Program Assessment Report (PAR)

Materials Science + Egr (MSE) Baccalaureate Degree

REPORT PREPARED by: [PreparedBy]

ACADEMIC YEAR COVERED BY THIS REPORT: [AcademicYear]

I. PROGRAM LEARNING OUTCOMES

The Materials Science and Engineering program has adopted the Student Outcomes (SO) listed below 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 judgments, 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. These outcomes are identical to those listed in Criterion 3 of the ABET criteria for accreditation of engineering programs. No additional outcomes have been developed for the program.

II. PROCEDURES USED FOR ASSESSMENT

A. Direct Assessment

Summary of Student Outcome Assessment Cycle, 2018-2019 and 2019-2020 academic years At the end of the 2-year assessment cycle taking place during 2017-2019, a comprehensive review of the collected assessment was completed by compiling data from all 4 semesters. While all (1)-(7) Student Outcomes were covered during this period, each outcome was not covered with equal frequency. Outcomes (1), (2), (3), (4), (6) and (7) were consistently assessed, (5) was primarily assessed through Capstone Design and thus less frequently. The total number of

assessments broken down by (1)-(7) is shown in table 4-2, and a sample of the distilled data is shown in figure 4-4. All detailed assessment data is available upon request.

Table 4-2. Number of assessment data points broken down by ABET student outcome.

Student Outcome	Number of Assessments
1	6
2	9
3	11
4	6
5	4
6	13
7	7

Figure 4-4. Examples of summarized student outcome assessment for 2018-2019.

Class	Exam/Project	Question	Outcome	% Outstanding	% Strong	% acceptable	% Developing	% Needs improvement	% Satisfactory or better
ME 1040 (F18)	project report	Develop/meet a budget	2	2	0	0	0	0	100
ME 1040 (F18)	project report	creative recycling plan	4	0	1	0	1	0	50
ME 4910 (F18)	capstone report	written report completeness	3	1	0	0	0	0	100
ME 4910 (F18)	capstone report	clearly identify societal need	4	0	0	1	0	0	100
ME 4910 (F18)	capstone report	task division between teammates	5	0	0	1	0	0	100
ME 4910 (F18)	capstone report	develop clear experimental plan	2,6	1	0	0	0	0	100
ME 4910 (F18)	capstone report	lit search properly executed	7	1	0	0	0	0	100
ME 4740 (S19)	final exam	boat oar material selection	1,2	4	1	2	3	1	63
ME 4740 (S19)	final exam	column optimization	1,2	6	1	1	2	1	72
ME 4920 (F19)	class exercise	engineering ethics judgement	4	0	2	0	0	0	100
ME 3600 (S20)	lab report	beam modulus measurement	6,7	0	0	1	0	0	100
ME 3600 (S20)	lab report	modern data acquisition skills	6,7	0	1	0	0	0	100
ME 3600 (S20)	final exam	thermopile calculation	1	0	1	0	0	0	100
ME 4740 (S20)	project report	proper literature search	7	0	13	1	0	0	100
ME 4740 (S20)	project report	presentation skills	3	0	12	2	0	0	100
ME 4740 (S20)	project report	designing for societal needs	2,4	0	13	1	0	0	100

The CQI committee reviewed this entire data set in order to determine a set of programmatic concerns or recommendations. The committee was especially careful to review each assessment data point that was below the 70% threshold for acceptable performance. As discussed before, the nature of this assessment design results a comprehensive data on student performance, and not every data point below the 70% threshold is a cause for concern. Many exam questions given by instructors are meant to be challenge questions, and a low score on such questions does not generally merit program changes or improvements – they simply represent efforts by faculty to challenge their students. For the 2018-2019, a number of data points were below the 70% threshold. All of these were considered by the CQI committee as possible causes for concern. Out of all these assessments, a very limited number were identified as possibly needing further attention from the chair or course coordinator. These items are shown in table 4-3. As per the WSU BSMSE SO closed-loop assessment procedure, the CQI committee compiled a list of recommendations and charged the Curriculum committee to assess and take action. The recommendations were passed to the course coordinators for further discussion. During these discussions, it was heavily emphasized to the course coordinators that students had performed acceptably in many other assessments and that the vast majority of the assessments were of no concern. The course coordinators were invited to participate in the CQI committee discussions about any possible programmatic improvements or changes as a result of these assessments. The CQI committee identified no issues with the prerequisite structure during the 2018-2019 assessments.

Table 4-3. Student Outcome assessment items identified as possibly requiring further concern.

