

AC 2007-2151: ASSESSMENT METHODS FOR A MECHANICAL ENGINEERING TECHNOLOGY PROGRAM

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Assessment Methods for a Mechanical Engineering Technology Program

Abstract

The Mechanical Engineering Technology (MET) program at the University of North Carolina at Charlotte recently underwent reaccreditation with the Technology Accreditation Commission ABET (TAC of ABET). This was the program's first reaccreditation activity under the outcomes based criteria, known informally as *TC2K*.

MET programs must demonstrate fulfillment of seven general criteria plus an eighth criteria specific to the discipline. During the reaccreditation process, two criteria, *Program Outcomes* and *Assessment and Evaluation*, occupied a disproportionate amount of time and resources. Program Outcomes consists of eleven units of knowledge or skill, known colloquially as *a through k*. Assessment and Evaluation involves assessment measures and documentation to show that objectives and outcomes are being met.

This paper summarizes the assessment methods and continuous improvement process employed during the recent reaccreditation of the MET program at the University of North Carolina at Charlotte. Details include specific measures designed to assess *a through k* skills, as well as the nuts and bolts of the continuous improvement process instituted as part of the reaccreditation activity.

Introduction

Beginning in the year 2000, the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC of ABET) instituted a major change to its accreditation process and criteria. Known informally as *TC2K*, the criteria for accreditation became outcomes based, rather than focusing on hard lists such as credit hours and course content¹.

In accordance with TAC of ABET's accreditation criteria document², engineering technology programs must satisfy seven general criteria plus an additional eighth criteria specific to the program area. Although each of the eight criteria is clearly important, there are two that often require a disproportionate effort on the part of the program's faculty to demonstrate that they have been satisfied³. They are Criterion 2 – *Program Outcomes*, and Criterion 3 – *Assessment and Evaluation*.

The Mechanical Engineering Technology (MET) program at the University of North Carolina at Charlotte, which is currently approaching 200 full time students, recently underwent TAC of ABET reaccreditation, its first under the outcomes based criteria. Although much work was done in many other areas, this paper summarizes the assessment methods and the continuous improvement process utilized to demonstrate fulfillment of ABET Criteria 2 and 3.

ABET Criterion 2 – Program Outcomes

ABET Criterion 2, Program Outcomes, consists of eleven units of knowledge or skill that students are expected to acquire during their time in the program. As these appear in the criteria document² in an alphabetized list, they have come to be known colloquially as *a through k*. To satisfy the criterion, a baccalaureate engineering technology program must demonstrate that graduates have:

- a. an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines,
- b. an ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology,
- c. an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes,
- d. an ability to apply creativity in the design of systems, components or processes appropriate to program objectives,
- e. an ability to function effectively on teams,
- f. an ability to identify, analyze and solve technical problems,
- g. an ability to communicate effectively,
- h. a recognition of the need for, and an ability to engage in lifelong learning,
- i. an ability to understand professional, ethical and social responsibilities,
- j. a respect for diversity and a knowledge of contemporary professional, societal and global issues, and
- k. a commitment to quality, timeliness, and continuous improvement.

As part of the accreditation process, programs must demonstrate that their graduates possess these skills and abilities. This is typically accomplished by various measures taken during the students' time in the program.

Assessment of some of these outcomes is naturally easier than others. For example, it's a fairly straight forward matter to determine if a student has the ability to identify, analyze and solve technical problems, or if he/she can conduct, analyze, and interpret experiments. However, it is a much thornier issue to demonstrate that graduates understand professional, ethical, and social responsibilities and recognize the need for lifelong learning.

Program Educational Objectives

As an early part of the process, the department developed a set of detailed program educational objectives (PEOs). Although the objectives are required to satisfy Criterion 1 (Program Educational Objectives), they are presented here due to their relation to the program outcomes of Criterion 2. The objectives are the result of an extensive long-range planning process, and are consistent with the university's institutional mission statement. They are:

1. Applying general and discipline-specific concepts and methodologies to identify, analyze, and solve technical problems

2. Articulating technical material in a professional manner to potentially diverse audiences and in a variety of circumstances
3. Contributing within team environments, demonstrating ethical, respectful and professional behavior in all associations
4. Recognizing and appreciating the environmental, societal and fiscal impact of the technical professions in a local, national and global context
5. Demonstrating an individual desire and commitment to pursue continuous self improvement and lifelong learning

Program Outcomes

Following the PEOs, the department developed six program outcomes, and then developed specific performance criteria for each outcome. The intent is for the outcomes to act as a bridge between the PEOs and the requirements of Criterion 2 (*a through k*). The outcomes describe the knowledge and skills of students at the time of their graduation from the program. The outcomes, along with their performance criteria, are:

1. Utilize appropriate tools to acquire data and analyze problems
 - i. Demonstrate the proper use of appropriate software to solve technical problems
 - ii. Use proper resources to obtain necessary information
 - iii. Operate discipline specific lab equipment
2. Demonstrate effective skills in the development and presentation of team projects
 - i. Exhibit effective team skills
 - ii. Present oral reports
 - iii. Produce a written report
 - iv. Complete assigned tasks in a timely manner
3. Exhibit knowledge and skills consistent with the expectations of a practicing engineering technologist
 - i. Take part in continued education and/or training
 - ii. Participate in appropriate activities or organizations or obtain relevant employment
 - iii. Perform tasks in a professional manner
4. Generate creative and realistic solutions to defined problems and projects
 - i. Solve structured technical problems
 - ii. Solve technical problems to satisfy a given set of specifications
 - iii. Develop alternate strategies to solve open-ended problems
5. Recognize the value of diversity, and identify ethical and societal issues in business and technical tasks
 - i. Exhibit the willingness to participate in a diverse group
 - ii. Discuss ethical and societal issues related to technology
6. Solve problems and design components, systems or processes appropriate to the discipline

- i. Analyze, design and implement using concepts in:
statics & strengths / dynamics / fluid mechanics / thermodynamics / instrumentation / machine design
- ii. Solve open-ended design problems in at least one area:
mechanical design / thermal sciences / fluids / electromechanical devices and controls / computer-aided engineering graphics

With the program outcomes and performance criteria developed, the next step was to establish a mapping to ABET Criterion 2 (*a through k*).

Assessment Planning Matrices – Mapping Program Outcomes to Criterion 2

To ensure that the program outcomes encompass the requirements of Criterion 2 (*a through k*), a systematic methodology for program assessment was developed. The first step was the mapping of each performance criteria to a Criterion 2 (*a through k*) competency. A check was then performed to ensure that each *a through k* competency was represented at least once as a primary mapping. The result of this work is shown in Table 1.

