videos, etc.)
☐Review of student research
☒Other (please specify):
Tests and assignments

Describe the how the assessment method was implemented, administered, and/or conducted.
See attached report
Did your department/program faculty have a goal set for this learning outcome? ☐ Yes ☒No
For example, "80% of students included in the assessment will receive a 4 on the rubric" or "80% of students included in the assessment will achieve a passing score on the certification exam." If yes, please describe the goal below.
However, we want the lower 95% value of all outcomes to be good or above.
Provide a summary of the results from the assessment of Learning Outcome 1.
Report student's scores for this assessment, as well as students' strengths and weaknesses relative to this learning outcome.
See attached report

What do the results suggest about student achievement of this learning outcome?

Click here to type what the results suggest about student achievement of Learning Outcome 1.

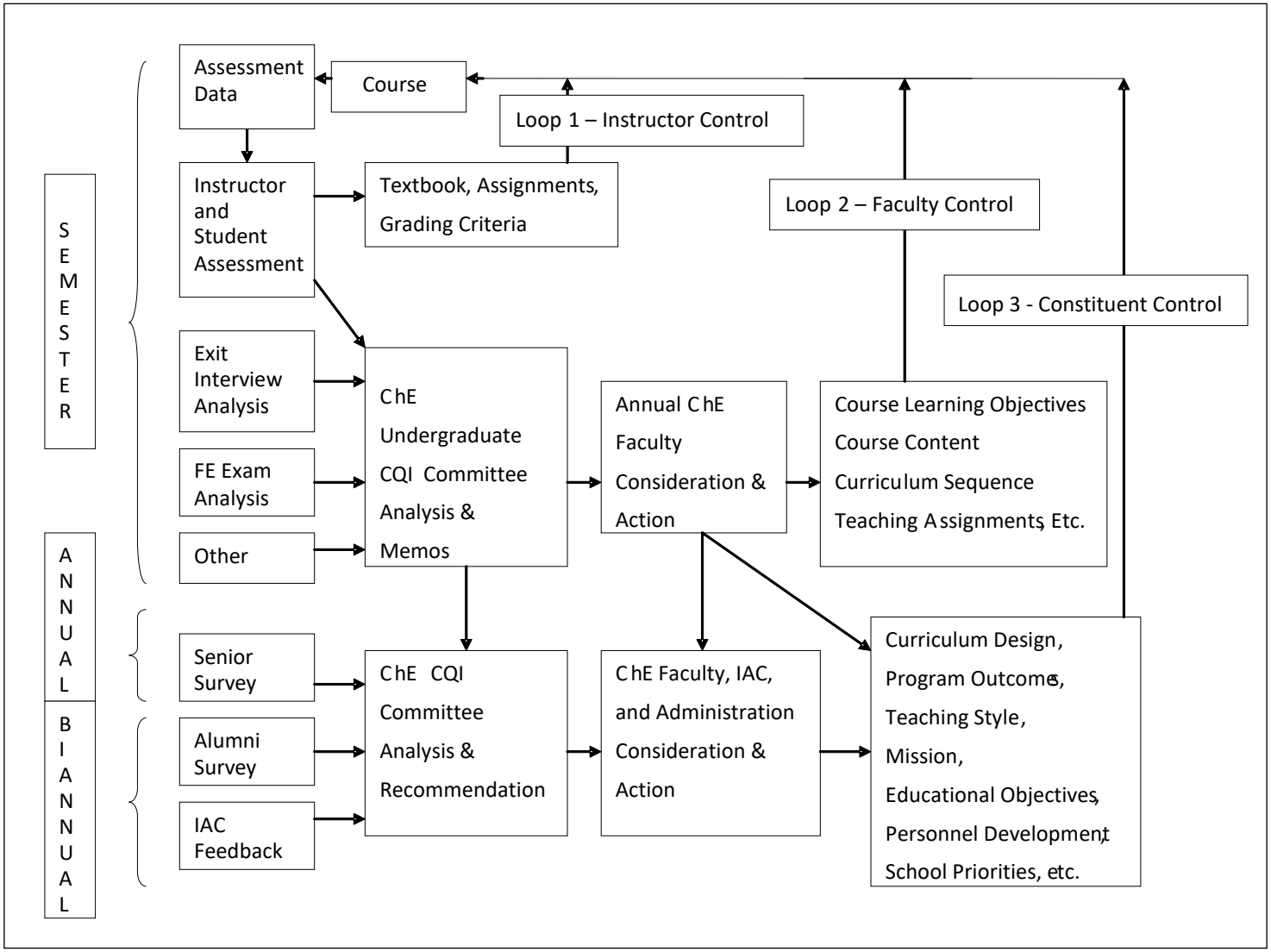
Timeline for the Assessment

Indicate the timeline for the assessment of this learning outcome. While outcomes assessment must be conducted every year, not all student learning outcomes for a given program must be assessed every year. If the assessment of a particular learning outcome occurs on cycle or rotation, please describe and provide the rationale for the cycle/rotation below.

