Environmental Engineering
ABET Evaluation Summary
2016-2017

This document describes the evaluation of ABET Program Educational Objectives (PEOs) and Student Outcomes for the Environmental Engineering undergraduate program for 2016-17. Data were collected throughout the year and evaluated by the CEE Assessment Committee (Drs. Barr, Dupont, McNeill, and Tullis) in June 2017.

Program Educational Objectives

The Environmental Engineering (EnvE) Program Educational Objectives (PEOs) are reviewed by each of the program's three constituencies (Table 1).

Table 1: PEO Review Process and Schedule for EnvE Program Constituency

Constituency	Review opportunity	Frequency	Most recent reviews	Date of next review
Students	Freshman Orient. (CEE 1880)	Every freshman class (Fall and Spring)	Spring semester 2017	Fall semester 2017
	Junior design course (CEE 3880)	Every junior class (Spring)	Spring 2017	Spring 2018
	Senior exit interview	Every graduating class (Spring)	April 2017	April 2018
Employers	Advisory Board meeting	Annually (typically late Fall)	November 2016	November 2017
Faculty	CEE Faculty Retreat	Annually (August)	August 2016	August 2017

Students: The PEOs are introduced to the freshman class in CEE 1880 as part of a lecture on the accreditation and licensing processes (see the slides in Appendix A). PEOs are again shown to the juniors in CEE 3880. This reminds continuing students about the PEOs and allows transfer students (who typically do not take CEE 1880) to see the PEOs. Finally, as part of the senior exit interview process, graduating seniors are given an opportunity to review the PEOs in an effort to establish some big picture career goals. No feedback was received from students related to the PEOs.

CEE Advisory Board: The CEE Advisory Board met on November 8, 2016 (see Appendix B for meeting minutes). The PEOs were reviewed and discussion included the desire for the program to encourage students to improve their communication skills (PEO1) and support for including "sustainability considerations" in PEO2. The Advisory Board unanimously approved keeping the current PEOs. The PEOs will continue to be reviewed and discussed at all future annual Advisory Board Meetings.

Program Faculty: The PEOs are reviewed and discussed with the program faculty at the annual faculty retreat, which takes place every August just prior to the Fall semester. The faculty unanimously approved keeping the current PEOs during the 2016 faculty retreat (see Appendix C for meeting minutes). The PEOs will continue to be reviewed and discussed at all future annual faculty retreats.

Student Outcomes

Evaluation of the Student Outcome attainment is conducted by the CEE Assessment committee on a specified schedule with approximately one-third of the Student Outcomes assessed every year (Table 2). When deficiencies are identified, recommendations are made to fix specific problems and support continuous improvement.

Table 2: Evaluation Schedule for Student Outcomes

Evaluation Date	School Year	Outcomes evaluated
May 2015	2014-15	a, b, c, d
May 2016	2015-16	e, f, g
May 2017	**2016-17**	**h, i, j, k**
May 2018	2017-18	a, b, c, d
May 2019	2018-19	e, f, g
May 2020	2019-20	h, i, j, k

The assessment process uses data from three sources: student coursework, FE Exam results, and senior exit interviews. The 2016-17 Assessment of Student Outcomes includes data from Fall 2016 and Spring 2017.

Student Coursework: Outcomes h, i, j, and k were reviewed in 2016-17 (Table 2). Assessment data are summarized in Table 3 and Figure 1; detailed evaluation of each outcome is presented in Appendix D. Student assignments are evaluated on a 0-1-2 scale, which corresponds to the student's performance not meeting, partially meeting, and meeting the Outcome Objective, respectively. The EnvE program has two goals for student performance:

- Goal 1: a minimum of 70% of the students will perform at a 2 level
- Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

Both goals were met for the four outcomes assessed this year. Note the "sample size" in Table 3 refers to the number of individual examples of student work that were assessed for each outcome, not the number of students.

Table 3: Aggregated Assessment Results for EnvE Classes, Fall 2016 and Spring 2017

Outcome	Sample size	2	1	0	Sum of 1&2 ratings
h	429	80%	17%	3%	97%
i	171	94%	6%	1%	99%
j	430	83%	15%	2%	98%
k	574	86%	12%	2%	98%

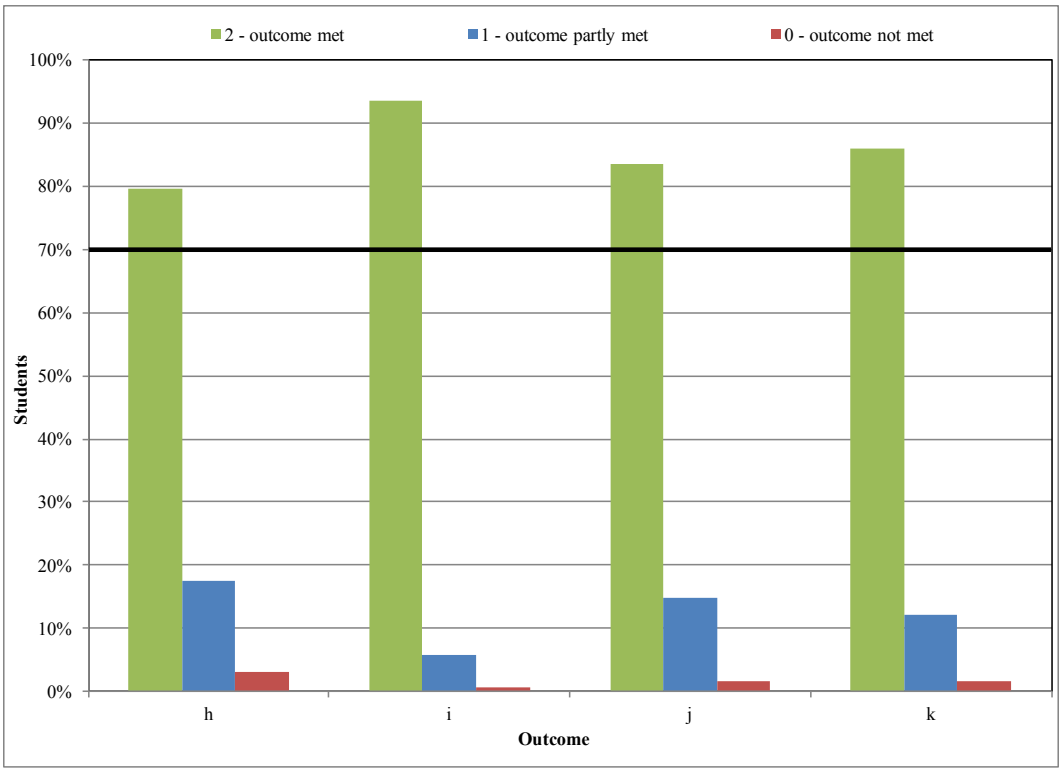


Figure 1: Aggregated Assessment Results for EnvE Classes for Fall 2016 and Spring 2017

Fe Exam: Our goal is to have 100% pass rate on the FE exam; our minimum acceptable level of performance is a pass rate at or above the national average. Table 4 summarizes the FE results for the past six years, including the percentage of students who had passed the FE exam by the time of graduation. The USU EnvE pass rate has been either 100% or comparable to the national average (considering the small number of USU EnvE graduates).

