

Electrical Engineering

ABET Evaluation Summary

2020-2021

This document describes the evaluation of ABET Program Educational Objectives (PEOs) and Student Outcomes for the Electrical Engineering undergraduate program for 2020-21. Data were collected throughout the year and evaluated by the ECE Assessment Committee (Drs. Winstead, Budge, Cripps, Gunther and Jolynne Berrett) in June 2021.

Program Educational Objectives

Program education objectives (PEOs) are broad statements that describe what graduates are expected to attain within a few years of graduation. The PEOs for the Electrical Engineering program are as follows.

PEO 1: Graduates will succeed in pursuing their chosen career path. The primary indicator of success is that graduates will establish a reputation among their peers for engineering expertise and sound ethical judgment. Other indicators of success include:

- Achieving professional advancement with increasing responsibility;
- Engaging in technology-based innovative or entrepreneurial activities;
- Engaging in advanced study in engineering graduate programs or related areas.

PEO 2: Graduates will engage in a continuous process of life-long learning. Evidence of such engagement includes activities such as:

- Staying abreast of emerging technologies;
- Obtaining new skills or developing proficiencies with tools and programming/hardware description languages;
- Actively participating in professional communities.

These objectives are consistent with the university mission and meet the needs of the programs constituents: students, faculty, and industry.

Students

Feedback from students regarding the PEOs is obtained through senior exit surveys. This provides a source of inputs from students each semester.

ECE Advisory Board

Industry participation in the review of the PEOs is coordinated through annual meetings of the ECE Department's Industry Advisory Committee (IAC). The IAC did not meet during 2021 due to the COVID-19 pandemic. The IAC will meet again in 2022 and will review the PEOs at that time. The PEOs will continue to be reviewed and discussed at all future IAC 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. Faculty review inputs and recommendations from students and the IAC and follow parliamentary procedures to vote on changes to the PEOs. The faculty unanimously approved keeping the current PEOs during the 2020 faculty retreat. The PEOs will continue to be reviewed and discussed at all future annual faculty retreats.

Student Outcomes

The student outcomes for the electrical engineering program are:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Assessment of the Student Outcome attainment is conducted by the ECE Assessment Committee on a specified schedule with all of the Student Outcomes assessed every year. When deficiencies are identified, recommendations are made to fix specific problems and support continuous

improvement. During the 2018-2019 school year, we changed to the new ABET Outcomes 1-7 instead of a-k.

Assessment data are summarized in Table 1 and Figure 1; detailed evaluation of each outcome is presented in Appendix A. Student assignments are evaluated on a scale of 1 to 5, with 5 being the highest. The CE program goal for student performance is that a minimum of 80% of the students will attain a 4 or 5 on the assessment.

Table 1

Student Outcomes	Score
An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	83
An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	81
An ability to communicate effectively with a range of audiences	91
An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	84
An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	89
An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	64
An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	93

