Chemical Engineering BS

Mission and Vision for the CHE-BS Program and Connections to the TTU Mission

Progress: Completed

Reporting Year: 2016-2017

Providing Department: Chemical Engineering BS

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Mission:

The Department of Chemical Engineering at Tennessee Technological University strives to develop the 21st Century Renaissance Engineer through development and implementation of novel learning environments anchored by the award-winning Renaissance Foundry Model. The foundation of this platform is rooted in the guidelines provided by the National Academy of Engineering's Vision for the Engineer of 2020. Educational protocols within the department are consistent with the mission and vision statements given below:

The **Mission** of the Department of Chemical Engineering is to prepare relevant and adaptive chemical engineers in state-of-the-art areas by emphasizing real-world problem solving and critical thinking skills. The **Vision** of the Department of Chemical Engineering is to be a recognized leader in chemical engineering education through excellence in teaching, research, and service.

The current program educational objectives stipulate that within roughly five years that our graduates will collectively exhibit the following traits:

- Be real-world problem solvers (RWPS): the graduates of our program will obtain positions such as plant process engineer, design engineer, group leader, production engineering, sales engineer.
- Be critical thinkers (CT): the graduates of our program will demonstrate that they consistently make informed decisions through a process wherein they utilize critical thinking skills.
- Have continued their formal education (CFE): our graduates will demonstrate that they have continued their education beyond the BS through some form of professional development (not necessarily leading to another degree) or will have graduated from a professional school with an MS, PhD, MD, JD or similar degree.
- Be working at the frontiers in ChE (FChE): graduates from our program will utilize and apply technologies such as biomaterials, nano- and micro-systems, multi-scale analysis, informatics, group dynamics, and multi-media.

These objectives are consistent with the TTU mission and vision.

Program Goal 1: Graduates Recognized as Real World Problem Solvers

Define Goal:

Program Goal 1: Be recognized as real-world problem solvers (RWPS): the graduates of our program will obtain positions such as plant process engineer, design engineer, group leader, production engineering, and sales engineer. RWPS – Real world problem solving as it relates to both design and experimentation has been addressed in the curriculum. Changes to our curriculum including the distributed lab integration have addressed both design and experimentation nicely. A “problem solving formalism” sequence was introduced early in the curriculum with an assessment strategy to establish a baseline from which we can assess progress later in the curriculum.

Intended Outcomes / Objectives:

The TTU Chemical Engineering BS curriculum is specifically designed to prepare students for either a professional career in the Southeastern US regional chemical process industries and/or simultaneously to prepare students who will choose to pursue graduate studies in engineering or other professional studies, e.g., medicine, law, business, pharmacy. Our overall Program Goals were redesigned throughout academic year 2007-2008. The redesign process involved use of faculty consensus management techniques, and multiple faculty meetings and retreats dedicated to discussion of the undergraduate curriculum. The feedback of our BOA and other constituencies was incorporated into this redesign process. The Program Goals are designed to guide curriculum development, to be measurable statements of purpose, and to advertise our curriculum intent to our constituency. Ultimately the intended outcome is that within roughly five to seven years after graduation, our graduates will satisfy four Program Goals (the first of which is listed above with the others provided in subsequent sections of this report) and 11 student learning outcomes (a-k).

Program Goal 2: Graduates Recognized as Critical Thinkers

Define Goal:

Program Goal 2: Be recognized as critical thinkers: the graduates of our program will demonstrate that they consistently make informed decisions through a process wherein they utilize critical thinking skills.

Intended Outcomes / Objectives:

Program Goal 3: Graduates Continuing Formal Education

Define Goal:

Program Goal 3: Continue their formal education: the graduates of our program will demonstrate that they have continued their education beyond the BS through some form of professional development (not necessarily leading to another degree) or will have graduated from a professional school with an MS, PhD, MD, JD or similar degree.

Intended Outcomes / Objectives:

Program Goal 4: Graduates Working at the Frontiers of Chemical Engineering

Define Goal:

Program Goal 4: Work at the frontiers in ChE: the graduates of our program will utilize and apply technologies such as bio materials, nano- and micro-systems, multi-scale analysis, informatics, group dynamics, and multi-media.