Table 4: EnvE Graduates Passing FE Exam vs. National Pass Rate

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
USU EnvE graduates	10	4	5	2	9	5
USU EnvE pass rate at graduation	80%	100%	100%	100%	89%	100%
National EnvE pass rate	83%	88%	84%	77%	76%	77%

FE Exam performance by first-time test takers for various engineering topics is summarized in Figures 2, 3, and 4. The uncertainty ranges are relatively large given the small number of students taking the exam; nevertheless, during the Spring 2017 testing period, USU EnvE students performed at or above the national average (including the uncertainty range) on all engineering topics. Overall, the fact that nearly all EnvE students continue to pass the FE exam is a strong, independent, external indicator for meeting Student Outcomes a, e, f, and k. It is also an indication of a good foundation for life-long (independent) learning skills.

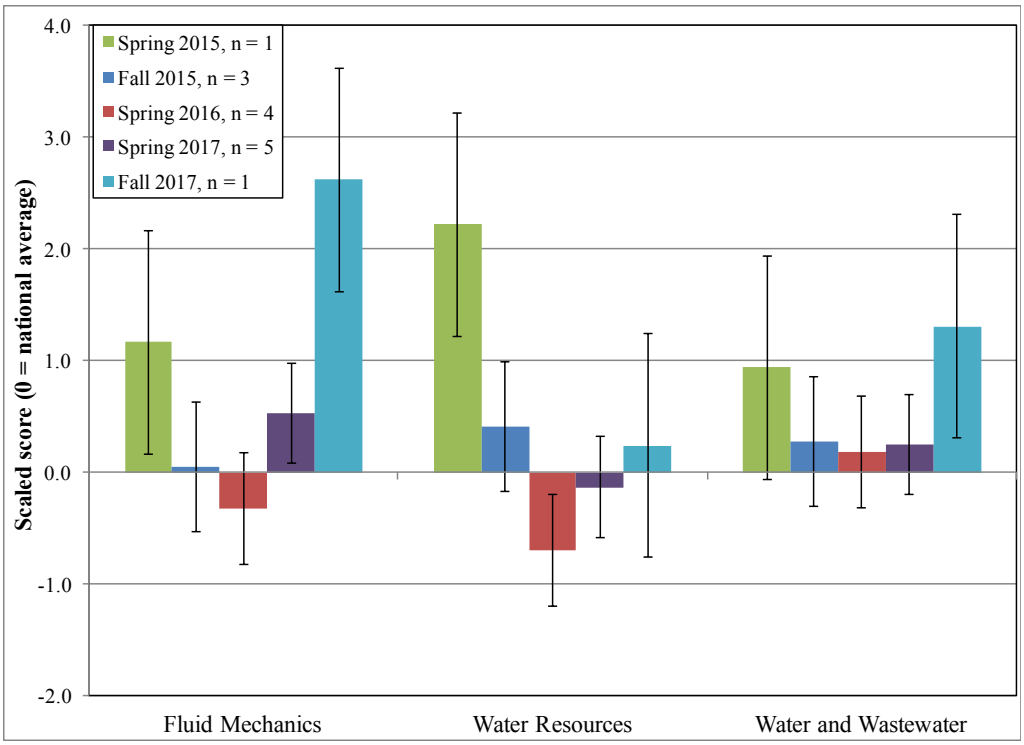


Figure 2: Scaled Fe Exam results (fluid mechanics, water resources, and water/wastewater). Error bars represent uncertainty range for scaled scores.

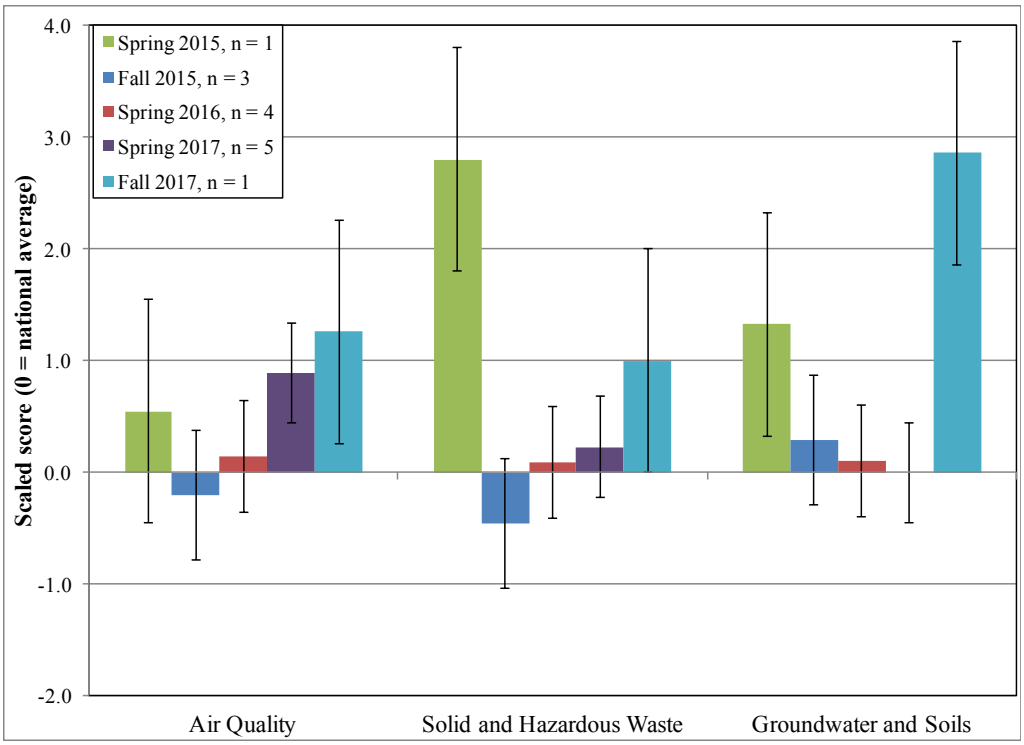


Figure 3: Scaled Fe Exam results (air quality, solid/hazardous waste, groundwater/soils). Error bars represent uncertainty range for scaled scores.