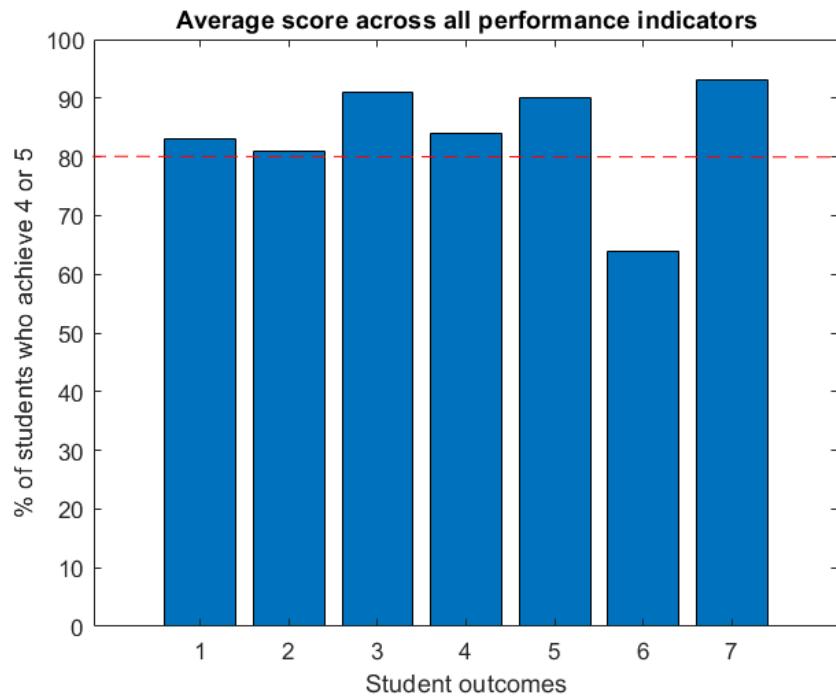


Figure 1

Appendix A
Detailed Evaluation of Student Outcomes

See following pages

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ABET Outcome Summary

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Outcome 1: An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

In order to assess student achievement of this outcome, a variety of performance indicators (PIs) are measured. Some performance indicators are measured using course work and exams, and others are measured using student exit surveys. Since both computer and electrical engineering students are assessed using the performance indicators, only the performance indicators specifically for EE students will be included in this summary.

Student work is rated on a scale from 1 to 5 with 5 being the highest. The goal for student performance is that a minimum of 80% of students will attain either a 4 or 5 on the assessment. Table 1-1 indicates the instruments used to measure each PI, and Figure 1-1 indicates which PIs have met the 80% goal.

Table 1-1: Assessment of Outcome 1 for Electrical Engineering

Performance Indicator	Class/Instrument	Score
1.1 Apply differential and integral calculus to electrical and computer engineering problems	ECE 3870	90
1.2 Ability to apply ordinary or partial differential equations in the setting of systems and electromagnetics	ECE 3870	76
1.3 Compute and apply continuous-time and discrete-time Fourier transform pairs, properties, symmetries	ECE 3640	83
1.4 Ability to determine/predict expected system response given descriptions of the inputs and the system	ECE 3640	93
1.6 Identify a basic circuit configuration (RC, diode and/or op amp), predict its behavior and/or solve a quantitative problem related to the circuit.	ECE 3410	70
1.7 Ability to sketch intermediate signals in both time and frequency domains at each point in a cascade of interconnected systems.	ECE 3640	83
1.13 Did your education provide you with an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics?	Senior exit survey	86
Average score across all indicators		83

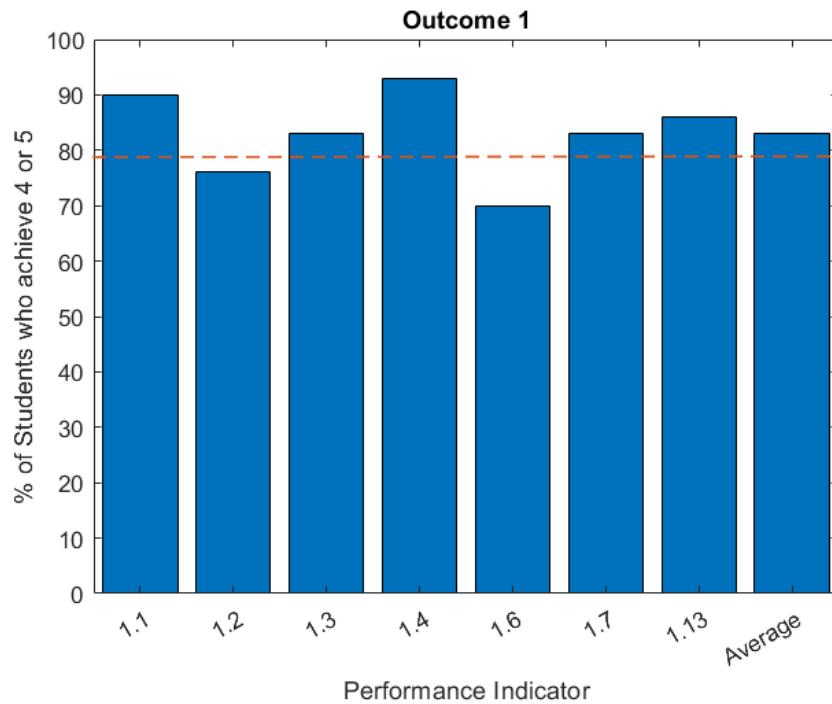


Figure 1-1

Summary

The evaluation of student work and senior exit interviews indicates that Outcome 1 was met in the 2020-2021 school year.