Course	Observation and/or Recommendation
ME 1040 (2018-2019)	The concern is for MSE students, and there were only two students in the course at the time of assessment. Recommended to wait and observe.
ME 2120 (2018-2019)	Student performance in one assessment was 64%. While low, this is quite close to the 70%

cutoff. No action necessary. ME 2210 (2018-2019) The exam question assessed was on angular accelleration of a body. Student performance was low at 38%. ME 3120 (2018-2019) Student performance on multiple assessments was quite low. Instructor (Young) acknowledges that he gives challenging problems on exams and generally expects students to perform lower than 70% on average. ME 4740 (2018-2019) Student performance in one assessment was 64%. While low, this is quite close to the 70% cutoff. No action necessary. ME 4910 (2018-2019) The concern is for MSE students, and there was only one student in the course at the time of assessment. Recommended to wait and observe. ME 4620 (2019-2020) It was observed that 3 out of 4 MSE students struggled to properly construct and format a stress-strain curve from tensile test data, Course coordinator and instructors should review the amount of lecture provided to assist students in analyzing their data. While this is a lab class and students should have the knowledge from previous courses, review might be necessary ME 4920 (2019-2020) Students struggled to clearly describe the larger societal impact of their capstone projects. This data point was only slightly below the 70% acceptable threshold (62.5%) due to the performance of a single capstone design group. The CQI committee recommends watch-and-wait. Full details and formatted tables and figures are available upon request.

B. Scoring of Student Work

Each instructor for an assessed class was asked to record student performance on each exam problem. At the end of the semester, the instructor reported individualized performance on each exam problem, in addition to the exam problems themselves, to the ABET committee for assessment. Each exam question was individually mapped to Student Outcomes (1)-(7), and assessed according to the following rubric 95% to 100% was considered Outstanding, 80% to 95% was considered Strong, 70% to 80% was considered Acceptable, 60% to 70% was considered Developing, and

C. Indirect Assessment

Qualitative Student Outcome Assessment Design – Exit Interviews In addition to the quantitative assessment process described above, there are several qualitative assessment processes that occur in the MSE undergraduate program that should be mentioned. In the past, senior exit interviews have been an important source of feedback and program assessment. Historically, the Academic Programming Director (Ms. Heather Casto) performed these interviews in person. Recently, the exit interviews have been performed as an online survey. While the specific format of the exit interviews has changed over the years, the feedback provided by graduating seniors has been found to be an excellent source of qualitative assessment. In fact, senior exit interviews often catch programmatic issues well before any other source of assessment, allowing quick adjustment of instructor, course formatting and programmatic elements as needed to maintain and improve the program. While a formal analysis of exit interviews is not

presented here, the data from the past 6 years of senior exit interviews is available upon request. Example of Exit Interview Questions The content of the exit interview can slightly change over time, but maintains the consistent goal of being an effective query of the graduating students on their overall experience in the program and their perceptions of strengths and weaknesses of the program. The current exit interview consists of the following questions 1. Looking back on your time here in the MME department here at WSU, what are some of the highlights? 2. Please describe any difficulty with courses, professors, or employment during your time in the MME department. For each, how could we improve our response to your request for assistance (tutoring, faculty support, etc)? 3. If you could give a faculty member an award, who and why? 4. What course did you learn the most from? What was special about this course? 5. What course has the most room for improvement and what improvements are necessary? 6. Are there any courses you would like to see offered that aren't currently being offered? 7. What course had the most room for improvement and what improvements are necessary? 8. Of the professors you took classes with in the MME Department, which professor had the most positive impact on you? 9. How could you have been better supported in terms of advising, tutoring, counseling, etc.? 10. What improvements in MME office operations should be made in areas such as scheduling appointments, senior design reimbursements, pre-req questions/issues, etc.? 11. If you could give a staff member an award, who and why? 12. What can be done to improve experiences in laboratories? 13. What areas of our facilities can be improved upon? 14. Did you participate in an Internship or Co-op? a. When? b. With who (list all)? c. What do you feel you gained from this experience? d. Did you visit or use resources provided by the BCDC? If so, please list and describe your assessment of the services. 15. Do you believe our curriculum prepared you for graduate school and /or a career in mechanical or materials engineering. Please explain. If no, what could we do to better prepare you for grad school/career? 16. What are your career goals? 17. Have you received any job offer? If so, with who? 18. What is your overall impression of the Department of Mechanical and Materials Engineering Department? 19. Would you recommend us to your peers? If not, what do we need to do better? 20. Is there anything else you would like to add that was not mentioned? 21. How would you rate your overall experience with your academic advisor (1-5 rating) 22. Please provide any comments or concerns related to advising Added to the Spring 2020 and subsequent exit interviews to address the widespread transition to remote and online learning following COVID-19 23. Which of the following ways did your instructors use to communicate new materials to you a. Synchronous delivery Lectures were broadcast live b. Asynchronous delivery Lectures were recorded and made available to you on Pilot 24. How did you interact with your instructor? Choose all that apply. a. During a live class using the chat box in BB Collaborate (Pilot) b. During a live class using the chat box in WebEx c. Using phone or email d. During office hours using BB Collaborate e. During office hours using WebEx f. Did not interact with the instructor 25. Did you have a study group that met regularly using WebEx, BB Collaborate, Zoom, or other online medium? (Yes or No) 26. How did you interact with your classmates? a. Using WebEx, BB collaborate, or other online medium b. Using phone or email c. Did not interact with classmates 27. In the space below, please comment on your best experience during remote learning 28. In the space below, please comment on your worst experience during remote learning