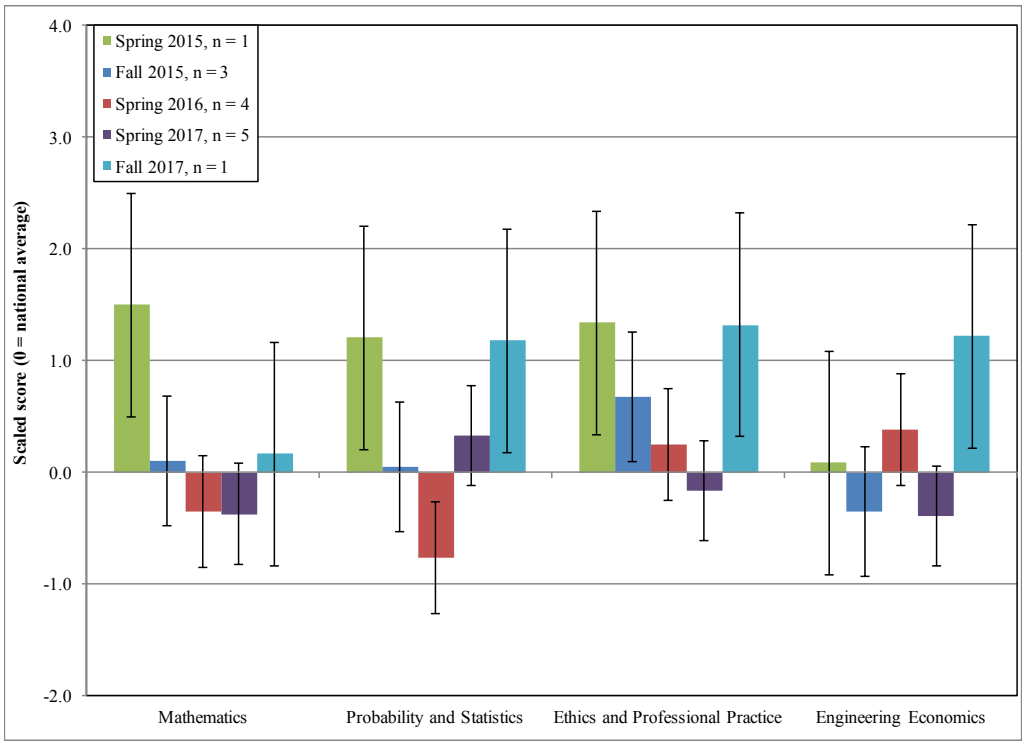


Figure 4: Scaled Fe Exam results (math, stats, ethics and professional practice, economics). Error bars represent uncertainty range for scaled scores.

Senior exit interview: Graduating seniors complete an anonymous online exit interview to provide feedback about the EnvE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as "fully met" or "partly met", which was achieved with 100% of students rating Outcomes i, j, and k as "fully met" and with 67% of students rating Outcome h as "fully met" and 33% as "partly met" for a total of 100% (Figure 5). Acknowledging that this is a subjective self-evaluation with a small sample size (n = 3), these exit interview results are taken as a general indication that students feel they are meeting the outcome.

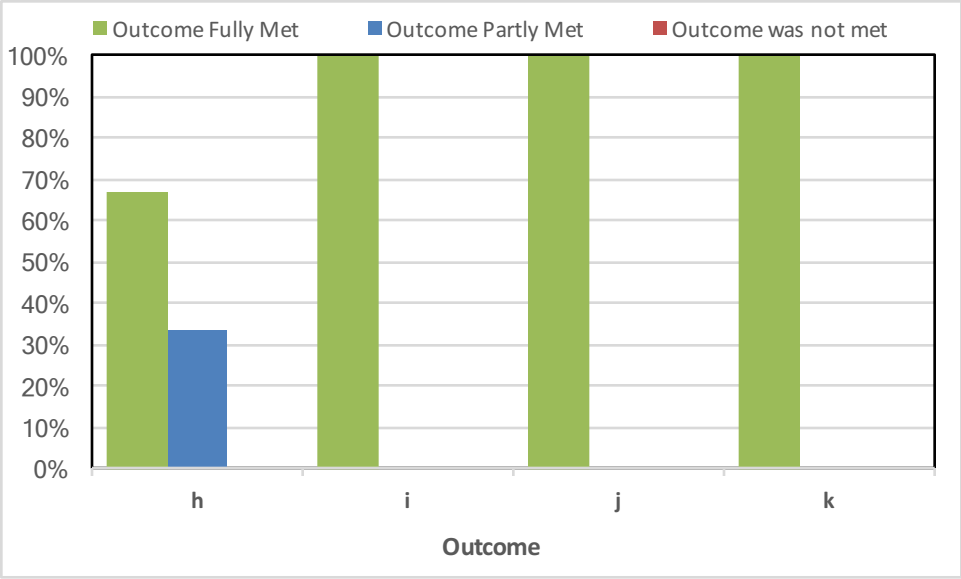
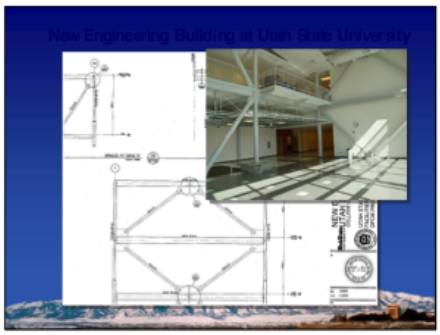


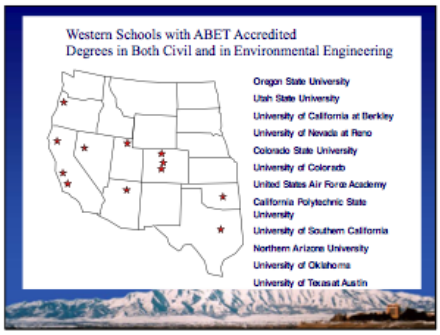
Figure 5: Student exit interview ratings of progress on Outcomes h, i, j, and k

Summary: The CEE Assessment Committee met in June 2017 and evaluated all of the assessment data presented herein.
The evaluation of student work, FE Exam results, and senior exit interviews indicates that Outcomes h, i, j, and k are being met.

Recommendations
Evaluate Outcomes a, b, c, and d as planned during the 2017-18 school year.

Appendix A
Slides from CEE 1880
(introducing freshmen students to ABET PEOs and outcomes)





ABET

ABET is a nonprofit, non-governmental organization that accredits college and university programs in the disciplines of applied science, computing, engineering, and engineering technology. ABET accredits over 3,300 programs at more than 680 colleges and universities in 24 countries. ABET provides specialized, programmatic accreditation that evaluates an individual program of study, rather than evaluating an institution as a whole.

ABET accreditation, which is voluntary and achieved through a peer review process, provides assurance that a college or university program meets the quality standards established by the profession for which the program prepares its students.
ABET is recognized by the Council for Higher Education Accreditation (CHEA).

Utah State University Mission Statement

The mission of Utah State University is to be one of the nation's premier student-centered land grant and space-grant universities by fostering the principle that academics come first, by cultivating diversity of thought and culture, and by serving the public through learning, discovery, and engagement.

College of Engineering Mission Statement

The mission of the USU College of Engineering is to foster a diverse and creative learning environment that will empower students and faculty with the necessary knowledge and facilities to be international leaders in creating new technologies and services that will improve

Program Educational Objectives

Program educational objectives (PEOs) are broad statements that describe what graduates are expected to attain within five years of graduation.

The PEOs for the Civil Engineering Program are that within five years of graduation:

PEO 1: Graduates will be successfully employed in civil engineering or related careers and will become independent thinkers and effective communicators, team members, and decision makers.

PEO 2: Graduates will incorporate economic, environmental, social, ethical, and sustainability considerations into the practice of civil engineering and will promote public health and safety.

PEO 3: Graduates will engage in life-long learning by pursuing advanced degrees or additional educational opportunities through coursework, professional conferences and training, or participation in professional societies.

PEO 4: Graduates will pursue professional licensure or other appropriate certifications.

Program Educational Objectives

Program educational objectives (PEOs) are broad statements that describe what graduates are expected to attain within five years of graduation.