Table 1 – Criterion 2 Outcomes Mapped to Program Outcomes and Program Objectives

ABET Criterion 2	Program Outcome	Program Objective(s)
a	1i: <i>Demonstrate the proper use of appropriate software to solve technical problems</i>	1
	4i: <i>Solve structured technical problems</i>	1, 4
	6i: <i>Analyze, design and implement using concepts in: statics & strengths / dynamics / fluid mechanics / thermodynamics / instrumentation / machine design</i>	1
b	1ii: <i>Use proper resources to obtain necessary information</i>	1
c	1iii: <i>Operate discipline specific lab equipment</i>	1
d	4iii: <i>Develop alternate strategies to solve open-ended problems</i>	1, 4
	6ii: <i>Solve open-ended design problems in at least one area: mechanical design / thermal sciences / fluids / electromechanical devices and controls / computer-aided engineering graphics</i>	1
e	2i: <i>Exhibit effective team skills</i>	2, 3
f	4ii: <i>Solve technical problems to satisfy a given set of specifications</i>	1, 2
g	2ii: <i>Present oral reports</i>	2, 3
	2iii: <i>Produce a written report</i>	2, 3
h	3i: <i>Take part in continued education and/or training</i>	1, 2, 3, 4, 5
i	5ii: <i>Discuss ethical and societal issues related to technology</i>	3, 4, 5
j	3ii: <i>Participate in appropriate activities or organizations or obtain relevant employment</i>	1, 2, 3, 4, 5
	5i: <i>Exhibit the willingness to participate in a diverse group</i>	3, 4, 5
k	3iii: <i>Perform tasks in a professional manner</i>	1, 2, 3, 4, 5
	2iv: <i>Complete assigned tasks in a timely manner</i>	1, 3

The next step was to determine how each performance criterion would be measured. The faculty examined the MET curriculum and selected courses in which measures associated with a specific performance criterion could be effectively taken. A combination of laboratory experimentation, traditional classroom instruction, and courses that require projects were identified. For each course measurement, a student opportunity, in terms of an assignment, test question, laboratory result or observation, or a portion of a project, was explicitly defined. Care was taken to ensure that for each outcome, measures were taken from a variety of different sources, for example, a test question, a laboratory observation and a peer evaluation, rather than three different test questions.

This was effective for most performance criteria, and also most competencies within Criterion 2. But it was determined that the so-called soft skills, such as *a recognition of the need for, and an ability to engage in lifelong learning, and a respect for diversity and a knowledge of contemporary professional, societal and global issues*, could more effectively be assessed by surveys of current students, graduates, and employers.

The final step was to detail the exact assessment opportunity, strategy, tool(s), recording method, time of assessment, and data gathering responsibility for each performance criteria. The result of this work is an Assessment Planning Matrix for each of the six program outcomes.

The complete matrices are included in Appendix 1. The definitions of assessment tools used by the department are detailed in Appendix 2. The text of the targeted survey questions is provided in Appendix 3. Finally, Appendix 4 includes figures that illustrate the interrelationships between the five program educational objectives (PEOs), the six program outcomes and performance criteria, and the mapping to Criterion 2 (*a through k*).

As an illustrative example, program outcome 1, (*utilize appropriate tools to acquire data and analyze problems*) has three performance criteria. The first criteria (*demonstrate the proper use of appropriate software to solve technical problems*) is mapped to ABET competency (a) of Criterion 2 (*appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines*). The assessment is based on two projects from ETGR 3272 (Applied Numerical Methods), one in Matlab and another using Excel. The assessment strategy involves current students, and is observed and recorded by the instructor once per year.

ABET Criterion 3 – Assessment and Evaluation

Criterion 3 – Assessment and Evaluation, defines requirements for assessment measures used by engineering technology programs. The purpose of assessment and evaluation activities is to document that program objectives and outcomes are being met. The criteria document² states that:

Assessment measures typically consist of, but are not limited to, student portfolios, student performance in project work and activity-based learning; results of integrated curricular experiences; relevant nationally-normed examinations; results of surveys to assess graduate and employer satisfaction with employment, career development, career mobility, and job title; and preparation for continuing education.

In addition to laying out requirements for assessment, the criteria document also requires programs to demonstrate that assessment results are used in a formal continuous improvement process to further develop the program.

Assessment Acronyms

The MET program utilizes the centralized assessment process provided by the college of engineering (COE). The COE first began an integrated process of strategic planning, measurement, evaluation, and feedback in 1992, with the purpose of identifying continuous improvement opportunities. The principal components and their interactions are summarized in the Assessment Triad shown in Figure 1.

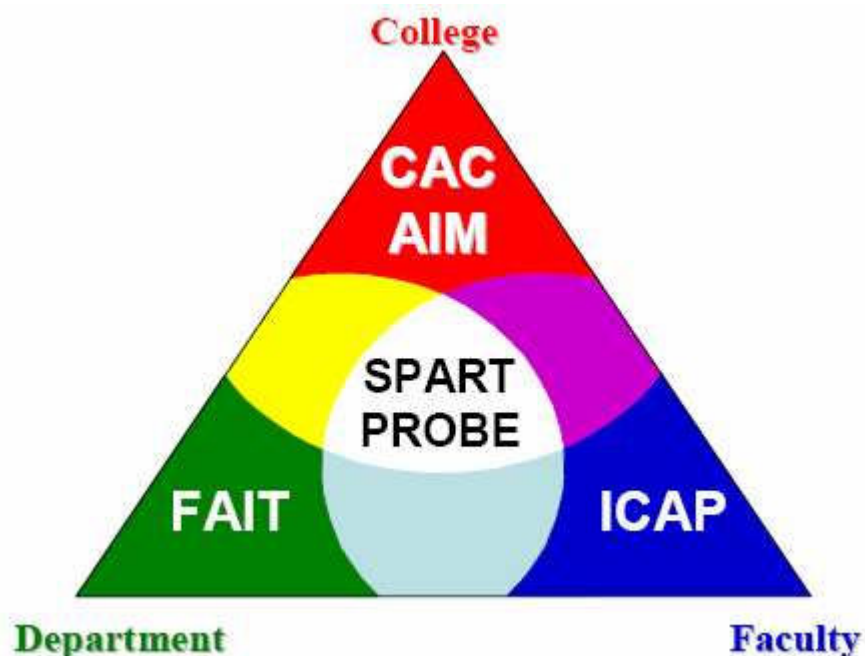


Figure 1 – Assessment Triad

As illustrated above, the continuous improvement process has a triad structure with components that overlap between college, department and individual faculty. The principal components of the triad are summarized as follows:

- | | |
|-------|--|
| CAC | College Administrative Committee – Weekly meetings that analyze progress and provide feedback to departments/units; (chairs, deans, other faculty/staff as needed) |
| AIM | Assessment and Improvement Meetings – Three yearly intensive assessment and planning workshops involving college leadership (chairs, deans, SPART as needed) |
| SPART | Strategic Planning and Assessment Resource Team – Continuous improvement guidance team composed of faculty and faculty associates; executes survey instruments |

PROBE	PRogram OBjective Evaluation – A team that evaluates academic program objectives within each department
FAIT	Focus Area Improvement Teams – Faculty groups reviewing subject area performance within departments/units.
ICAP	Individual Course Assessment Process – Documented review of performance criteria in selected courses.

SPART, FAIT, and ICAP

The components of the assessment triad that are of importance to Criterion 3 are SPART, FAIT, and ICAP.

SPART: The Strategic Planning and Assessment Resource Team (SPART) is the college-wide continuous improvement guidance team composed of a faculty representative from each department/unit, the Associate Dean for Academic Affairs and COE faculty associates from the Office of Student Development and Success (OSDS). This body is charged with development, refinement and implementation of COE planning and assessment tools. SPART is involved with the interpretation of data from these assessment tools and providing suggestions to department/units and/or the college on areas of concern with respect to continuous improvement of program objectives, student learning outcomes and progress towards other strategic goals.

FAIT: Faculty from MET, as well as other disciplines within the department, participate in Focus Area Improvement Team (FAIT) activities. FAIT has the responsibility for program curriculum and courses. Multiple FAIT teams exist within the department, specializing either within the specific discipline, or in other areas such as freshman courses, communication courses, and courses common to multiple engineering technology disciplines. The teams are responsible for monitoring, assessing, and suggesting and implementing changes for continuous improvement in the specific focus area. The goal of each FAIT is to ensure that appropriate topics are covered in a complete and orderly manner, and that all prerequisite and co-requisite requirements are met. Teams are also responsible for maintaining the description of these courses on the website, as well as updating the latest copy of the catalog. FAIT teams are required to meet on a regular basis and to report their recommendations to the department and chair. A sample FAIT report form is included in Appendix 5.