Intended Outcomes / Objectives:

Student Learning Outcome "a"

Define Goal:

An ability to apply knowledge of mathematics, science, and engineering

Intended Outcomes / Objectives:

The department's articulation matrix for ABET is followed to help ensure student learning outcomes are assessed throughout the curriculum. This applies for each of the program's 11 student learning outcomes.

Student Learning Outcome "b"

Define Goal:

An ability to design and conduct experiments, as well as to analyze and interpret data

Intended Outcomes / Objectives:

Student Learning Outcome "c"

Define Goal:

An ability to design a system, component, or process to meet desired needs

Intended Outcomes / Objectives:

Student Learning Outcome "d"

Define Goal:

An ability to function on multi-disciplinary teams

Intended Outcomes / Objectives:

Student Learning Outcome "e"

Define Goal:

An ability to identify, formulate, and solve engineering problems

Intended Outcomes / Objectives:

Student Learning Outcome "f"

Define Goal:

An understanding of professional and ethical responsibility

Intended Outcomes / Objectives:

Student Learning Outcome "g"

Define Goal:

An ability to communicate effectively

Intended Outcomes / Objectives:

Student Learning Outcome "h"

Define Goal:

The broader education necessary to understand the impact of engineering solutions in global and societal context

Intended Outcomes / Objectives:

Student Learning Outcome "i"

Define Goal:

A recognition of the need for, and an ability to engage in life-long learning

Intended Outcomes / Objectives:

Student Learning Outcome "j"

Define Goal:

A knowledge of contemporary issues

Intended Outcomes / Objectives:

Student Learning Outcome "k"

Define Goal:

An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Intended Outcomes / Objectives:

Assessment Mapping to Program Goals and Student Learning Outcomes

Goal/ Outcome/ Objective: Program Goals 1-4 and Student Learning Outcomes a-k

Type of Tool: Other

Frequency of Assessment: N/A

Assessment Methods:

Attached is the mapping of the assessments used to the CHE BS Program Goals and Student Learning Outcomes. The rationale for this mapping is discussed in each "assessment item" section.

Attached Files

Mapping of Assessments to Goals and Outcomes BS Program 2018 and Earlier.pdf

Assessment: Alumni Survey

Goal/ Outcome/ Objective: Program Goals 1-4

Type of Tool: Survey

Frequency of Assessment: Once every three years

Assessment Methods:

Alumni Surveys: These surveys have been typically sent out to graduates of the TTU CHE program on a 3 year cycle but have not been administered for several years now. The strategy of survey collection is currently being reviewed in an attempt to achieve a more effective response rate. Similar in nature to the employer surveys (see below), the alumni surveys previously contained questions directly related to the attainment of Program Educational Goals and Student Learning Outcomes. Written comments were also collected and coded as strengths or weaknesses and discussed in faculty meetings. The results were shared with the Undergraduate Program Coordinator for potential improvement actions.

Assessment: Capstone Design Outcomes and External Project -- CHE 4410 and CHE 4420

Goal/ Outcome/ Objective: Student Learning Outcomes a-k

Type of Tool: Capstone Project

Frequency of Assessment: Annually

Assessment Methods:

External Review of Senior (Capstone) Design Projects: (Senior Year, Spring Semester) Student Learning Outcomes a-k. The capstone process design sequence includes two, three-credit hour courses taken during the senior year. The first semester course focuses on equipment sizing, and the second semester course leverages student knowledge as teams of students work on a project of interest that is led by various faculty in the department. External evaluators are used for assessing the quality of the Senior Design Projects and providing feedback on the capstone design course, and by extension of the ChE Program at large. The evaluators ask questions of the team members and provide feedback on the technical quality of the projects and oral/poster presentations using an established ABET-criteria based rubric. The external evaluations are provided to the instructor who summarizes the feedback to the faculty for implementation of improvement as necessary.

Assessment: Capstone Lab Outcomes and External Project --CHE 4240

Goal/ Outcome/ Objective: Student Learning Outcomes a-k

Type of Tool: Capstone Project

Frequency of Assessment: Annually

Assessment Methods:

Capstone Lab and External Project Assessments: (Annually) - ChE 4240. Student Learning Outcomes a-k. Each year, the Capstone Lab student team projects are assessed by both the instructor and (periodically) by invited judges that provide an overall assessment of the relevance and practicality of the different projects.