The PEOs for the Environmental Engineering Program are that within five years of graduation:

PEO 1: Graduates will be successfully employed in environmental engineering or related careers and will become independent thinkers and effective communicators, team members, and decision makers.

PEO 2: Graduates will incorporate economic, environmental, social, ethical, and sustainability considerations into the practice of civil engineering and will promote public health and safety.

PEO 3: Graduates will engage in life-long learning by pursuing advanced degrees or additional educational opportunities through coursework, professional conferences and training, or participation in professional societies.

PEO 4: Graduates will pursue professional licensure or other appropriate certifications.

Student Outcomes

The Civil Engineering and Environmental Engineering Programs use 11 student outcomes to prepare graduates of the programs to attain the program educational objectives. By the time of 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

(d) an ability to function on multi-disciplinary 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 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.

ABET Accreditation at Utah State University leads to proficiency in at least 4 areas of Civil and Environmental Engineering

- Structural Engineering
- Geotechnical Engineering
- Hydraulics and Fluid Mechanics
- Water Resources
- Transportation Engineering
- Environmental Engineering

Most USU graduates will achieve proficiency in 5 to 6 areas

Code of Ethics (from ASCE)

Fundamental Principles

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

- using their knowledge and skill for the enhancement of human welfare and the environment;
- being honest and impartial and serving with fidelity the public, their employers and clients;
- striving to increase the competence and prestige of the engineering profession; and
- supporting the professional and technical societies of their disciplines.

Fundamental Canons (from ASCE)

- Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development3 in the performance of their professional duties.
- Engineers shall perform services only in areas of their competence.
- Engineers shall issue public statements only in an objective and truthful manner.
- Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
- Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
- Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession.
- Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.

And after graduation, becoming a Licensed Professional Engineer

Graduation with a Bachelors of Science in Civil and / or Environmental Engineering from an **ABET accredited degree program**

↓

FE (Fundamentals of Engineering) exam

↓

Experience working for a licensed engineer

↓

PE exam (Professional Engineer) Given by the state where you will practice

↓

Licensed Professional Civil Engineer

Note: non-ABET related items have been removed from these minutes

Appendix B
Minutes of the CEE Advisory Board Meeting Nov 8, 2016

Intro

- Fall 2016
  - Passing FE exam is now a requirement
  - FE exam now has more civil based updates
  - Civil pass rate : 95%
  - CEE 1880 is taught both spring and fall
    - ♣ Freshman class is the same size as sophomore class
    - ♣ Our department is growing
      - Worried about maintaining quality of one on one connection
    - ♣ This is why we are meeting with CEE 1880 classes
      - Gives the students an opportunity to meet and ask questions
    - ♣ Questions for the students
      - Why did you decide to study CEE?
      - What is your biggest difficulty being a CEE student so far?
      - What has been your best experience so far as a CEE student?
      - What improvements to the program can you suggest?

ABET-Laurie

- Review of PEOs
  - Program educational objectives
  - What our students will be able to do 5 years out
  - Feedback from advisory board?
    - ♣ Professional licensure?
      - Yes/no-we get aggregate stats on our students; just a number who passed the PE and FE exams
      - EnvE students are tracked since there are so few
    - ♣ No additional comments
  - Student outcome ratings
    - ♣ rated from 0-2
      - 0-didn't understood
      - 1-kind of understood
      - 2-completety understood
    - ♣ Goal to have more than 70% at the "2" level
    - ♣ Is there a better time to evaluate different outcomes?
      - We're looking at evaluating different classes
    - ♣ EnvE was successful with all student outcomes measured
  - Fe exam pass rate
    - ♣ Goal is to have 100% pass rate
    - ♣ CEE is above the national average
  - Outcomes B&F are being reevaluated along with H,I,J, & K

- Questions/Comments
  - ♣ Engineers view ethics differently than other professionals
    - It would have bene helpful to know that not all professionals have such a strong view on ethics
      - Attorneys allegiance are to their clients-engineers are more honest with their evaluations, etc.
      - Information can easily be taken, twisted, and turned
    - You can't under-teach ethics. I applaud any effort you make to be sure our students leave with a firm code of ethics.
  - ♣ What happens to students who don't pass the FE exam?
    - We offer resources and help to be sure that our students pass. Even if it's not on the first, or second time
    - "I would never change the requirement on passing the FE exam"

Note: non-ABET related items have been removed from these minutes

Appendix C
CEE Annual Faculty/Staff Retreat Minutes
August 22, 2016

Laurie-ABET

- Review program (PEO)
- To-do list for this year

PEO handout

- Changes?
  - What are students doing 5 years after graduation?
- Criteria 4
  - Student coursework
  - FE exam
  - Exit interview results
- Outcome of student schedule
  - Each year we review a subset of the outcomes
  - Subsets B,E,F,G
- Student course work rating scale
  - 0,1,2 rating scale
  - We need at least 70% at the 2 level
  - 80% at performing level (1-2)
  - Summary
    - ♣ E outcome met
    - ♣ G outcome met
    - ♣ B goal was not met (design and conduct)
    - ♣ F goal not met (ethics)
    - ♣ Environmental met all goals =]
- FE Exam
  - 100% pass rate
  - Minimum goal is to be at or above national pass rate
  - CE 98% pass rate
    - ♣ 69% nationally
  - Environmental
    - ♣ 78% pass rate
      - 76% nationally
  - Last year, we were above, or within, the error bar of national average for performance
  - Bottom line:
    - ♣ All students scored at or above on all FE exam topics
- Senior exit interviews
  - Self assessment for students
  - We would like to see that 80% are understanding curriculum
    - ♣ All students feel they met expectations
- Evaluation
  - Student course work: goals met for outcomes E,G but not for B, F
  - Outcomes B,F need to be redone

        - ♣ We didn't assess enough classes
    - Evaluation schedule
        - ♣ H,I,J,K plus B,F
        - ♣ Assess two outcomes in all required UG classes
    - Outcome B
        - ♣ Design and conduct experiments
            - Materials
            - Fluids
            - Soils
            - Hydraulics
            - Others?
        - ♣ We've failed the last two years with outcome B
    - Outcome F
        - ♣ Ethics
            - This can be done in any and all of our classes
            - The challenge is assessing….
                - www.asce.org/ethics
                - Case studies and ethically considered column
                - Ideas for classes
    - Outcomes H,I,J
        - ♣ Outcome H
            - Anything beyond the textbook
        - ♣ Outcome I
            - CEE orientation
            - EnvE sophomore seminar
            - Junior/senior design
            - Others?
        - ♣ Outcome J
            - Knowledge of contemporary issues
                - Everyone!
        - ♣ Outcome K
            - Ability to use techniques and skills for modern engineering
                - Anyone using software, design codes
                - May have to rely on elective classes
                - CEE 4870/4880?
    - Program criteria for CE
        - ♣ Probability and statistics
        - ♣ Include principles of sustainability in design
        - ♣ Explain basic concepts in project management, business, public policy, and leadership
        - These don't' need to be formally assessed, but we do have to discuss where the students are getting these concepts in our curriculum.