☐ Each Semester ☒ Yearly ☐ Every other year

☐ Other (please specify): If the assessment of Learning Outcome 1 occurs on a cycle or rotation, click here to describe and provide the rationale.

Overview of Chemical Engineering B.S. Degree Program Assessment Strategy



E. Summary of Assessment Results

Describe the overall results of the program assessment and program faculty members' interpretation of the assessment results.

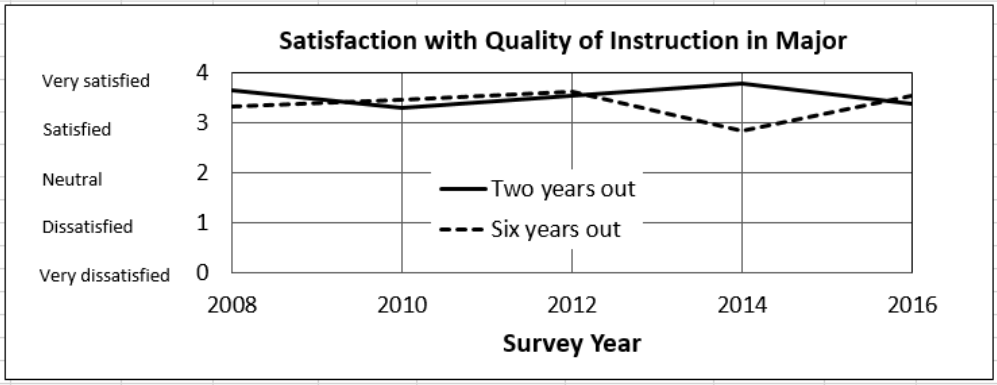
What did the assessment reveal? What do faculty interpret the results to mean? What do the results suggest about the curriculum, teaching practices, and/or student achievement of the program learning outcomes?

Annual Assessment and Evaluation Summary and Action Items from AY 2016

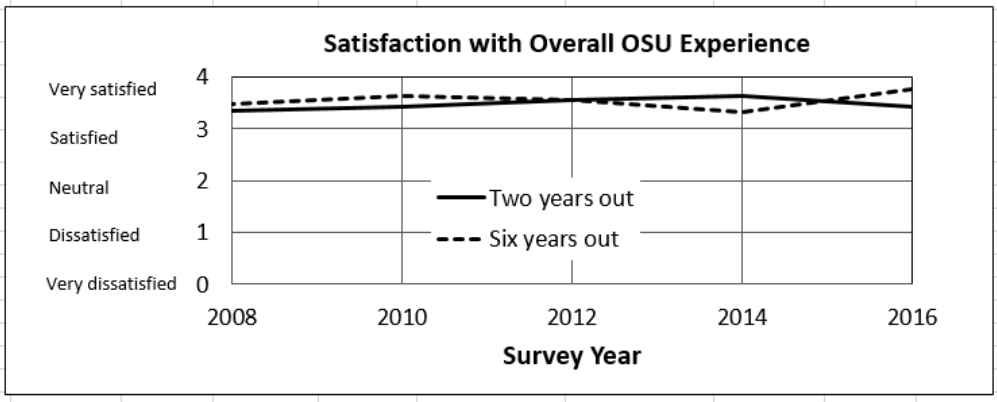
Semi-Annual BS Alumni Survey

Every other year (even years) the OSU Office of Assessment conducts phone interviews with BS graduates who have been out two and six years. Some questions relate to the a-k Student Outcomes and some to the Program Educational Objectives. Typically, nearly 50% of alumni participate. Results from the 2016 survey (33 % participation rate) are noted below.

Our alumni continue to be well satisfied with the BS CHE program. The charts below track survey results over the past 8 years.