Assessment: ChE External Advisory Board (BOA)

Goal/ Outcome/ Objective: Program Goals 1-4

Type of Tool: Advisory Board

Frequency of Assessment: Annually

Assessment Methods:

ChE External Advisory Board (BOA): (Annually) The ChE External Advisory Board (BOA) consists of approximately 8-10 members, selected primarily from employers of our students and other related industries. The main purpose of this board is an advisory one; it is not intended as a fund-raising mechanism. Specifically, the board provides input and feedback on various curricular and accreditation matters (ABET, SACS, THEC Graduate Program Review). Some BOA members also regularly serve as External Evaluators for the Senior Design Projects. Key selected items identified by the BOA are then discussed among faculty including the Undergraduate Program Coordinator for potential actions for improvement.

Assessment: Co-Op Performance Assessment

Goal/ Outcome/ Objective: Student Learning Outcomes a, d-k

Type of Tool: Checklist
Survey

Frequency of Assessment: Typically once at the end of each semester

Assessment Methods:

Co-Op Report Assessment: (Semi-annually or annually). The Department uses the evaluation summaries that are directly provided by the student supervisor at the co-op site to learn about important student competencies. Reports are reviewed by the Chair and or the Designee Faculty to extract valuable feedback.

Assessment: Course-Level Assessments of Selected Courses

Goal/ Outcome/ Objective: Student Learning Outcomes a-k

Type of Tool: Annual Unit Report
Other

Frequency of Assessment: Annually (dependent on course offering schedule)

Assessment Methods:

Course Level Assessments: (Annually, dependent on course offering schedule). The Department uses selected courses (nine in total) to learn about student performance at the different levels of the curriculum through the completion of what are referred to as "Course Level Assessment and Improvement Reports" (or CLACIR's for short). CLACIR's are completed for every term that the course is taught, and an overview summary is completed for the course every third year. Those summaries are used to continuously improve the courses and the curriculum as a whole and are discussed with the faculty and appropriate corrective action taken. These courses along with their mapping to the Student Learning Outcomes are listed in the attached table (Note that two versions of the table are attached; one includes the original version and the other reflects curriculum changes). The "M" and "m" designations refer to what are considered "Major" and "minor" assessment criteria.

Attached Files
articulationmatrix (2016-17M).doc
articulationmatrix (2016-17).doc

Assessment: Critical thinking Assessment Test (CAT) and Course Rubrics

Goal/ Outcome/ Objective: Program Goal 2 and Student Learning Outcomes a-c, e, and k

Type of Tool: Other

Frequency of Assessment: As needed to demonstrate effectiveness of new courses and course changes (only done occasionally)

Assessment Methods:

Critical thinking Assessment Test (CAT) and Course Rubrics: Critical thinking skills are assessed directly and indirectly using a variety of rubrics developed by the faculty for use in evaluating student projects in multiple courses within the program, particularly the transfer science courses (heat transfer, fluid mechanics, and mass transfer) as well as process design. In addition, the faculty is engaged in educational research in these and other courses under IRB approval in which the Critical thinking Assessment Test (CAT) is utilized in a pre-post fashion (i.e., beginning of a semester and end of a semester).

Assessment: Employer Survey

Goal/ Outcome/ Objective: Program Goals 1-4

Type of Tool: Survey

Frequency of Assessment: Once every three years

Assessment Methods:

Employer Surveys: These surveys have been typically sent out on a three year cycle to employers of the TTU CHE graduates but have not been administered for several years now. The strategy of survey collection is currently being reviewed in an attempt to achieve a more effective response rate. Similar in nature to the alumni surveys (see above), the employer surveys previously contained questions directly related to the attainment of Program Educational Goals and Student Learning Outcomes. Written comments were also collected and coded as strengths or weaknesses and discussed in faculty meetings. The results were shared with the Department for potential improvement actions.

Assessment: FE Exam Results

Goal/ Outcome/ Objective: Student Learning Outcomes a-k

Type of Tool: Certification Exam

Frequency of Assessment: Annually

Assessment Methods:

FE Exam: (Annually) While not a complete assessment tool in itself, the Fundamentals of Engineering (FE) exam provides an objective, nationally-normalized testing of certain engineering, math, and science topics, as well as the ability to analyze, formulate, and solve engineering problems. Consequently, the FE exam can be a useful measure of Student Learning Outcomes of the program. Results are analyzed and feedback is provided to the faculty for improvement actions.