ICAP: Course enhancement is achieved through the Individual Course Assessment Process (ICAP). This process provides the foundation for reviewing and improving course content, ensuring continuity, promoting course enhancements, and identifying areas of deficiency. ICAP also provides a framework for sharing this information among faculty that teach the same course(s). As originally conceived, ICAP forms were sent to instructors of courses targeted for measures based on the assessment planning matrices (Appendix 1). The forms were provided along with the previous semester's recommendations for course improvement or enhancement. The current instructor is then responsible for providing the status of the previous recommendation(s), the performance with respect to the defined measure, the sample size, and any recommendations or observations from the current semester.

Based on the early success of the ICAP process, it was expanded to include assessment and recommendations for every course taught in the department, not just those targeted for measures based on the assessment planning matrices. This enhanced analysis of all courses is intended to promote constant focus on course improvement and capture enhancements that routinely occur within each teaching of a specific course.

This procedure maintains a written record of the course history, ensures that learning outcomes are addressed, and provides a concrete strategy for continuous improvement. All ICAP reports are archived in a database that is maintained at the departmental level, with college level technical support. The contents of the ICAP forms are compiled and provided to the responsible FAIT in terms of program outcome, Criterion 2 outcome, and/or course designation. A sample ICAP form is shown in Appendix 6.

In addition to the ICAP form, specific checklists have been developed for evaluation of oral and written submissions. These checklists provide consistency in the evaluation of student work and a common reference for interdisciplinary efforts within the department. Sample Oral Presentation Evaluation and Written Assignment Evaluation forms are included in appendices 7 and 8 respectively.

Putting It All Together

Although this paper discusses the department's experience in satisfying two separate accreditation criteria (2 & 3), the accreditation activities are closely related when considered in summary. To satisfy ABET Criteria 2 and 3, the department:

- Established a set of five program educational objectives (PEOs) consistent with the mission of the university, the college, the department, and ABET accreditation requirements.
- Developed six program outcomes that describe the knowledge and skills of students at the time of graduation from the program. Additionally developed specific performance criteria for each outcome to be utilized in the assessment process.
- Mapped the performance criteria from the program outcomes to ABET Criterion 2 (*a through k*).
- Developed metrics for measurement of each performance criterion, either through individual course assessments (ICAP) or surveys of current students, graduates, and employers.
- Established a continuous improvement process* that allows the curriculum and course content to be critically evaluated on a routine basis (SPART, FAIT, and ICAP).

* Readers interested in additional information on the department's continuous improvement process are referred to reference 4.

Conclusion

This paper has focused on the assessment methods employed as part of the recent reaccreditation of the mechanical engineering technology program at the University of North Carolina at Charlotte. These methods have been presented with the hopes that they may be useful to other programs preparing for an accreditation or reaccreditation activity. Readers are encouraged to contact the authors for additional information about the reaccreditation activities, electronic versions of documents, or other general inquiries.

Bibliography

1. Neff, Gregory, Scachitti, Susan, and Zahraee, Mohammad, *Continuous Improvement of Engineering Technology Programs – Coming Soon to a University Near You*, Proceedings of the 2000 American Society for Engineering Education Conference, 2000
2. Criteria for Accrediting Engineering Technology Programs, Technology Accreditation Commission, ABET, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202, Telephone: 410-347-7700
3. Sarin, Sanjiv, *A Plan for Addressing ABET Criteria 2000 Requirements*, Proceedings of the 2000 American Society for Engineering Education Conference, 2000
4. Cottrell, David, Gehrig, Bruce, Brizendine, Anthony, *A Successful Working Model for Continuous Improvement*, Proceedings of the 2006 American Society for Engineering Education Conference, 2006

Appendix 1 - Assessment Planning Matrices

Program Outcome 1: Use appropriate tools to acquire data and analyze problems.

Performance Criteria	MAP	Student Opportunity	Assessment Strategy	Assessment Tool(s) and Recording Method*	When Assess?	Assessment Responsibility
What characteristics, skills, knowledge, attitudes, and/or values will the student exhibit so you will know you have achieved the desired objective?	a-k	What is done to provide students the opportunity to achieve, practice, and/or demonstrate the performance criteria? Be specific	Program Outcomes: Current Students Educational Objectives: Graduates & Alumni Employers	What assessment tool(s) are you using/going to use to gather evidence of performance criteria and what is the method of formally recording results?	When are you going to conduct the assessment?	Who is going to collect the assessment data?
i. Demonstrate the proper use of appropriate software to solve technical problems	a	ETGR3272: Project (Excel) ETGR3272: Project (Matlab)	Current Students Current Students Alumni Employers	Performance Appraisal → ICAP Performance Appraisal → ICAP Employer Survey (Q19) → Database	Once per semester Once per semester Every 3 years	Course instructor Course instructor OSDS Staff
ii. Use proper resources to obtain necessary information	b	ETME3242: Final Project ETME3151: Lab Report	Current Students Current students Alumni Employers	Reference Review → ICAP Written Assignment Evaluation → ICAP Employer Survey (Q18) → Database	Once per semester Once per semester Every 3 years	Course instructor Course instructor OSDS Staff
iii. Operate discipline specific lab equipment	c	ETME3251: Lab Experiment	Current Students Graduates Alumni Employers	Performance Appraisal → ICAP Graduate Survey (Q13) → Database Employer Survey (Q9) → Database	Once per semester Every 3 years Every 3 years	Course instructor OSDS Staff OSDS Staff

*ICAP forms will be regularly reviewed by the FAIT

Program Outcome 2: Demonstrate effective skills in the development and presentation of team projects.

Performance Criteria	MAP	Student Opportunity	Assessment Strategy	Assessment Tool(s) and Recording Method*	When Assess?	Assessment Responsibility
What characteristics, skills, knowledge, attitudes, and/or values will the student exhibit so you will know you have achieved the desired objective?	a-k	What is done to provide students the opportunity to achieve, practice, and/or demonstrate the performance criteria? Be specific	Program Outcomes: Current Students Educational Objectives: Graduates & Alumni Employers	What assessment tool(s) are you using/going to use to gather evidence of performance criteria and what is the method of formally recording results?	When are you going to conduct the assessment?	Who is going to collect the assessment data?
i. Exhibit effective team skills	e	ETME3113: Team Project	Current Students Graduates Alumni Employers	Peer Evaluation → ICAP Graduate Survey (Q15) → Database Employer Survey (Q11) → Database	Once per semester Every 3 years Every 3 years	Course instructor OSDS Staff OSDS Staff
ii. Present oral reports	g	ETME3242: Oral reports ETME 3152: Oral reports	Current Students Current Students Graduates Alumni Employers	Oral Presentation Evaluation → ICAP Oral Presentation Evaluation → ICAP Graduate Survey (Q18) → Database Employer Survey (Q14) → Database	Once per semester Once per semester Every 3 years Every 3 years	Course instructor Course instructor OSDS Staff OSDS Staff
iii. Produce a written report	g	ETME3242: Final reports ETME 3252: Lab reports	Current Students Current Students Graduates Alumni Employers	Written Assignment Evaluation → ICAP Written Assignment Evaluation → ICAP Graduate Survey (Q18) → Database Employer Survey (Q14) → Database	Once per semester Once per semester Every 3 years Every 3 years	Course instructor Course instructor OSDS Staff OSDS Staff
iv. Complete assigned tasks in a timely manner	k	ETGR 3071: Homework	Current Students Alumni Employers	Written Assignment Evaluation → ICAP Employer Survey (Q22) → Database	Once per semester Every 3 years	Course instructor OSDS Staff

*ICAP forms will be regularly reviewed by the FAIT

Program Outcome 3: Exhibit knowledge and skills consistent with the expectations of a practicing engineering technologist.