Recommendation: Choose select performance indicators to measure in subsequent years.

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Outcome 2: An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

In order to assess student achievement of this outcome, a variety of performance indicators (PIs) are measured. Some performance indicators are measured using course work and exams, and others are measured using student exit surveys. Since both computer and electrical engineering students are assessed using the performance indicators, only the performance indicators specifically for EE students will be included in this summary.

Student work is rated on a scale from 1 to 5 with 5 being the highest. The goal for student performance is that a minimum of 80% of students will attain either a 4 or 5 on the assessment. Table 2-1 indicates the instruments used to measure each PI, and Figure 2-1 indicates which PIs have met the 80% goal.

Table 2-1: Assessment of Outcome 2 for Electrical Engineering

Performance Indicator	Course/Instrument	Score
2.2 Did your education provide you with an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors?	Senior exit survey	58
2.4 Design homework assignment: Show the op-amp canonical realization of a given transfer function $H(s) = (s^2 + 5s + 2)/(s^2 + 4s + 13)$. Realize the transfer function using op amps, resistors, and capacitors. Use 10 uF capacitors and 10-100 kOhm resistors.	ECE 3620 Homework assignment	75
2.6 Specifications – Can the student identify physical and safety requirements and resulting trade-offs?	ECE 4830 Homework assignment	80.5
2.8 Client Questionnaire – Can the student identify the stakeholder and user interface requirements and resulting tradeoffs?	ECE 4830 Homework assignment	93.5
2.10 Final Report – Can the student demonstrate thorough consideration and evaluation of a good set of design approaches?	ECE 4850 Final report	97

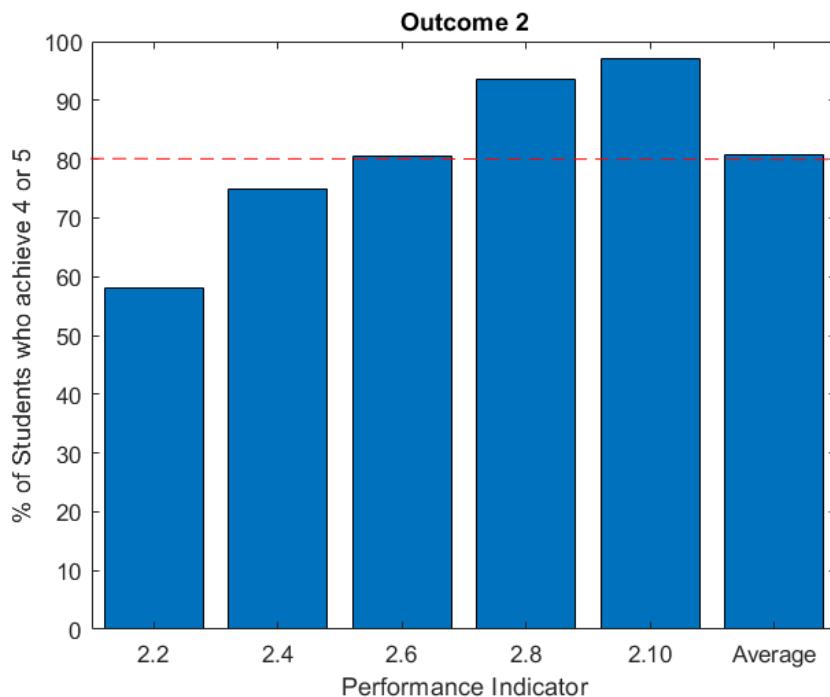


Figure 2-1

Summary

The evaluation of student work and senior exit interviews indicates that Outcome 2 was met in the 2020-2021 school year.

Recommendation

It was observed that the low score on performance indicator 2.4 occurred because many students did not work the related problem on the homework assignment. Therefore the 75% reading is not an accurate indicator of students' ability to do the design problem. Dr. Budge agreed that he would emphasize this next year and encourage students to complete the related problem on the homework assignment.