Assessment: Student Senior Survey/Chair Debriefing of Students

Goal/ Outcome/ Objective: Student Learning Outcomes a-k

Type of Tool: Survey
Other

Frequency of Assessment: Annually

Assessment Methods:

Student Senior Survey and Chair Debriefing: (Annually) These items provide the opportunity for student feedback (anonymously) or directly to the Chair on the different aspects of the program, including ChE curriculum, and the students' experiences while at TTU. In addition, a number of (survey or direct) questions are directly related to specific Program Goals and Student Learning Outcomes. Items identified for action are discussed with faculty. The Department utilizes a set of feedback mechanisms to receive information from students that allow improvements for the program. These include direct meetings of the Chair with the students from selected courses and students communicating areas of concern to the BOA (Board without Faculty or the Chair present). Based on this feedback, the Department discusses outcomes that are implemented and reassessed for the next iteration.

Results (for Critical Thinking)

Results:

Critical Thinking Assessment Test (CAT): Students taking CHE 4973 (Special Topics: Clinical Immersion at Disciplinary Interfaces) during the fall and spring semesters of the 2015-16 and the 2016-17 academic years were assessed for critical thinking skills via the Critical thinking Assessment Test (CAT) which is an NSF-supported instrument developed at TTU and based on four broad aspects of critical thinking: evaluation/interpretation of information, problem solving, creative thinking, and effective communication. The test, designed to be interesting and engaging for students, has questions derived from real world situations. Most of the questions require short-answer essay responses, and a detailed scoring guide as well as grader training, and multiple graders help insure good scoring reliability. While various assessment designs are possible, a pre- and post- test strategy was used for these course offerings. Ultimately, this includes results from four course offerings in which 53 students (almost all from either chemical engineering or nursing) took the test pre and post. The results are reported in a peer-reviewed manuscript published in *Nurse Educator* (Geist, Sanders, Harris, Arce-Trigatti, & Hitchcock-Cass, 2018). As reported in that manuscript:

"Although the CAT total score difference was statistically significant from only 1 of the semesters, $t8 = 2.554$, $P = .034$, $d = 0.96$, an increase in the total was found when considering all 53 students from all 4 semesters for whom both pre-post scores were available, $t52 = 3.104$, $P = .003$, $d = 0.50$. Focusing on Part II of the CAT (the problem-solving portion), students in 2 of the 4 semesters made statistically significant gains. When considering scores on Part II from all 53 students, the gain was also significant, $t52 = 3.91$, $P = .001$, $d = 0.63$. There were no significant differences between nursing and engineering students for gains made on the CAT total score or on Part II of the CAT."

Attachments:

Results (from Alumni and Employer Surveys)

Results:

Alumni and Employer Surveys: These surveys have been typically sent out on a three year cycle to alumni and employers of the TTU CHE graduates but have not been administered for several years now. Due to the lengthy nature of these surveys, few responses were received. The strategy of survey collection is currently being reviewed in an attempt to achieve a more effective response rate.

Attachments:

Results (from Board of Advisors' Meetings)

Results:

CHE Board of Advisors (BOA) Feedback: The BOA meetings are held annually, typically in the Spring. The BOA generally documents its findings in the form of an Executive Summary. Their findings regarding student success and satisfaction are reported there. Recommendations are used specifically as feedback into the program's curricular change process; however, such are rarely made by the BOA. Broader programmatic issues are typically identified by the BOA and are used to influence elements, including but not limited to faculty numbers and institutional support.