Performance Criteria	MAP	Student Opportunity	Assessment Strategy	Assessment Tool(s) and Recording Method*	When Assess?	Assessment Responsibility
What characteristics, skills, knowledge, attitudes, and/or values will the student exhibit so you will know you have achieved the desired objective?	a-k	What is done to provide students the opportunity to achieve, practice, and/or demonstrate the performance criteria? Be specific	Program Outcomes: Current Students Educational Objectives: Graduates & Alumni Employers	What assessment tool(s) are you using/going to use to gather evidence of performance criteria and what is the method of formally recording results?	When are you going to conduct the assessment?	Who is going to collect the assessment data?
i. Take part in continued education and/or training	h	Professional Societies / Educational Exchange / Co-ops, OSDS, Internships	Current Students Graduates Alumni Employers	Student Survey (Q21) → Database Graduate Survey (Q20) → Database Employer Survey (Q16) → Database	Every 3 years Every 3 years Every 3 years	OSDS Staff OSDS Staff OSDS Staff
ii. Participate in appropriate activities or organizations or obtain relevant employment	j	Professional Societies, Service organizations, OSDS, Recruiting activities, tutoring, SOAR, co-op, internship, employment while a student	Current Students Current Students Graduates	Student Survey (Q16-18) → Database Senior Exit Survey (A6) → Database Graduate Survey (Q20, 29) → Database	Once per semester Once per semester Every 3 years	OSDS Staff Program Coordinator OSDS Staff
iii. Perform tasks in a professional manner	k	ETME3242: Senior project ETME3242: Senior project	Current Students Current Students Alumni Employers	Written Assignment Evaluation → ICAP Oral Presentation Evaluation → ICAP Employer Survey (Q20) → Database	Once per semester Once per semester Every 3 years	Course instructor Course instructor OSDS Staff

*ICAP forms will be regularly reviewed by the FAIT

Program Outcome 4: Generate creative and realistic solutions to defined problems and projects.

Performance Criteria	MAP	Student Opportunity	Assessment Strategy	Assessment Tool(s) and Recording Method*	When Assess?	Assessment Responsibility
What characteristics, skills, knowledge, attitudes, and/or values will the student exhibit so you will know you have achieved the desired objective?	a-k	What is done to provide students the opportunity to achieve, practice, and/or demonstrate the performance criteria? Be specific	Program Outcomes: Current Students Educational Objectives: Graduates & Alumni Employers	What assessment tool(s) are you using/going to use to gather evidence of performance criteria and what is the method of formally recording results?	When are you going to conduct the assessment?	Who is going to collect the assessment data?
i. Solve structured technical problems	a	ETGR3171: Test Question	Current Students Graduates Alumni Employers	Performance Appraisal → ICAP Graduate Survey (Q12) → Database Employer Surveys (Q8) → Database	Once per semester Every 3 years Every 3 years	Course instructor OSDS Staff OSDS Staff
ii. Solve technical problems to satisfy a given set of specifications	f	ETME3213: Hwk problem	Current Students Graduates Alumni Employers	Performance Appraisal → ICAP Graduate Survey (Q16) → Database Employer Survey (Q12) → Database	Once per semester Every 3 years Every 3 years	Course instructor OSDS Staff OSDS Staff
iii. Develop alternate strategies to solve open-ended problems	d	ETME3242: Senior Project	Current Students Graduates Alumni Employers	Oral Presentation Evaluation → ICAP Graduate Survey (Q14) → Database Employer Survey (Q10) → Database	Once per semester Every 3 years Every 3 years	Course instructor OSDS Staff OSDS Staff

*ICAP forms will be regularly reviewed by the FAIT

Program Outcome 5: Recognize the value of diversity, and identify ethical and societal issues in business and technical tasks.

Performance Criteria	MAP	Student Opportunity	Assessment Strategy	Assessment Tool(s) and Recording Method*	When Assess?	Assessment Responsibility
What characteristics, skills, knowledge, attitudes, and/or values will the student exhibit so you will know you have achieved the desired objective?	a-k	What is done to provide students the opportunity to achieve, practice, and/or demonstrate the performance criteria? Be specific	Program Outcomes: Current Students Educational Objectives: Graduates & Alumni Employers	What assessment tool(s) are you using/going to use to gather evidence of performance criteria and what is the method of formally recording results?	When are you going to conduct the assessment?	Who is going to collect the assessment data?
i. Exhibit the willingness to participate in a diverse group	j	ETME3113: Team Project	Current Students Graduates Alumni Employers	Senior Exit Survey (A21) → Database Graduate Survey (Q15) → Database Employer Survey (Q11) → Database	Once per semester Every 3 years Every 3 years	Program Coordinator OSDS Staff OSDS Staff
ii. Discuss ethical and societal issues related to technology	i	ETGR3071: HW Problem	Current Students Graduates Alumni Employers	Performance Appraisal → ICAP Graduate Survey (Q19) → Database Employer Survey (Q15) → Database	Once per semester Every 3 years Every 3 years	Course instructor OSDS Staff OSDS Staff

*ICAP forms will be regularly reviewed by the FAIT

Program Outcome 6: Solve problems and design components, systems or processes appropriate to the discipline.

Performance Criteria	MAP	Student Opportunity	Assessment Strategy	Assessment Tool(s) and Recording Method*	When Assess?	Assessment Responsibility
Technology Criteria 2000 – Program Criteria <i>Criteria for Accrediting Engineering Technology Programs, 2003-04, p47</i>	a-k	What is done to provide students the opportunity to achieve, practice, and/or demonstrate the performance criteria? Be specific	Program Outcomes: Current Students Educational Objectives: Graduates & Alumni Employers	What assessment methods are you using/going to use to gather evidence of performance criteria?	When are you going to conduct the assessment?	Who is going to collect the assessment data?
i. Analyze, design and implement using concept s in: 1. statics & strengths 2. dynamics 3. fluid mechanics 4. thermodynamics 5. instrumentation 6. machine design	a	1. ETME 3123: Hwk problem 2. ETME 3113: Hwk problem 3. ETME 3133: Hwk problem 4. ETME 3143: Hwk problem 5. ETME 3163: Hwk problem 6. ETME 3213: Hwk problem	Current Students Current Students Current Students Current Students Current Students Current Students	Observation→ ICAP Observation→ ICAP Observation→ ICAP Observation→ ICAP Observation→ ICAP Observation→ ICAP	Once per semester Once per semester Once per semester Once per semester Once per semester Once per semester	Course instructor Course instructor Course instructor Course instructor Course instructor Course instructor
ii. Solve open-ended design problems in at least one area: - mechanical design - thermal sciences - fluids - electromechanical devices and controls - computer-aided engineering graphics	d	ETME3242: Final Report	Current Students Graduates Alumni Employers	Written Assignment Evaluation→ ICAP Graduate Survey (Q14) → Database Employer Survey (Q10) → Database	Once per semester Every 3 years Every 3 years	Course instructor OSDS Staff OSDS Staff

*ICAP forms will be regularly reviewed by the FAIT

Appendix 2 – Definition of Assessment Tools

Archival Records: Biographical, academic, or other file data available from college – e.g., GRE scores, professional society attendance, etc.

Evaluation: A quantitative representation of skill(s) and/or knowledge through the use of selected questions on the Oral Presentation Evaluation and/or Written Assignment Evaluation forms. The Written Assignment Evaluation is restricted to the use of the instructor or grader for the course, while the Oral Presentation Evaluation may be used to receive information for instructor, external evaluator and peer evaluation information.