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Outcome 3: An ability to communicate with a wide range of audiences.

In order to assess student achievement of this outcome, a variety of performance indicators (PIs) are measured. Some performance indicators are measured using course work and exams, and others are measured using student exit surveys. Since both computer and electrical engineering students are assessed using the performance indicators, only the performance indicators specifically for EE students will be included in this summary.

Student work is rated on a scale from 1 to 5 with 5 being the highest. The goal for student performance is that a minimum of 80% of students will attain either a 4 or 5 on the assessment. Table 3-1 indicates the instruments used to measure each PI, and Figure 3-1 indicates which PIs have met the 80% goal.

Table 3-1: Assessment of Outcome 3 for Electrical Engineering

Performance Indicator	Course/Instrument	Score
3.2 Did your education provide you with an ability to communicate effectively with a range of audiences?	Senior exit survey	71
3.4 Design review – Did the student clearly explain the design process and provide logical justifications for design decisions?	ECE 4850 Homework question	100
3.6 User guide – Did the student provide a clear explanation of how to perform the procedures?	ECE 4850 Homework question	98
3.8 Multi-audience elevator pitch – Did the student describe the strategies used with audience-appropriate language?	ECE 4850 Homework question	95
Average score across all performance indicators		91

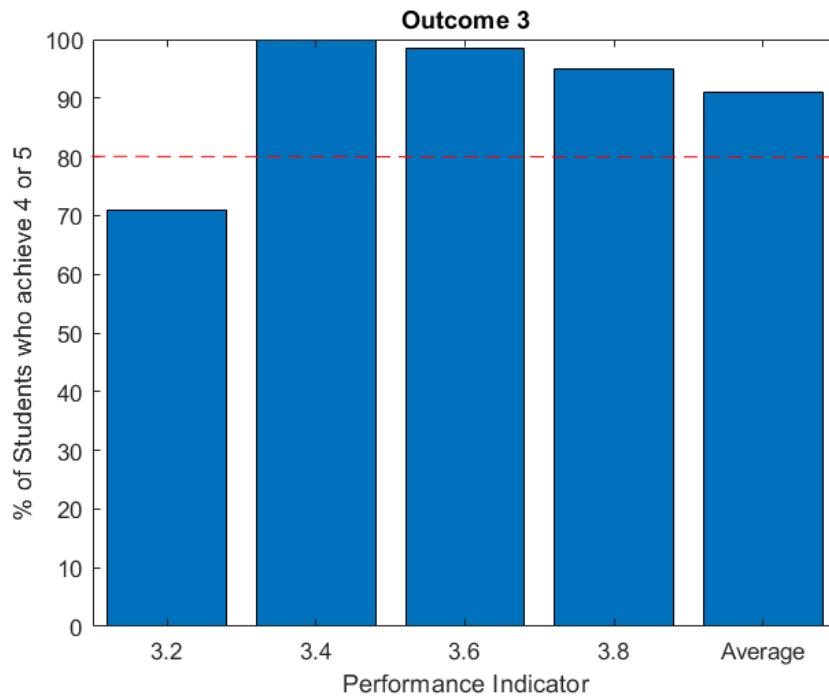


Figure 3-1

Summary

The evaluation of student work and senior exit interviews indicates that Outcome 3 was met in the 2020-2021 school year.

Recommendation

Evaluate Outcome 3 during the 2021-2022 school year as planned.

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Outcome 4: An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

In order to assess student achievement of this outcome, a variety of performance indicators (PIs) are measured. Some performance indicators are measured using course work and exams, and others are measured using student exit surveys. Since both computer and electrical engineering students are assessed using the performance indicators, only the performance indicators specifically for EE students will be included in this summary.

Student work is rated on a scale from 1 to 5 with 5 being the highest. The goal for student performance is that a minimum of 80% of students will attain either a 4 or 5 on the assessment. Table 4-1 indicates the instruments used to measure each PI, and Figure 4-1 indicates which PIs have met the 80% goal.