Appendix D
Detailed Evaluation for Outcomes h, i, j, and k

See following pages

Environmental Engineering
ABET Outcome Summary
2016-2017

Outcome h: the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

Student Course Work Assessment

Student work is rated on a 0 – 1 – 2 scale:

0 = student did not understand the fundamental principle or component
1 = student applied some but not all of the fundamental principles in their solution
2 = student applied the correct fundamental principles in their solution

The EnvE program has two goals for student performance for student course work assessment:

Goal 1: a minimum of 70% of the students will perform at a 2 level
Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

As recommended by the Assessment Committee the last time this outcome was evaluated (2013-2014), the number of assessments for this outcome has increased. Student performance on this outcome has been assessed on ten assignments in five different courses (429 samples of student work; see Table H-1 on the next page). Student performance satisfactorily meets both Goal 1 and Goal 2 (Figure H-1).

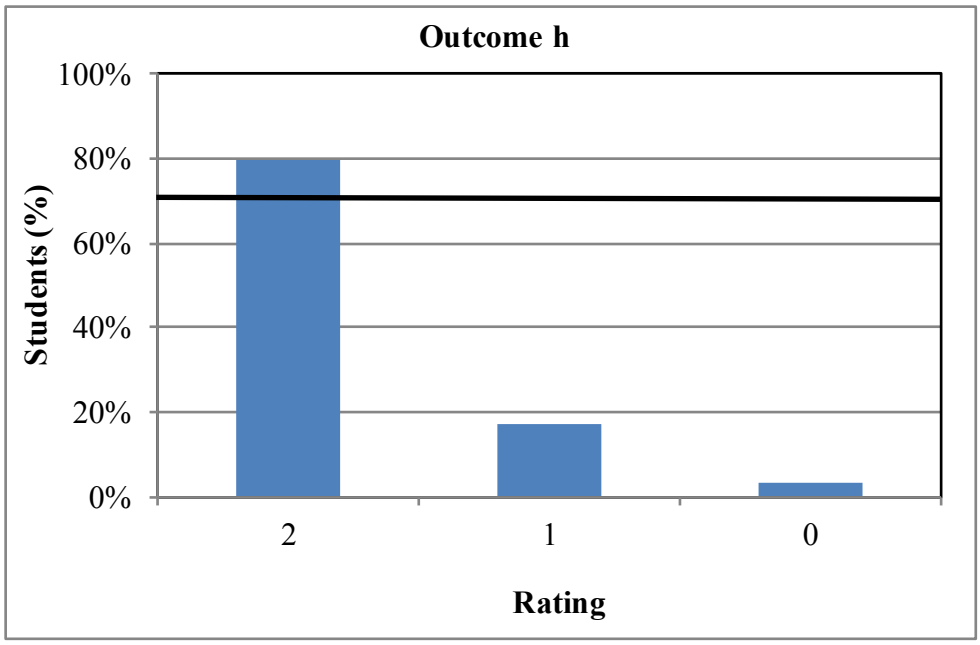


Figure H-1: Summary of ratings of student work on Outcome h

Table H-1: List of student work assessed for Outcome h

Class		Name	Instructor	Term	Enrol.	Method	Description	2	1	0
CEE	2620	Env Microbiology	Sorenson	Sp 2017	13	exam question	economic and env impact of biofuels	54%	31%	15%
CEE	3610	Environmental Management	McNeill	F 2016	79	essay HW	summarize EIS - env, econ, societal	76%	22%	3%
CEE	3610	Environmental Management	McNeill	F 2016	79	essay HW	summarize TMDL - env, econ, societal	92%	8%	0%
CEE	3610	Environmental Management	McNeill	F 2016	79	essay HW	summarize Superfund site - env, econ, societal	67%	30%	3%
CEE	3610	Environmental Management	McNeill	F 2016	79	field trip report	env, econ, societal consid of WWTP	78%	16%	5%
CEE	3650	Wastewater Treatment	Dupont	Sp 2017	7	mini-design	Env and cost impacts of TMDL	57%	29%	14%
CEE	4200	Engineering Economics	Alminagorta	F 2016	76	exam	economic impact of eng solutions	89%	11%	0%
CEE	5610	Environ Quality Analysis	McLean	F 2016	8	lab exercise	effect of BMP on nutrient loading in river	88%	13%	0%
CEE	5610	Environ Quality Analysis	McLean	F 2016	8	lab exercise	env relevance of nutrients in a river	88%	0%	13%
CEE	5610	Environ Quality Analysis	McLean	F 2016	8	lab exercise	sources of nutrients into water bodies	75%	13%	13%

FE Exam Results

Not applicable to this outcome.

Senior Exit Interviews

Graduating seniors complete an anonymous online exit interview to provide feedback about the EnvE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as "met" or "partly met", which was achieved with 67% of students rating Outcome b as "met" and 33% as "partly met" for a total of 100% (Figure H-2). Acknowledging that this is a subjective self-evaluation and a very small sample size (n = 3), these exit interview results are taken as a general indication that students feel they are meeting the outcome.

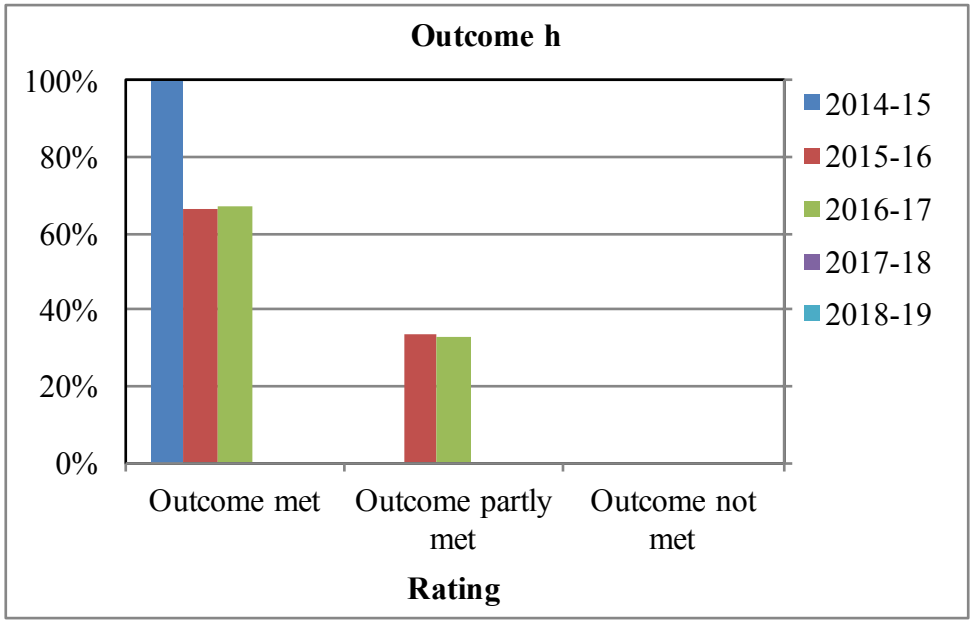


Figure H-2: Student exit interview ratings of progress on Outcome h

Summary

The evaluation of student work and senior exit interviews indicates that Outcome h is being met.

Recommendations

Evaluate Outcome h as planned during the 2019-20 school year.