Exit Interview: Specific questions that ask individuals to share their perceptions about the target of study – e.g., their own skills/attitudes, skills and attitudes of others, or program qualities – in a face to face dialog with an interviewer.

External Evaluator: Any non-student participant in the evaluation process. An external evaluator may be a department, college or university faculty member, a member of the advisory committee, or an industrial representative who has agreed to serve in this capacity.

Observation: Direct observation of student skills in a laboratory or classroom setting. Observation measurements involve a binary (yes/no) assessment of student performance for a particular action while performing a particular task to be defined by all faculty involved in course instruction.

Peer Evaluator: Any student participant in the evaluation process who is enrolled in the course. A peer evaluation may be performed to assess teamwork skills of teammates and/or may provide feedback on individual and/or team presentations.

Performance Appraisal: Subjective analysis of skill(s) and/or knowledge through consideration of student submission. The appraisal may be performed by the faculty member teaching the course, or may be performed by a party external to course instruction. Subject to agreement by all faculty responsible for teaching a particular course, appraisal may be binary (e.g., yes/no), or involve multiple achievement levels, or “bins” (e.g., a three bin appraisal may involve exemplary, satisfactory, unsatisfactory).

Reference Review: A qualitative analysis of the number, type and value of resources to be defined by instructors teaching relevant courses.

Survey: Specific questions on written questionnaires that ask individuals to share their perceptions about the study target – e.g., their own or others’ skills/attitudes/behavior, or program/course qualities and attributes. Departmental and/or college surveys will be given to three distinct populations:

- Alumni: All department alumni are surveyed every three years
- Employer: Employers of departmental alumni are surveyed every three years
- Senior Exit: Before graduation, seniors meet individually with the discipline coordinator
- Student: Current students are given annual surveys

Appendix 3 – Survey Questions

Alumni

- Q12 Apply knowledge of mathematics, science, and engineering.
- Q13 Design and conduct statistically valid experiments and analyze and interpret data.
- Q14 Design systems, components, or processes to meet desired needs.
- Q15 Work effectively in teams composed of people with a variety of skills and backgrounds.
- Q16 Identify, formulate, and solve technical problems.
- Q18 Communicate effectively in both oral and written forms.
- Q19 Evaluate the impact of my technical solutions in a global and societal context.
- Q20 Remain technically competent and competitive by engaging in life-long learning.
- Q29 I have pursued other opportunities for learning and professional development since graduating from UNC Charlotte.

Employer

- Q8 Apply knowledge of mathematics, science, and engineering.
- Q9 Design and conduct statistically valid experiments and analyze and interpret data.
- Q10 Design systems, components, or processes to meet desired needs.
- Q11 Work effectively in teams composed of people with a variety of skills and backgrounds.
- Q12 Identify, formulate, and solve technical problems.
- Q14 Communicate effectively in both oral and written forms.
- Q15 Evaluate the impact of technical solutions in a global and societal context.
- Q16 Remain technically competent and competitive by engaging in life-long learning.
- Q18 Use the techniques, skills, and modern tools necessary for professional practice.
- Q19 Have adequate computer skills.
- Q20 Demonstrate business-related skills in addition to technical skills.
- Q22 Are organized and manage their time well.

Senior Exit

- A6 Were you ***actively*** involved with at least one student organization while in college?
- A21 Work effectively in teams composed of people with a variety of skills and backgrounds.
- A28 Use the techniques, skills, and modern tools necessary for professional practice.

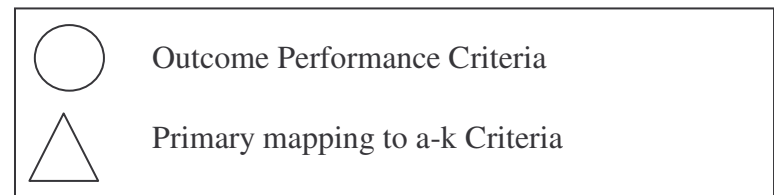
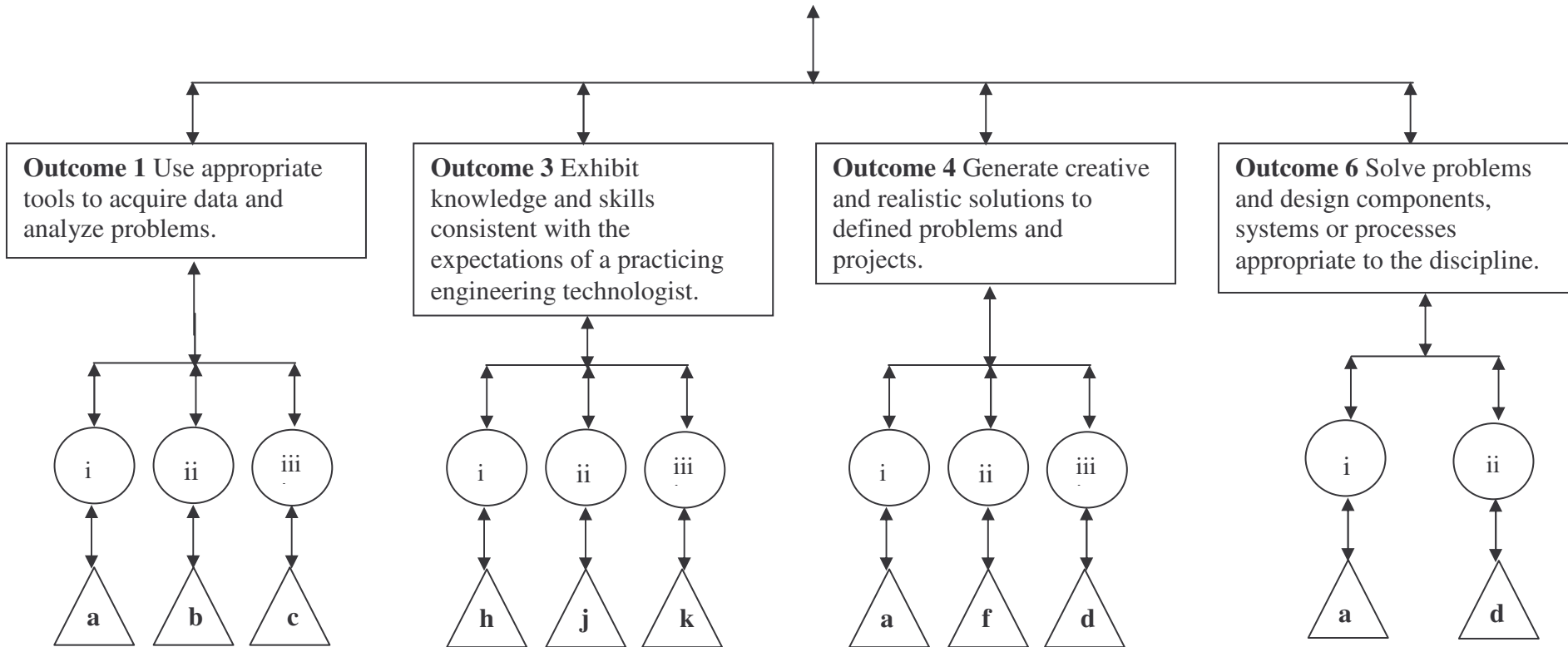
Student

- Q16 I have participated in or intend to participate in a co-op.
- Q17 I have participated in or intend to participate in a 49ership (internship).
- Q18 I have participated in or intend to participate in an international exchange or study abroad program.