Instruction in Major	
5-year average:	
Two-years out	3.53
Six-years out	3.36



Overall OSU Experience	
5-year average:	
Two-years out	3.49
Six-years out	3.55

The open-ended comments are similar to what we have seen in previous years. Interaction with professors and an emphasis on industrial practice are strengths of our curriculum that our alums encourage retaining as a priority. The rigor of the program and emphasis on critical thinking and analytical reasoning are also frequently mentioned as strengths. The single biggest complaint is, and always has been, that most concepts are illustrated using examples from the oil and gas industry. We are making efforts to provide more breadth but will not make wholesale changes as 75 % of our BS graduates typically go to work in some area related to oil and gas. Overall, the survey results provide strong affirmation of our program quality. There were no surprises in the results of the 2016 survey.

Employer Preferences:

An OSU survey of employers (all majors not just CHE) affirms the values and flavor that we direct in our student development. Top qualities, sorted from top, are: strong work ethic, reliability, ethical decision making, teamwork, leadership, openness to new things, creativity and innovation, flexibility, and community engagement. It is interesting that these placed above skills.

Skills, from the top, were: critical thinking and problem solving, verbal communication, apply knowledge in a work setting, technical knowledge related to the job, ability to set goals and plan, knowledge of major field of study. It is interesting that 6th on the list was the discipline specific knowledge, significantly lower than those just listed. Also interesting, written communication placed 8th on the list, much lower than verbal.

Annual Meeting with Faculty and Industrial Advisory Committee:

The CHE Industrial Advisory Committee (IAC) met on Friday, April 28, 2017. Undergraduate students met with the IAC members at lunch and spent 50 minutes discussing curriculum, faculty, facility/infrastructure needs, employment opportunities and performance expectations in the workplace. Highlights of the report pertaining to our undergraduate program include the following.

- Luncheon with the students was very enlightening with great interaction between all. Key input from the students included the following:
    - First concern was lack of a computer lab which has been virtually eliminated. Software they need cannot be put on their laptops, access to, and printer reliability at locations is terrible and it is hard to work on their team projects.
    - Input on curriculum cuts included Electrical Science, Strength of Materials, and Sophomore Seminar
    - A desire for more hands-on labs in the curriculum and continue upper level electives
    - Exposure to more career paths
    - Curriculum does not allow for students to pursue coop positions unless they want to add significant time to their stay at OSU
    - Students would like to have more professors and one on one time

- If the goal is to reduce curriculum to 120 hours for a B.S. Degree due to economic or competitive pressure then proceed with that goal. However keep core classes, and if possible, increase hands-on labs and provide exposure to all potential career paths. The IAC would like to have input into any curriculum changes and as stated earlier is struggling as to the need and the requirement to reduce the BS Degree hours to 120.

- All efforts should be made to provide a working computer lab with sufficient hardware and software to meet the students' needs.

2017 Spring Student Exit Interview Notes

Open discussion that the School Head has with the graduating seniors each May and December asks their response to "What were the best and worst experiences at OSU?" Often the students have a lot to say, of both positives and negatives. When conversation needs new directions, the Head asks for student opinion about program issues that faculty have been discussing. We also ask students to complete an exit interview form asking for career decisions and plans. In the past, each year we also asked students to fill in another form providing their evaluation of their perspective on a-k in the curriculum. We have found that information not to change from year to year, and it provides a close match to the obvious expectations. We now use that form about every third year, and may stop. About 75% of the students participate in the exit interview. A summary of exit survey results for AY16 inlude:

Successes/positives:

Friendships made within the class

Financial aid, if willing to fill out paperwork
Cordell computer lab, nice to be almost exclusively CHE students, and quieter
Computer labs help keep people together and makes them more productive; promotes teamwork
Prefer desktops to laptops
Felt the professors care and gave a lot, even if some were better than others

Required courses outside CHE and CEAT:

Physics at OSU is terrible. I and II; Professors not clear, unapproachable, not understandable, no good office hours
CEAT departments do a great job compensating for poor physics education
Chemistry – just okay. Biochem lab had lots of help, Organic not enough TAs
Engineering Science – Circuits was a waste of time, only one person liked it
Materials – liked the course but the professor was not willing to work with students, was too rigid; there was a lot of conflict with the coursework; professor assumed all the students were Fr. or Soph. Should be moved to earlier in the curriculum. Didn't find the course relevant
Would prefer to choose the Eng. Science courses instead of set curriculum
Fluids and Thermo good core courses for CHE, and good gen. ed. course. Students need to keep the textbooks!
Could use a different instructor, Dr. AJ was more in depth with information
VBA – a lot of work for 2 hours credit; the lecture was useless, should only have the lab; should be required to take it at OSU, other schools teach differently and not as in depth