Table 4-1: Assessment of Outcome 4 for Electrical Engineering

Performance Indicator	Course/Instrument	Score
4.1 Students are asked to comment on ethics case studies published by TAMU at this site: https://ethics.tamu.edu/nsf-report/	ECE 3810 homework question	90
4.3 Following course reading and discussion, students are asked to reflect on how they can avoid becoming a workplace harasser, and what actions to take if they witness harassment.	ECE 3810 homework question	100
4.9 Did your education provide you with an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Senior exit survey	62
Average score across all performance indicators		84

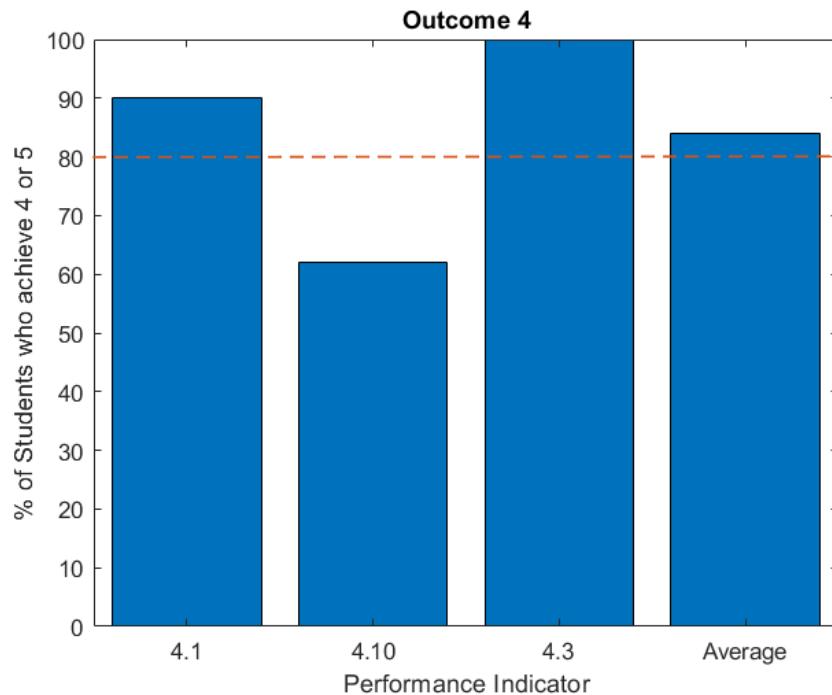


Figure 4-1

Summary

The evaluation of student work and senior exit interviews indicates that Outcome 4 was met in the 2020-2021 school year.

Recommendation

Evaluate Outcome 4 during the 2021-2022 school year as planned.

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Outcome 5: An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

In order to assess student achievement of this outcome, a variety of performance indicators (PIs) are measured. Some performance indicators are measured using course work and exams, and others are measured using student exit surveys. Since both computer and electrical engineering students are assessed using the performance indicators, only the performance indicators specifically for EE students will be included in this summary.

Student work is rated on a scale from 1 to 5 with 5 being the highest. The goal for student performance is that a minimum of 80% of students will attain either a 4 or 5 on the assessment. Table 5-1 indicates the instruments used to measure each PI, and Figure 5-1 indicates which PIs have met the 80% goal.

Table 5-1: Assessment of Outcome 5 for Electrical Engineering

Performance Indicator	Course/Instrument	Score
5.2 Students are asked to “describe a good team” and to explain how they will contribute to building a good team.	ECE 3810 homework question	100
5.4 Did your education provide you with an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives?	Senior exit survey	76
5.6 What did I do for my team?	ECE 3810 homework question	92
Average score across all performance indicators		89