Appendix 4 – Interrelationships

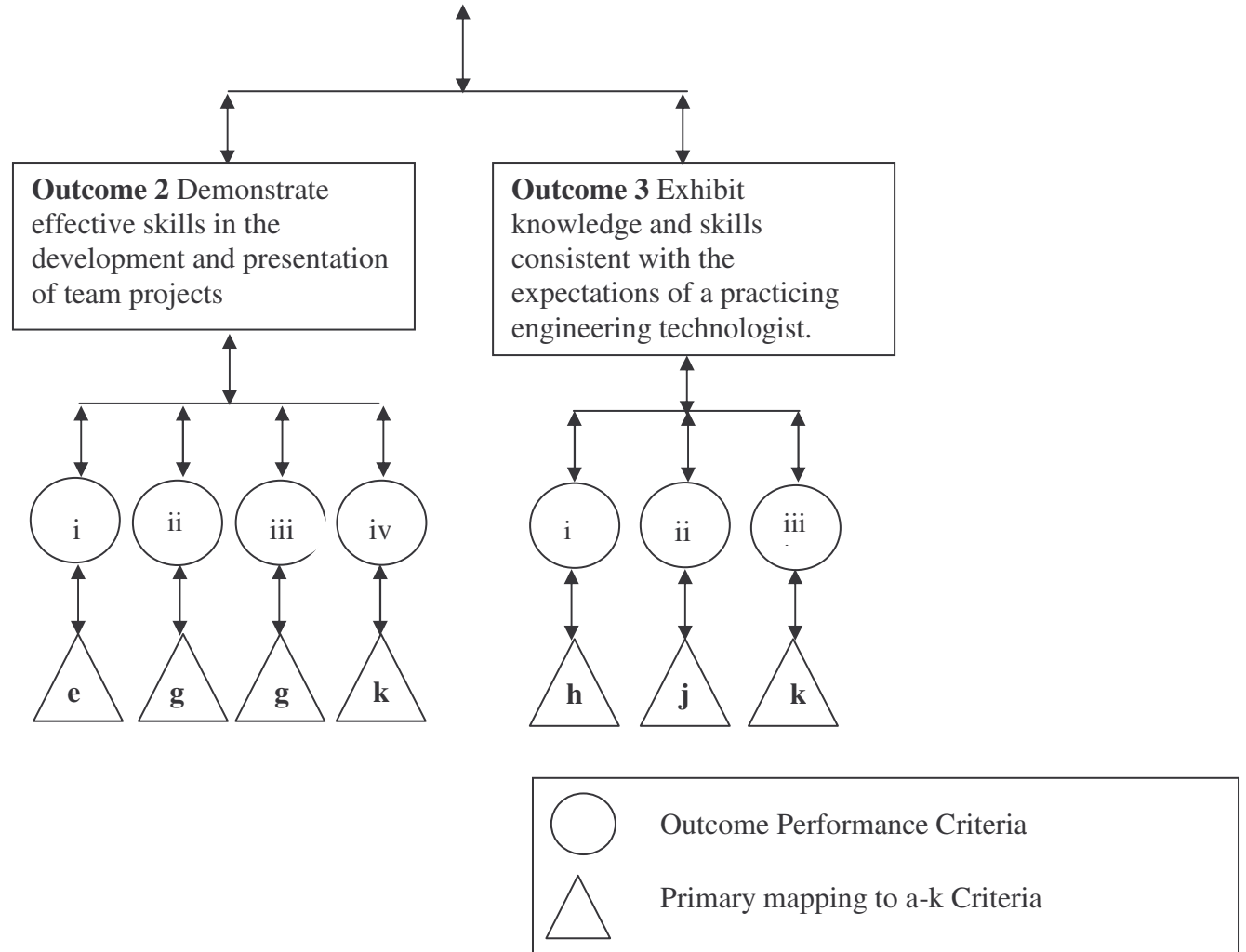
Objective 1

Applying general and discipline-specific concepts and methodologies to identify, analyze, and solve technical problems.



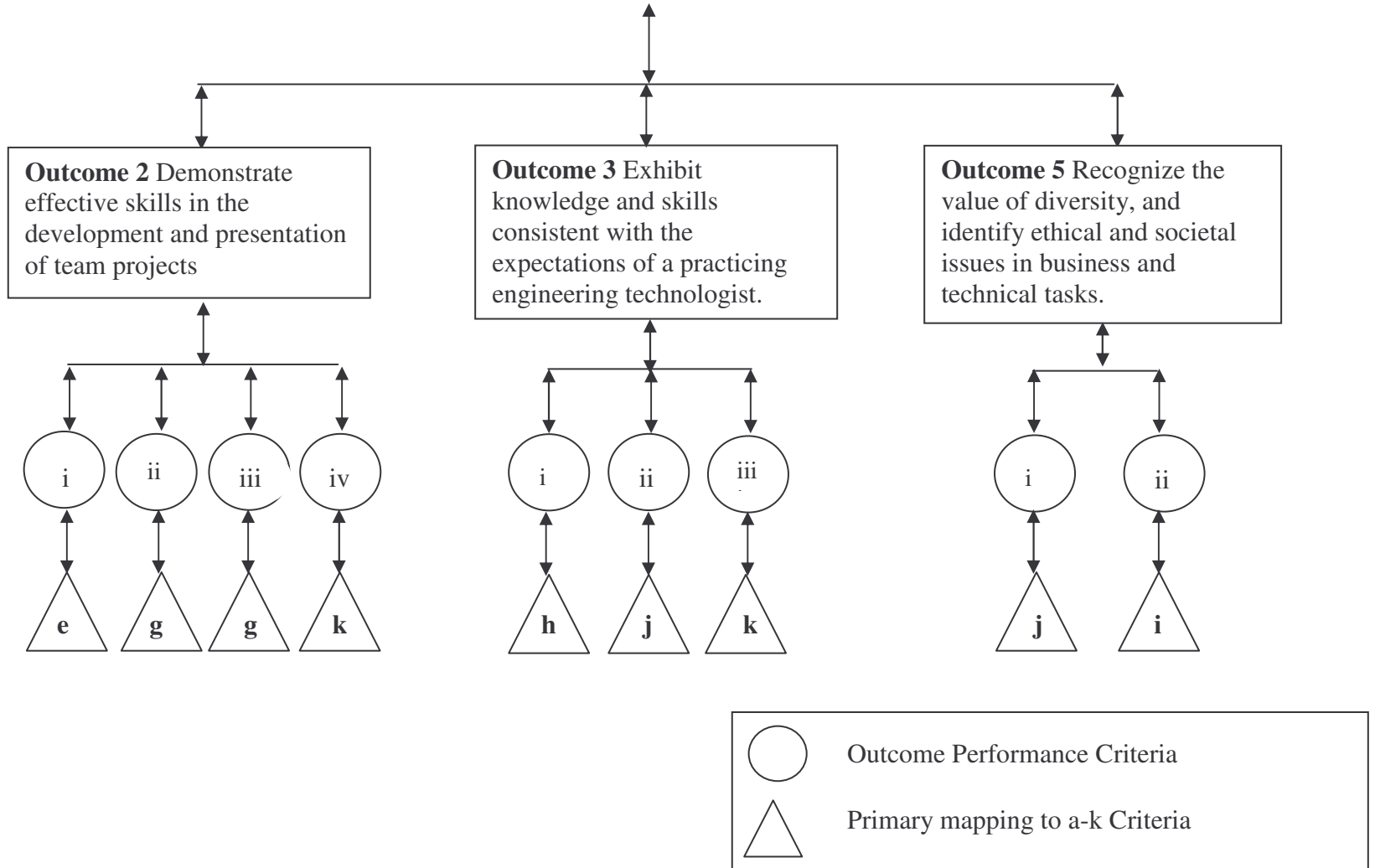
Objective 2

Articulating technical material in a professional manner to potentially diverse audiences and in a variety of circumstances.