Attachments:

Results (from Co-Op Performance Assessments)

Results:

Co-Op Performance Assessments: The Co-Op survey includes 12 questions which map to Student Learning Outcomes d-j (see attached file for results). The results of these surveys which consist of responses from employers for co-op student internships from spring 2008 to spring 2017 are largely unremarkable. Survey questions are ranked on a 1 (lowest) to 5 (highest) scale. Our rubric is that no student receives a score lower than 3. On average (as shown in the attached file), scores are between 4 and 5 for most students with an occasional lower score. We conclude that co-op

employers are satisfied with our students' performance across the board. Similarly, co-op final reports are 100% approved by the co-op supervisors. At this time, the survey that is used is a College-developed co-op survey that does not include questions related to knowledge (a), experimentation (b), design (c) and tools (k). Since most co-op students are sophomores and juniors, it seems that omitting questions related to experimentation and design might be logical. For a detailed mapping of the survey skills assessed to the Student Learning Outcomes d-j, please see the table below:

Items Assessed on Co-Op Employer Survey

Survey Item	Skills Assessed
a	Efficiently manage their assigned duties and responsibilities
b	Demonstrate the ability to work independently
c	Demonstrate a commitment to professional development
d	Participate in activities that serve the profession and/or public
1	Work effectively with other employees
2	Identify, formulate and solve engineering problems
3	Understand professional and ethical responsibilities
4	Produce effective written communications
5	Deliver effective oral presentations
6	Understand the global/societal impact of engineering
7	Recognize the need for and engaging in life-long learning
8	Understanding contemporary engineering issues
RO	Relationship with Others
AL	Ability to Learn
OP	Overall Performance

Attachments: Attached Files

Co-Op Survey Results.docx

Results (from Design and Capstone Experiences and Other Example Course Level Assessments)

Results:

Results from Course Level Assessments and Curriculum Improvement Reports (CLACIRs):

CHE 2020 (Intro to Chemical and Biological Engineering Analysis II)

Target rubric value: 70%
Overall Class Average Performance: 84% (This percentage indicates that the class average performance was above target rubric.)

While student performance is trending towards and increase, the course design requires further integration of a lab experience to provide students with a more tangible connection to course material. Due to equipment issues, this experience was not able to be provided for the current term. The course instructor recommends faculty discussion being centered on lab use at the beginning of each semester so a budget can be developed and implemented for equipment repair, if necessary.

CHE 3010 (Thermodynamics of Chemical Processes)

Target rubric value: 75%
Overall Class Average Performance: 72% (This percentage indicates that the class average performance was slightly below target rubric.)

The level of preparation of the students (including transfer and international) resulted in poor student performance. Largely, the student cohort of this term seemed to lack the average basic mathematical skills. The course instructor suggests further discussion with the department to address potential issues associated with the diverse demographic of the student body. No change is suggested at this time.

CHE 3111 (Transfer Science I: Conduction, Radiation, Diffusion)

Target rubric value: 70%
Overall Class Average Performance: 71% (This percentage indicates that the class average performance was at target rubric.)

The course instructor noted no concerns for the most recent term except that the students performed lower than expected on average. He indicated lack of student preparation might be attributed to the lower than expected performance. No recommendations for remediation were proposed.

CHE 3121 (Transfer Science II: Fluid Mechanics)

Target rubric value: 70%
Overall Class Average Performance: 69% (This percentage indicates that the class average performance was very slightly below target rubric.)

No concerns were noted by the course instructor in the most recent iteration of the course. As there were no noted concerns by the course instructor in the most recent iteration of the course, no remediation was proposed.

CHE 4210 (Chemical Reaction Engineering)

Target rubric value: 70%
Overall Class Average Performance: 68% (This percentage indicates that the class average performance was slightly below target rubric.)

The course instructor noted some issues related to student attendance and correlated performance on unannounced quizzes. Despite the concerns noted by the current course instructor, there were no suggestions for remediation provided.

CHE 4240 (Chemical Engineering Capstone Laboratory)

Target rubric value: 70%
Overall Class Average Performance: 88% (This percentage indicates that the class average performance was well above target rubric.)

No concerns were noted by the course instructor in the most recent iteration of the course. As there were no noted concerns by the course instructor in the most recent iteration of the course, no remediation was proposed.

CHE 4410 (Chemical Engineering Process Design I)

Target rubric value: 70%
Overall Class Average Performance: 77% (This percentage indicates that the class average performance was above target rubric.)