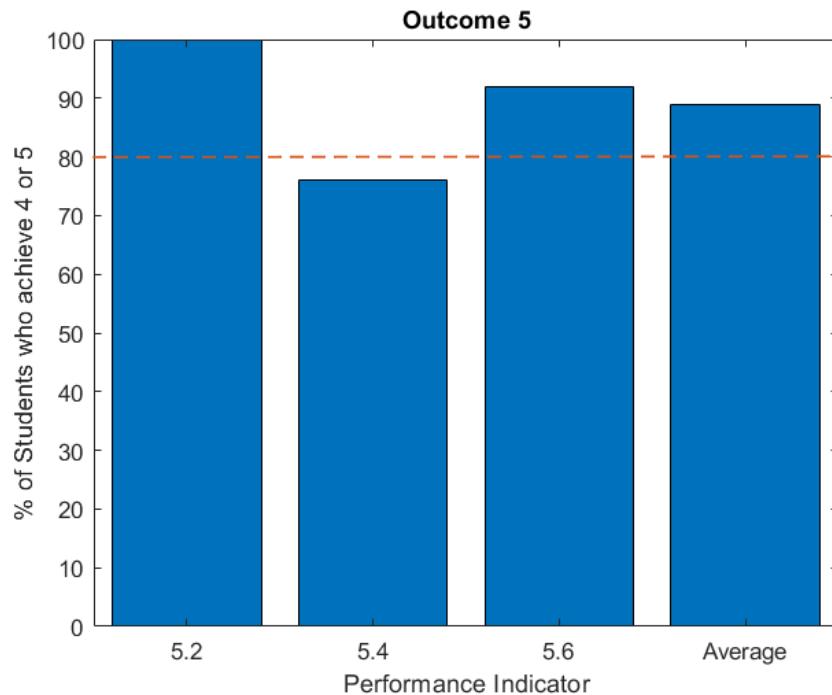


Figure 5-1

Summary

The evaluation of student work and senior exit interviews indicates that Outcome 5 was met in the 2020-2021 school year.

Recommendation

Evaluate Outcome 5 during the 2021-2022 school year as planned.

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Outcome 6 An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

In order to assess student achievement of this outcome, a variety of performance indicators (PIs) are measured. Some performance indicators are measured using course work and exams, and others are measured using student exit surveys. Since both computer and electrical engineering students are assessed using the performance indicators, only the performance indicators specifically for EE students will be included in this summary.

Student work is rated on a scale from 1 to 5 with 5 being the highest. The goal for student performance is that a minimum of 80% of students will attain either a 4 or 5 on the assessment. Table 6-1 indicates the instruments used to measure each PI, and Figure 6-1 indicates which PIs have met the 80% goal.

Table 6-1: Assessment of Outcome 6 for Electrical Engineering

Performance Indicator	Course/Instrument	Score
6.1 Design, analyze, simulate, test and evaluate a MOSFET active balun circuit.	ECE 3410 lab assignment	97
6.2 Design, deploy, and demonstrate a digital system.	ECE 3700 lab assignment	37
6.4 Did your education provide you with an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	Senior exit survey	64
Average score across all performance indicators		64

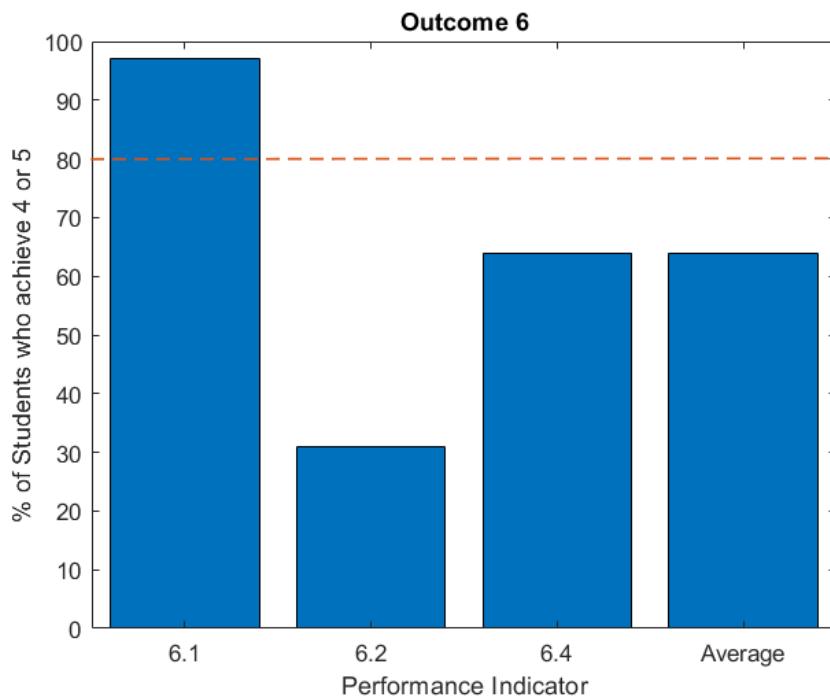


Figure 6-1

Summary

The evaluation of student work and senior exit interviews indicates that Outcome 6 was not met in the 2020-2021 school year.