Environmental Engineering
ABET Outcome Summary
2016-2017

Outcome i: a recognition of the need for, and an ability to engage in life-long learning

Student Course Work Assessment

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The EnvE program has two goals for student performance for student course work assessment:

Goal 1: a minimum of 70% of the students will perform at a 2 level
Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

This outcome is assessed in the freshman orientation class, sophomore seminar, and the second and third classes of the capstone design sequence (171 samples of student work; see Table I-1 on the next page). Student attainment is demonstrated through a memo on the importance of life-long learning, a quiz on professional registration requirements (including associated continuing education requirements), and an essay on a guest speaker's discussion of this topic. Student performance is satisfactory and meets both Goal 1 and Goal 2 (Figure I-1). To additionally reinforce this idea in the capstone design sequence, since the 2014-2015 academic year, all guest speakers who are professional engineers are requested to include the topic of life-long learning in their presentation.

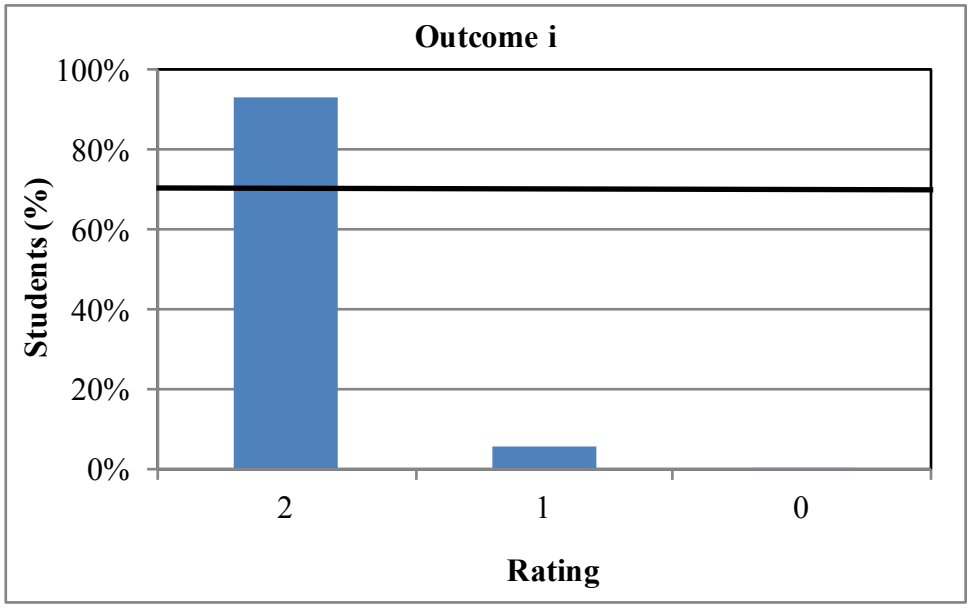

Figure I-1: Summary of ratings of student work on Outcome i

Table I-1: List of student work assessed for Outcome i

Class		Name	Instructor	Term	Enrol.	Method	Description	2	1	0
CEE	1880	CEE Orientation	Rahmeyer	F 2016	73	group HW	rules for professional licensure	100%	0%	0%
CEE	1880	CEE Orientation	Rahmeyer	Sp 2017	65	group HW	rules for professional licensure	83%	15%	2%
CEE	2890	Environ sophomore seminar	McLean	Sp 2017	16	group project	need for lifelong learning in design	100%	0%	0%
CEE	4870	Civil Engineering Design II	Peralta	F 2016	7	quiz	quiz on continuing ed requirements	100%	0%	0%
CEE	4880	Civil Engineering Design III	Peralta	Sp 2017	7	quiz	quiz on lifelong learning in Code of Ethics	100%	0%	0%

FE Exam Results

Not applicable to this outcome.

Senior Exit Interviews

Graduating seniors complete an anonymous online exit interview to provide feedback about the EnvE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as "met" or "partly met", which was achieved with 100% of students rating Outcome i as "met" (Figure I-2). Acknowledging that this is a subjective self-evaluation and a very small sample size (n = 3), these exit interview results are taken as a general indication that students feel they are meeting the outcome.

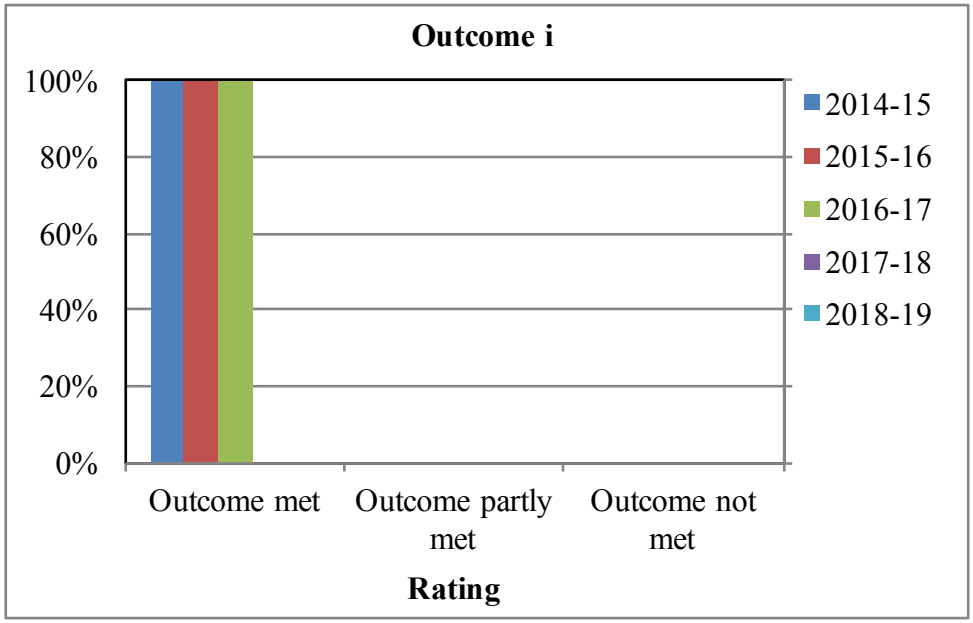

Figure I-2: Student exit interview ratings of progress on Outcome i

Summary

The evaluation of student work and senior exit interviews indicates that Outcome i is being met.

Recommendations

Evaluate Outcome i as planned during the 2019-20 school year.

Environmental Engineering
ABET Outcome Summary
2016-2017

Outcome j: a knowledge of contemporary issues

Student Course Work Assessment

Student work is rated on a 0 – 1 – 2 scale:

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2 = student applied the correct fundamental principles in their solution

The EnvE program has two goals for student performance for student course work assessment:

Goal 1: a minimum of 70% of the students will perform at a 2 level
Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

This outcome was assessed in multiple classes by having students demonstrate knowledge of contemporary issues through HW, writing assignment, or exam (430 samples of student work; see Table J-1 on the next page). Student performance is satisfactory and meets both Goal 1 and Goal 2 (Figure J-1).