A trend was identified by the course instructor that student performance was decreasing with an increase in student body size and a shift in student body demographics. Most notable deficiencies included the following: working in teams, completing professional work documents, failing to reconcile mathematical concepts with course training, and demonstrating a lack of preparation when searching scholarly literature. To address these concerns, learning groups, or "pods", were recommended for introduction to the course. Training workshops to address functional teamwork issues are suggested for implementation in the course. It was additionally recommended that professional communication and consideration and implementation of mathematical formalisms should be consistent across the curriculum.

CHE 4420 (Chemical Engineering Process Design II)

Target rubric value: 70%
Overall Class Average Performance: 86% (This percentage indicates that the class average performance was above target rubric.)

The course instructor noted that student performance was lower when the criteria was individually assessed rather than assessed across student teams. The course instructor's interpretation of this indicates that some students are largely uninterested in exploring new material late in the course of study and rely on achieving only a passing grade. The course instructor suggests that the department faculty considers separating the course into a stand-alone 2 credit hour lab and a 1 credit hour class. It is suggested that this change would force students to take the course more seriously as assessment of individual progress would be graded in this new course format.

CHE 4910 (Professionalism and Ethics in CHE) / CHE 4971 (Opportunities for CHE Innovation: Products, Process and Ethics)

Target rubric value: 70%
Overall Class Average Performance: 88% (This percentage indicates that the class average performance was above target rubric for the Fall 2016 course offering.) There is no CLACIR on record for the Spring 2017 semester.

The course instructor (Fall 2016) expressed much concern due to cheating, which has been pervasive among international students of the current cohort. To address the current concerns with academic misconduct, a zero-tolerance policy was recommended for implementation both within the course and clearly articulated on the course syllabus. The course is transitioning from a senior-level course to a freshman-level course in order to introduce students to ethical concepts early in the curriculum in order to allow students ample opportunity to practice ethical concepts and leverage their learning throughout the curriculum.

Attachments:

Results (from FE Exam)

Results:

FE Exam: Because Professional Engineering (PE) is not emphasized by the chemical engineering community at large, neither academic (research) nor industrial, only a small number of CHE students self-select to take the FE exam. Further, licensure as a PE is seldom required by employers in CHE-related industries. The results obtained by the Department suggest that our students typically pass the FE Exam at a rate below the "ABET Comparator" data provided by the testing agency. Specific student identifiers are not provided, and thus pass rate data cannot be correlated to student GPA, for example. In the Department, we have chosen not to make the exam a requirement and do not teach a preparatory course or review. Students who elect to take the exam also elect their own study regimen. FE Exam statistics for the 2016/2017 reporting period are provided in the table below and represent an overall 70% pass rate of TTU CHE students. Given the small number of students self-selecting to take this exam, it is difficult to place statistical significance on the use of these data as a basis for improvements in the CHE department's student learning outcomes.

FE Exam Statistics for TTU CHE Students/Graduates			
Fall 2016	**No. Taken**	**No. Passed**	**Pass (%)**
Enrolled	1	1	100%
ABET Comparator	517	381	74%
Graduated	5	3	60%
ABET Comparator	470	296	63%
Spring 2017	**No. Taken**	**No. Passed**	**Pass (%)**
Enrolled	3	2	67%
ABET Comparator	970	720	74%
Graduated	1	1	100%
ABET Comparator	209	161	77%

Attachments:

Results (from Student Survey and Chair Debriefing)

Results:

Student Survey and Chair Debriefings: A student senior survey is conducted once every three years to gauge student impressions of various aspects of the curriculum in CHE. Such questions concern:

1. Students' agreement or disagreement with stated Program Goals.
2. Student assessment of effectiveness of the program at addressing the Program Goals.

The results indicate that students are very pleased and in agreement regarding our four stated Program Goals. Roughly 90% of our students agree with these.

The assessment of effectiveness was broken into four parts, one for each of the four departmental Program Goals. Concerning "real world problem solving," students are generally in agreement that the CHE curriculum is addressing this goal. Responses indicate that a small fraction of our students feel that they do data gathering with little analysis and were directed to use a process of elimination, both strategies that the Faculty try to avoid. More and more authentic opportunities to do data analysis should be offered.

Concerning "communications," responses indicate that students are not as confident about either their oral or written communication skills. This lack of confidence should be addressed.

Concerning "critical thinking," responses indicate that again students might use trial and error. Responses also indicate that more opportunity to use statistical methods should be offered. Extending theories beyond the original context learned is also an area that could be improved.