Recommendation

Evaluate Outcome 6 during the 2021-2022 school year as planned.

The low performance indicator in Outcome 6 was 6.2 which is assessed in ECE 3700. The problem reported by Chris Winstead, who teaches this course, is that students were not as well prepared with knowledge of Verilog coming into the course, and it slowed down students' progress throughout the semester. Dr. Winstead is working with Dr. Zhang who teaches the prerequisite course, ECE 2700 Digital Circuits to address the deficiency. We believe the problem with students not knowing Verilog could also be due to remote learning during Covid.

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Outcome 7 An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

In order to assess student achievement of this outcome, a variety of performance indicators (PIs) are measured. Some performance indicators are measured using course work and exams, and others are measured using student exit surveys. Since both computer and electrical engineering students are assessed using the performance indicators, only the performance indicators specifically for EE students will be included in this summary.

Student work is rated on a scale from 1 to 5 with 5 being the highest. The goal for student performance is that a minimum of 80% of students will attain either a 4 or 5 on the assessment. Table 7-1 indicates the instruments used to measure each PI, and Figure 7-1 indicates which PIs have met the 80% goal.

Table 7-1: Assessment of Outcome 7 for Electrical Engineering

Performance Indicator	Course/Instrument	Score
7.1 Students are asked to describe how they learned a technical subject outside of their formal training.	ECE 3810 homework question	97
7.2 Did your education provide you with an ability to acquire and apply new knowledge as needed, using appropriate learning strategies?	Senior exit survey	88
Average score across all performance indicators		92

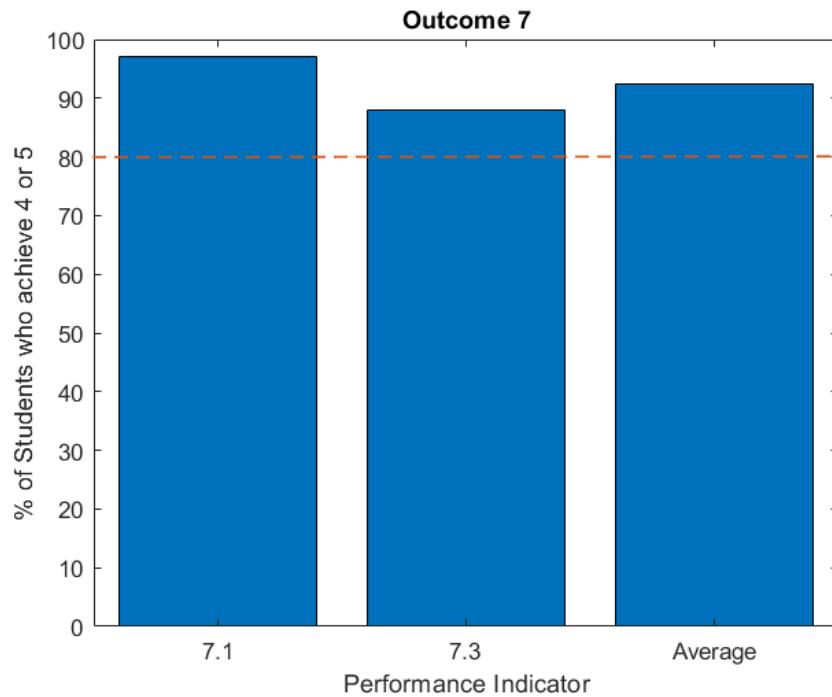


Figure 7-1

Summary

The evaluation of student work and senior exit interviews indicates that Outcome 7 was met in the 2020-2021 school year.

Recommendation

Evaluate Outcome 7 during the 2021-2022 school year as planned.