CHE Courses:

Rate Ops II – didn't cover enough; stop separating I & II, make one course; need more time on heat transfer and separations/distillation
Unit Ops – brought everything together; Dr. Rhinehart is awesome! He was positive and supportive. Need better training for the TAs; need better documentation
Intro – those that were TAs realized how beneficial the course was; may be taught too early; some didn't appreciate the relevance at the time they took it
Transport – didn't seem relevant at the time but think it is now
Fall of Jr. year was awful! Forced to learn time management. Could put the homework on a regular schedule to help balance; not enough time to do homework between Friday and Wednesday, suggests to assign due dates for homework at the beginning of the semester and give a full week for assignments
New professors – still adjusting, some don't have experience, need mentoring, need help with writing exams and cover topic in class that are on the exams
Design I – the economics covered was good but the design part didn't cover needed information early enough to incorporate into the project; put more design into the 2nd test and all the economics on the 1st exam
UOL was the best course
Rate Ops & Transport and Circuits were the least useful overall
Please focus on consistency – the current Jr. class doesn't seem to have to work as hard as when this Sr. class were Jrs.
Would like more availability to professors beyond 8-5, like having their cell phone #s
Great to have industry exposure and examples, continue teaching practices and tips
There could be more oversight on the new professors and the in-class Thermo instructor
Had just two professors for the junior year, not good
Poor communication with labs and CEAT – too full

Fundamentals of Engineering Exam:

We believe that the FE Exam topics and style of questions are well aligned with our understanding of fundamentals and their application. We use the FE Exam results as a significant indicator related to Student Outcomes. Although the FE Exam does not exactly match our choice for course content (for example process control differs in the extent of Laplace mathematics), or of timing (for example, the FE exam is taken prior to students completing the process control and second design course), and does not assess 100% of the students; it provides a consistent and valid assessment. We look at both the overall pass rate and the performance within FE Exam topics. Data for each year will be available to the Visitor.

In Spring 2016, 89 % (17 of 19) students passed. National average pass rate for CHE for the same exam was 79 %. Students were at or above the national average for all question categories except one or two categories.

Miscellaneous: Many forms of feedback come extemporaneously from discussions with recruiters, return-to-campus visits by alumni, and emails to favorite faculty members from graduates related to their preparation and success on their job. Raw data for each year will be available to the Visitor.

F. Dissemination of Results

Describe the individual(s) or committee (e.g., a curriculum committee) responsible for reviewing and interpreting assessment data.

Assessment coordinator compiles data, and provides initial overview analysis. Then it is discussed by the CQI committee of three. Then presented to the faculty for discussion and action. Annually, actions are relayed to the members of the Industrial Advisory Committee for joint discussion with faculty.

Describe the process for sharing and discussing assessment results with program faculty.

Periodic email messages as assessment data comes in, data and issues summary presented at faculty meetings.

G. Program Improvements Based on Assessment

Based on the findings of this assessment, what changes are being considered or planned for the program?
Describe the actions that will be taken as a result of the discussion of the assessment evidence.

Data indicates the expected enrollment wave is now hitting the senior class. There are 84 CHEs enrolled in the senior level courses, as compared to 64 last fall. There are already (1 Dec) 84 enrolled in the spring CHE 2033 class, as opposed to 97 last spring. However, there is a significant and sustained step up in freshmen ChE enrollment. Historically it has been cycling around 55 with a modest growth of about 15 each 10 years. Three years past it jumped to about 125 OSU freshmen declaring ChE. About a 150% increase. Projections are that this will move our average graduation class size from 35 up to about 60. This has significant impact on demand for organic chemistry laboratory sections, UOL sections, and the grading/coaching work of CHE faculty in the capstone and lab classes.

Based on the findings of this assessment, what (if any) changes are planned for the assessment process?
For example, are there additional assessment data that may need to be collected? Are changes to the program assessment plan warranted?

See attached report

Describe the process for implementing these changes/planned program improvements.

There is a new Undergraduate teaching laboratory under construction. This would provide an interdisciplinary environment. These would help in accommodating increased enrollment in chemical engineering classes.

H. Assessment Tools

Please provide a copy of any assessment tools (questionnaire, scale, interview questions, etc.) **here.**