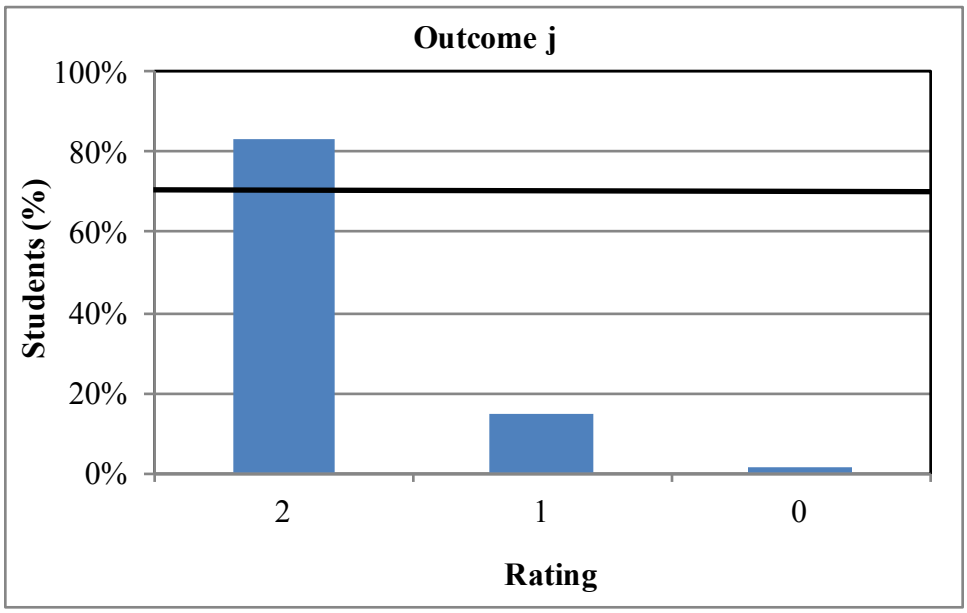

Figure J-1: Summary of ratings of student work on Outcome j

Table J-1: List of student work assessed for Outcome j

Class		Name	Instructor	Term	Enrol.	Method	Description	2	1	0
CEE	1880	Civil and Environmental Eng. Orientation	Rahmeyer	F 2016	73	group HW	group essay on contemporary issues	89%	11%	0%
CEE	1880	Civil and Environmental Eng. Orientation	Rahmeyer	Sp 2017	65	group HW	group essay on contemporary issues	91%	8%	2%
CEE	2890	Environmental sophomore seminar	McLean	Sp 2017	16	group project	contemp issues -- eng. in develop countries	100%	0%	0%
CEE	3610	Environmental Management	McNeill	F 2016	79	HW	Cache Valley PM2.5 issue	89%	5%	6%
CEE	3610	Environmental Management	McNeill	F 2016	79	field trip report	solid waste mgmt current issues in CV	73%	27%	0%
CEE	3610	Environmental Management	McNeill	F 2016	79	field trip report	current issues in Logan City drinking water	73%	25%	1%
CEE	3640	Drinking Water Treatment	McNeill	Sp 2017	32	HW	essay on Flint, MI drinking water scandal	91%	9%	0%
CEE	3650	Wastewater Treatment	Dupont	Sp 2017	7	group project	contemp issues for WWTP	57%	43%	0%

FE Exam Results

Not applicable to this outcome.

Senior Exit Interviews

Graduating seniors complete an anonymous online exit interview to provide feedback about the EnvE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as "met" or "partly met", which was achieved with 100% of students rating Outcome b as "met" in 2016-17 (Figure J-2). Acknowledging that this is a subjective self-evaluation and a very small sample size (n = 3), these exit interview results are taken as a general indication that students feel they are meeting the outcome.

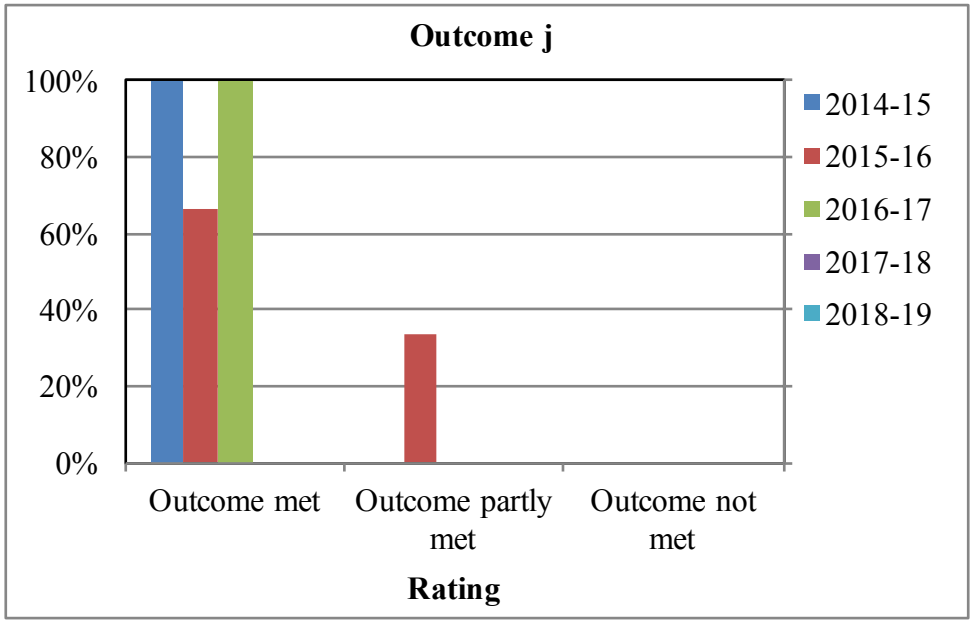

Figure J-2: Student exit interview ratings of progress on Outcome j

Summary

The evaluation of student work and senior exit interviews indicate that Outcome j is being met.

Recommendations

Evaluate Outcome j as planned during the 2019-20 school year.

Environmental Engineering
ABET Outcome Summary
2016-2017

Outcome k: an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Student Course Work Assessment

Student work is rated on a 0 – 1 – 2 scale:

0 = student did not understand the fundamental principle or component
1 = student applied some but not all of the fundamental principles in their solution
2 = student applied the correct fundamental principles in their solution

The EnvE program has two goals for student performance for student course work assessment:

Goal 1: a minimum of 70% of the students will perform at a 2 level
Goal 2: a minimum of 80% of the students will perform at the 1 or 2 level.

Multiple classes across the curriculum assess students' ability to use modern tools including surveying equipment; tools for evaluating environmental quality parameters such as BOD, hardness, and dissolved oxygen; and various software programs like excel/VBA, HEC-HMS, and EPANET (574 samples of student work; see Table K-1 on the next page). Overall, student performance is satisfactory and meets both Goal 1 and Goal 2 (Figure K-1).