Concerning "lifelong learning," responses suggest that our students do not seem to understand their professional obligation to continue education. More needs to be done in our curriculum to address the importance of continuing education and lifelong learning.

Concerning "frontiers in chemical engineering," our students at-large agree that they are being adequately exposed to a broad range of discipline-relevant technologies.

During this period, the Department Chair met with junior and senior students in informal debriefing sessions with an open and candid exchange forum. This is used to debrief students on their overall view of their experiences in the program and includes such topics as: Core program course experiences, Co-Op experiences, as well as experiences with the Math, Physics, Chemistry, and Biology courses. The Chair takes notes that are discussed with Faculty including the Undergraduate Program Coordinator (UPC) for further actions. In general, the students find their experiences satisfactory and rewarding; however the following items have been identified as key concerns during this reporting period:

a- The Department received some concern about the manner via which a course was conducted. The Chair in conversations with numerous students successfully worked with other Faculty and students and was able to successfully make adjustments.

b- As a follow-up to the concern expressed in point "a", the Department Chair worked with the Faculty of the Department and Coordinators to identify suitable mentoring opportunities that could benefit all Faculty.

c- Another useful action was to request the assistance of the Center for Teaching and Learning to provide hands-on training and guidance for Faculty desiring such training and in particular those identified by students with potential concerns in an effective communication with students.

d- Another feedback received via the BOA communication was the implementation of the capstone laboratory which was perceived as lacking rigor for student training. Therefore, the decision was made to hire an Adjunct Professor who in addition to having extensive knowledge in the implementation of process engineering approaches also has significant experience with control strategies and computational technology as a pilot experiment. The experiment was assessed via survey and direct communication between the Chair and the students.

Attachments:

Faculty Studies and Pedagogical Strategies of New and More Effective Learning Approaches

Goal/Objective/Outcome Number: Student Learning Outcomes a-k

Program Changes and Actions due to Results:

The transition of the process analysis (material and energy balances) course sequence from a second semester freshmen course (CHE 1510, 1 credit) and a first semester sophomore course (CHE 2011, 4 credits) to a sophomore level sequence for both courses at 3 credits each was underway. This transition was initiated due to deficiencies that were recognized through assessments of the senior-level process design course and in an effort to increase awareness of applications of chemical engineering fundamentals earlier in the curriculum. The process of moving the ethics course from a senior-level course (1 credit) to a freshmen-level course (1 credit) was initiated. This was implemented in an effort to offer ethics much earlier in the curriculum as issues (e.g., cheating) associated with ethical behavior were occurring.

Link to Assessment:

These changes were initiated per findings related to course level assessments of student learning outcomes within the curriculum.

Link to 'Tech Tomorrow' Strategic Plan: Efficiency and Effectiveness
Programs, Certificates, and Training

Monitoring of Retention and Diversity

Goal/Objective/Outcome Number: N/A

Program Changes and Actions due to Results:

Monitoring of Retention and Diversity: Statistics regarding such items as student retention and demographics are monitored. These statistics are also considered to be key indicators of the department's ABET-driven continuous improvement efforts but are not used as metrics to guide change.

The ChE department (effective Fall 2016) has nine full-time faculty including the Chair. Four of these faculty are female. This diverse faculty team energetically and enthusiastically works with a diverse student group. Per results from the TTU Office of Institutional Research, the CHE-BS enrollment over the last several years has hovered in the 25-30% range for female enrollment and includes students from multiple locations throughout TN and beyond including from other countries.

For first-time freshmen students majoring in CHE starting in the Fall 2015, the "first fall" to "first spring" retention rate was 94.3% (66 students retained in the program out of 70 total students entering the program) while the "first fall" to "second fall" retention rate was 81.4%. Source: "Retention Rates for First-Time Freshmen by Program: Fall 2015 Cohort" [Office of Institutional Research, May 15, 2017]

Link to Assessment:
N/A

Link to 'Tech Tomorrow' Strategic Plan: Diverse Faculty and Staff
Diversity
Efficiency and Effectiveness
Programs, Certificates, and Training

New Improvement to Assessment Plan Item

Improvements to Assessment Plan:
The assessment plan has remained unchanged from previous reporting years.