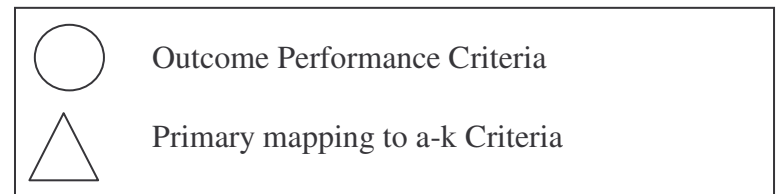
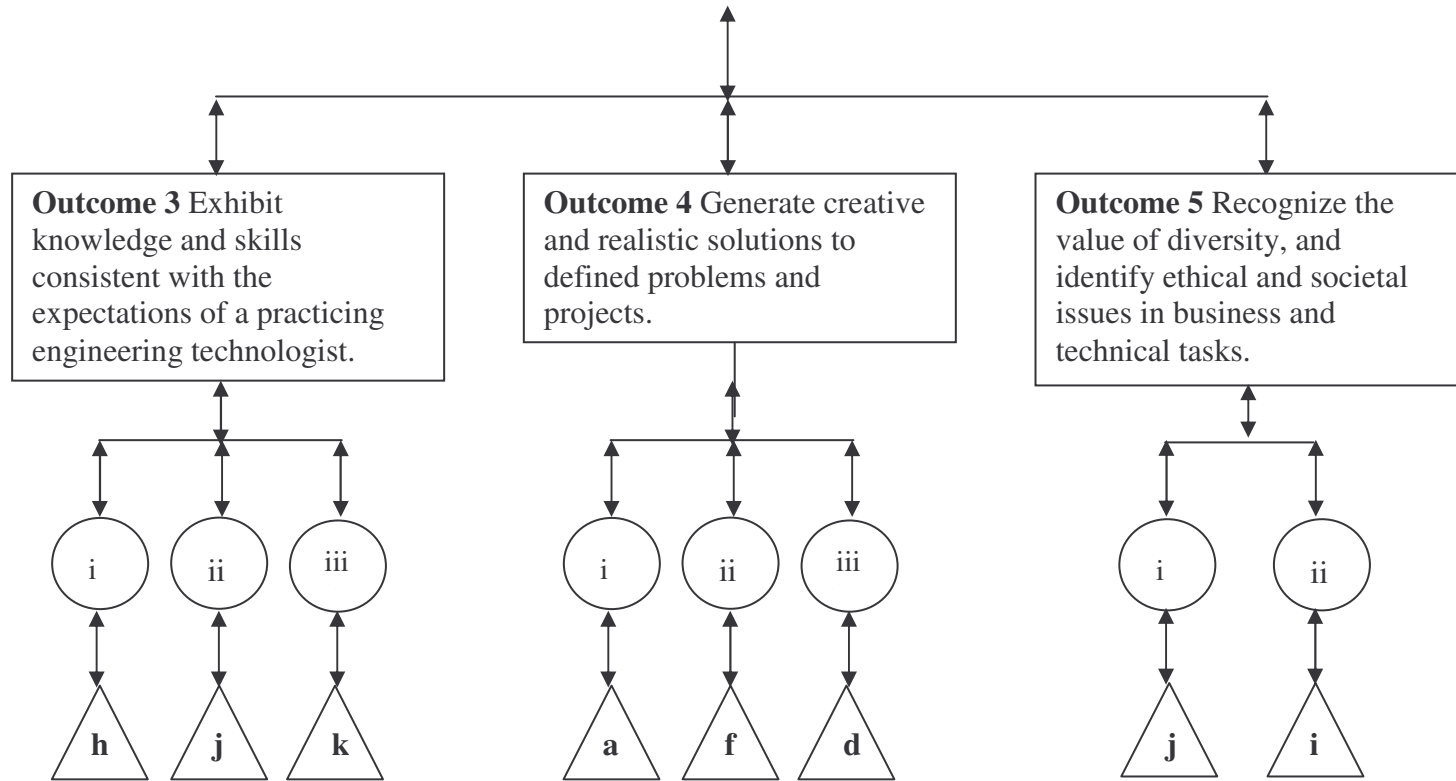
Objective 3

Contributing within team environments, demonstrating ethical, respectful and professional behavior in all associations.



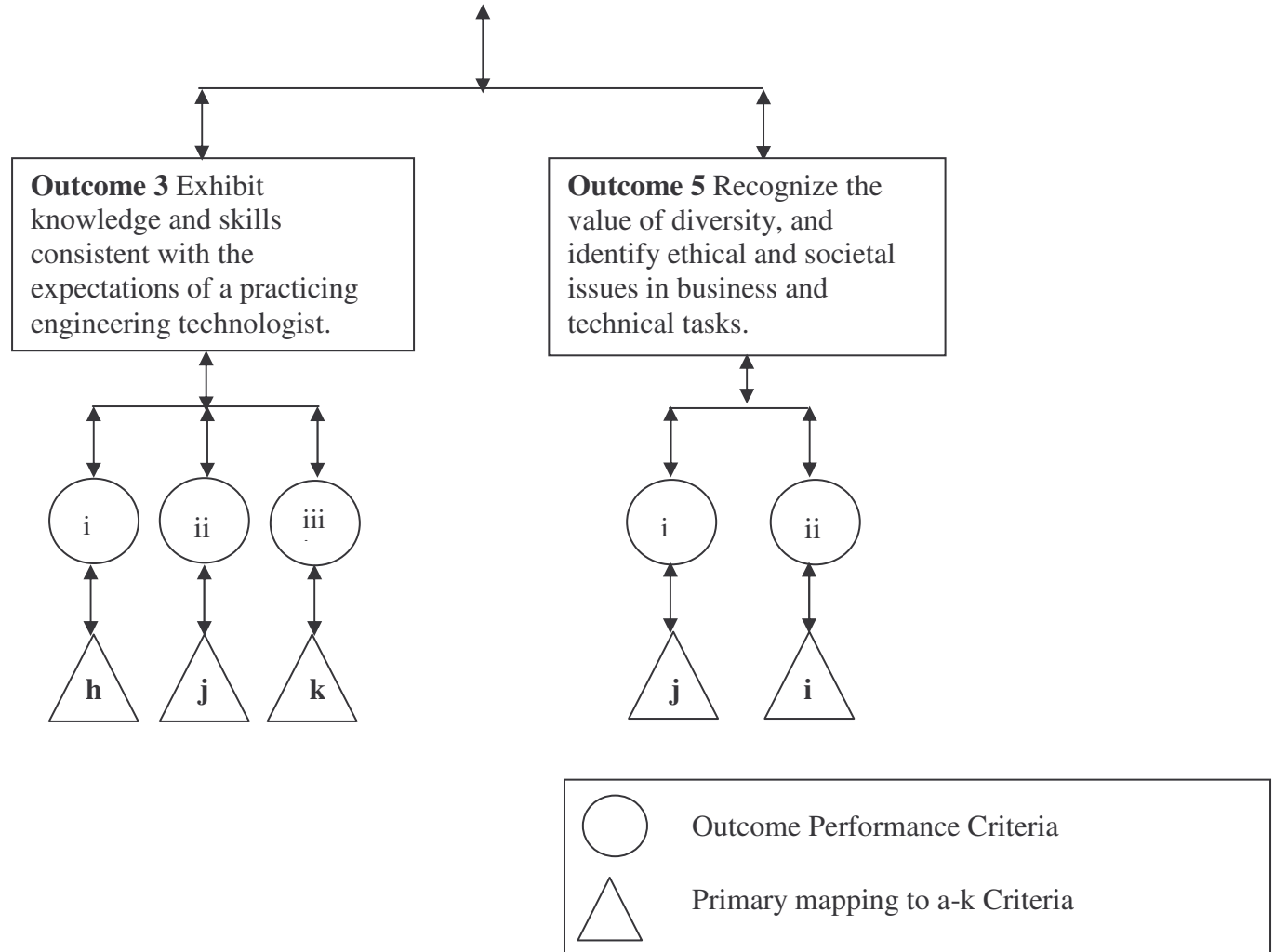
Objective 4

Recognizing and appreciating the environmental, societal and fiscal impact of the technical professions in a local, national and global context.