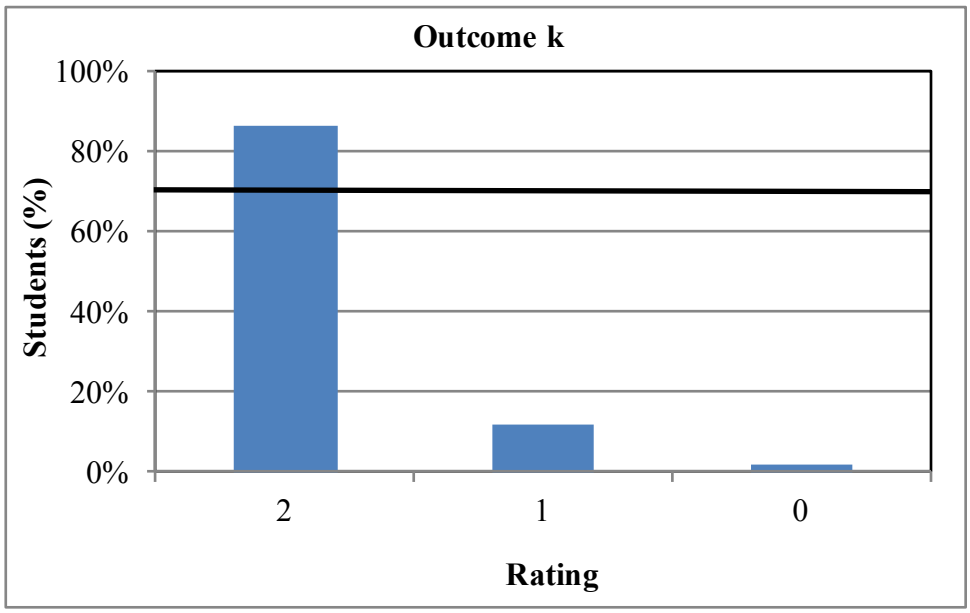

Figure K-1: Summary of ratings of student work on Outcome k

Table K-1: List of student work assessed for Outcome k

Class		Name	Instructor	Term	Enrol.	Method	Description	2	1	0
CEE	2240	Surveying	Caliendo	F 2016	121	lab	surveying traverse special problem	70%	30%	0%
CEE	2620	Env Microbiology	Sorenson	Sp 2017	13	lab	BODTrak lab technique	69%	23%	8%
CEE	2870	Intro to Programming	Urroz	F 2016	102	HW	use VBA and spreadsheet to calc flow in open channel	93%	3%	4%
CEE	3430	Engineering Hydrology	Urroz	Sp 2017	81	HW	use excel and HEC-HMS to find hydrograph	89%	7%	4%
CEE	3510	Hydraulics	Urroz	Sp 2016	69	exam	EPANET 2.0 for analysis of pipe network	86%	14%	0%
CEE	3510	Hydraulics	Urroz	Sp 2017	71	exam	EPANET 2.0 for analysis of pipe network	97%	3%	0%
CEE	3780	Solid and Haz Waste Mgmt	Dupont	F 2016	53	exam	spreadsheet to calculate effect of recycling on landfill	89%	8%	4%
CEE	5001	Field Irrigation Systems	Torres-Rua	F 2016	7	exam	remote sensing applications	100%	0%	0%
CEE	5610	Environ Quality Analysis	McLean	F 2016	7	lab	DO lab -- understanding QC requirements	100%	0%	0%
CEE	5610	Environ Quality Analysis	McLean	F 2016	7	lab	DO lab -- understanding analytical methods	100%	0%	0%
CEE	5610	Environ Quality Analysis	McLean	F 2016	7	lab	DO lab -- comparing methods	71%	29%	0%
CEE	5610	Environ Quality Analysis	McLean	F 2016	7	lab	DO lab -- interpreting data	71%	29%	0%
CEE	5610	Environ Quality Analysis	McLean	F 2016	7	lab	DO lab -- selecting best method to meet objectives	71%	29%	0%
CEE	5610	Environ Quality Analysis	McLean	F 2016	7	lab	hardness lab -- understanding QC requirements	100%	0%	0%
CEE	5610	Environ Quality Analysis	McLean	F 2016	7	lab	hardness lab -- comparing analytical methods	100%	0%	0%
CEE	5610	Environ Quality Analysis	McLean	F 2016	7	lab	hardness lab -- selecting best method to meet objectives	100%	0%	0%

FE Exam Results

Our goal is to have 100% pass rate on the FE exam; our minimum acceptable level of performance is a pass rate at or above the national average. Table K-2 summarizes the FE results for the past six years, including the percentage of students who had passed the FE exam by the time of graduation. The USU EnvE pass rate has been either 100% or just below the national average. Realistically, these values are considered comparable to the national average, considering the small number of USU EnvE graduates.

The fact that nearly all of the EnvE students pass the FE exam is a strong, independent, external indicator for meeting Student Outcomes a, e, f, and k. It is also a strong indication of a good foundation for life-long (independent) learning skills.

Table K-2: EnvE Graduates Passing FE Exam vs. National Annual Pass Rate

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
USU EnvE graduates	10	4	5	2	9	5
USU EnvE pass rate at graduation	80%	100%	100%	100%	89%	100%
National EnvE pass rate	83%	88%	84%	77%	76%	77%

Senior Exit Interviews

Graduating seniors complete an anonymous online exit interview to provide feedback about the EnvE program and rate their perceived progress in meeting each of the outcomes. The performance goal is to have at least 80% of the students rating their attainment as "met" or "partly met", which was achieved with 100% of students rating Outcome i as "met" in 2016-17 (Figure K-2). Acknowledging that this is a subjective self-evaluation and a very small sample size (n = 3), these exit interview results are taken as a general indication that students feel they are meeting the outcome.

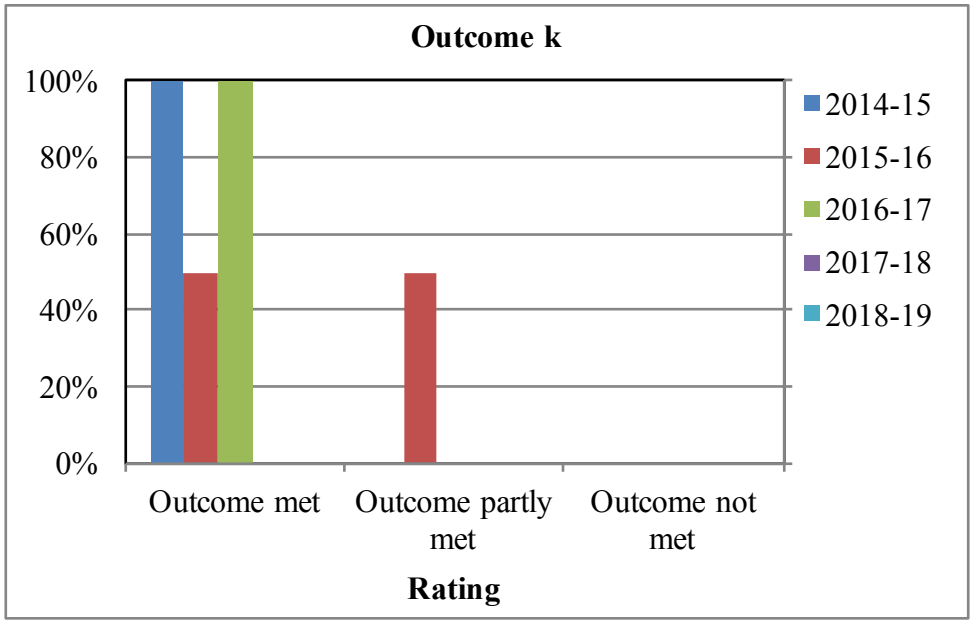

Figure K-2: Student exit interview ratings of progress on Outcome k

Summary

The evaluation of student work, FE Exam results, and senior exit interviews indicates that Outcome k is being met.

Recommendations

Evaluate Outcome k as planned during the 2019-20 school year.