Objective 5

Demonstrating an individual desire and commitment to pursue continuous self-improvement and lifelong learning.



Appendix 5 – Sample FAIT Report Form

<p>THE WILLIAM STATES LEE COLLEGE OF ENGINEERING</p> <p>FOCUS AREA IMPROVEMENT TEAM (FAIT) REPORT</p> <p style="text-align: center;">for</p> <p style="text-align: center;">_____</p> <p style="text-align: center;">(FAIT Name)</p>			
FAIT PURPOSE/CHARGE:			
Meeting Date: _____			
Members Attending: _____			

<p>Assessment Results Reviewed Today by FAIT (check all that apply)*:</p> <p>_____ Individual Course Learning Outcomes** for (list courses): _____</p> <p>_____ Freshman Engineering Learning Outcomes** _____ MAPS Program Results (SI and Mentoring)</p> <p>_____ Change of Major Survey Results _____ Retention Trends</p> <p>_____ Experiential Learning Trends _____ Graduating Senior Survey Results**</p> <p>_____ FE Exam Results _____ Other (please specify): _____</p> <p>_____ Annual SPART Survey Results** _____</p> <p style="padding-left: 20px;">_____ Student</p> <p style="padding-left: 20px;">_____ Faculty</p> <p style="padding-left: 20px;">_____ Alumni</p> <p style="padding-left: 20px;">_____ Employer</p> <p>Course Syllabi Reviewed Today by FAIT: _____</p> <p><small>*Most of these assessment results are available on the SPART website at http://www.coe.uncc.edu/faculty_staff/SPART.</small></p> <p><small>**These results also include ABET A-K criteria.</small></p>			
What is the status of recommendations and/or action items from the last FAIT meeting?			
What other activities, if any, were undertaken related to this area since the last FAIT meeting?			
What did the team's review of the assessment results reveal today?			
What changes are recommended and/or planned by FAIT as a result of these assessment findings?			
Changes Recommended	Lead Responsibility	Target Date	Comments/Notes
What changes, if any, should be made to improve the assessment process?			
Other action items for the next FAIT meeting:			
Action Item	Lead Responsibility	Target Date	Comments/Notes
The next FAIT meeting is scheduled for:			

Appendix 6 – Sample ICAP Form

ICAP Data Entry Form

Course	ETME 3123
Course Title	Strength of Materials
Department	ETME
ABET Criterion	a Demonstrate an appropriate mastery of the knowledge, techniques, skills, and modern tools of their disciplines
Performance Criterion	6i Analyze and implement using concepts in six defined areas
Measure Code	HP Selected homework problem
Frequency	Once per semester
Section	All
Instructor	Greg Watkins
Semester	Fall 2003
<i>*Sample Size</i>	<i>30</i>
Target Performance	75%
<i>*Actual Performance</i>	<i>76.7%</i>
<i>*Measure Description</i>	Percentage of students who demonstrate the correct approach to the targeted homework problem Performance Criteria 6i(1): Statics & strengths
Previous Semester:	1 st time assessment was done
<i>*Status of Previous Semester's Recommendations:</i>	<i>N/A</i>
<i>*Current Semester</i>	Although target was met, actual performance can still improve. Suggest more attention to problem solving techniques, including additional in-class examples. Increase target to 85%.

**Faculty must report results for items in red italics.
2/10/2004*

Page 1 of 1

Appendix 7 –Sample Oral Presentation Evaluation Form

Oral Presentation Evaluation

Course: _____ Semester: _____ Student Name(s): _____

Evaluator: Are you a student____, external evaluator____ or instructor____?

Please rate your level of agreement with each of the following statements using the rating scale below.

A=1	B=2	C=3	D=4	E=5
TOTALLY DISAGREE	DISAGREE	NEUTRAL	AGREE	TOTALLY AGREE

1. _____ The presentation topic and/or area of emphasis were clearly articulated.
2. _____ The presentation effectively communicated the scope, relevance and importance of the research. (*Outcome 2,ii*)
3. _____ Relevant concepts and theories were introduced and discussed (as appropriate).
4. _____ A structured design process and/or decision strategy was evident (as appropriate). (*Outcome 4, iii*)
5. _____ The student(s) answered questions completely, coherently and professionally.
6. _____ The presentation was professional (attire, content, and format). (*Outcome 3,iii*)
7. _____ Visual presentation components were relevant and professional.
8. _____ The student(s) were well prepared and showed a thorough knowledge of the topic.
9. _____ (If a team project presentation) The presentation effectively demonstrated a concerted team effort. (*Outcome 2, i*)
10. _____ Overall, this was an excellent presentation.

Comments: _____

STUDENTS: On a scale of 1 to 10 (10 highest) rate each of your team members on:

11. the effectiveness of his/her team skills.
 (Name) _____ (Score) _____
 (Name) _____ (Score) _____
 (Name) _____ (Score) _____
12. the completeness and timeliness of assigned tasks.
 (Name) _____ (Score) _____
 (Name) _____ (Score) _____
 (Name) _____ (Score) _____

Appendix 8 – Sample Written Assignment Evaluation Form

Written Assignment Evaluation

Course: _____ Semester: _____ Student Name(s): _____

Format and Submission Criteria: Did the student(s)

1. ____ submit the assignment on time and to the correct location?
(*Outcome 2, iv*)
2. ____ format the document appropriately?
3. ____ correctly identify figures, tables, etc.?
4. ____ have no spelling, punctuation, or grammatical errors?
5. ____ write in the appropriate voice? NOTE: Voice and person are to be specified, and must be maintained throughout the assignment.

Assignment Criteria: Did the student(s)

6. ____ produce a complete and effective written report? (*Outcome 2, iii*)
7. ____ provide a logical, coherent and concise overview of the entire project?
8. ____ clearly articulate any requirements and constraints?
9. ____ effectively use figures, graphs and tables (as appropriate) to make key points *and discuss* relevant results?
10. ____ summarize the entire report in the conclusion, explain behavior with respect to original specifications and provide relevant recommendations? (*Outcome 4, ii*)
11. ____ present work in a manner befitting the target audience, i.e., professionally, logically and coherently? (*Outcome 3, iii*)
12. ____ include a complete and appropriately formatted reference list?
(*Outcome 1, ii*)

Other Criteria (As appropriate):

13. ____ A complete description of how the design was completed, i.e., what assumptions and/or approximations were made and the methodology used to reach the optimum solution was provided in the report. (*Outcome 6, ii: ELET & MEET*)
14. ____ Anticipated concerns in the physical implementations of the final design and possible modifications that may be required were discussed.
15. ____ The submission effectively demonstrated a concerted team effort. (*Outcome 2, i*)
16. ____ The report discusses ethical and societal issues related to technology. (*Outcome 5, ii*)

Report Grade: _____

English Grade: _____