III. ASSESSMENT RESULTS/INFORMATION:

The data from the qualitative and quantitative Student Outcome assessments is used in a closed-loop process of review and program improvement as shown in Figure 4-3. At the end of each assessment cycle, the CQI committee and department chair conduct a formal review of the quantitative and qualitative Student Outcome data. The results of this review are a series of observations and recommendations for program improvement, which is presented to the department chair, course coordinators and faculty, as appropriate. A significant amount of deliberation is required by the CQI committee as the quantitative assessment results are translated into recommendations for action. During the evaluation of assessment data, all results that fell below the 70% Acceptable threshold were individually considered. Upon inspection of the data, it is evident that student performance on exams is highly dependent on the difficulty level of the specific exam question. For example, some questions on exams are specifically designed as "challenge" questions by the instructor. For this type of exam question, the ABET committee generally determined that performance below the 70% Acceptable threshold was not a cause for concern. On the other hand, consistent sub-70% performance across multiple assessment data sets in a single topic area was considered problematic. The results and recommendations are presented to the Curriculum committee for further evaluation and/or modification, which then pass them on to program faculty and course coordinators as appropriate. For example, a recommendation for small adjustments to an individual course can be presented to the course coordinator and implemented without much difficulty. Larger changes, such as the addition of a new class or a prerequisite structure change, required full faculty approval. These types of change are presented and discussed in departmental meeting and faculty retreats. The results of the changes are then monitored in the next assessment cycle. Note that the order of recommendation presentation can vary depending on meeting schedules. For example, if the CQI committee meet and perform their annual analysis in the middle of a semester, the resulting recommendations will be presented to the Curriculum committee before being presented at the end-of-semester departmental meeting. While this may be a procedural variability, the overall goal is to ensure that the proper faculty, administrators and committees are all aware of the changes and have the opportunity to provide input.

While the CQI committee considers the MME program to be in a healthy state, data analysis identified several areas where improvement and/or monitoring should continue. ME 1040 (2018-2019) The concern is for MSE students, and there were only two students in the course at the time of assessment. Recommended to wait and observe. ME 2120 (2018-2019) Student performance in one assessment was 64%. While low, this is quite close to the 70% cutoff. No action necessary. ME 2210 (2018-2019) The exam question assessed was on angular accelleration of a body. Student performance was low at 38%. Monitor topic in the future. ME 3120 (2018-2019) Student performance on multiple assessments was quite low.

Instructor (Young) acknowledges that he gives challenging problems on exams and generally expects students to perform lower than 70% on average. ME 4740 (2018-2019) Student performance in one assessment was 64%. While low, this is quite close to the 70% cutoff. No action necessary. ME 4910 (2018-2019) The concern is for MSE students, and there was only one student in the course at the time of assessment. Recommended to wait and observe. ME 4620 (2019-2020) It was observed that 3 out of 4 MSE students struggled to properly construct and format a stress-strain curve from tensile test data, Course coordinator and instructors should review the amount of lecture provided to assist students in analyzing their data. While this is a lab class and students should have the knowledge from previous courses, review might be necessary ME 4920 (2019-2020) Students struggled to clearly describe the larger societal impact of their capstone projects. This data point was only slightly below the 70% acceptable threshold (62.5%) due to the performance of a single capstone design group. The CQI committee recommends watch-and-wait.

The CQI committee was unable to identify any general areas of concern or weakness with regards to Student Outcomes 1-7. There are small, topic-specific concerns that will be scrutinized in the future, and are being addressed through the ABET closed-loop improvement process.

IV. ACTIONS TO IMPROVE STUDENT LEARNING

The results of this assessment process are shared with the undergraduate curriculum committee on a regular basis. Areas of concern are communicated to course coordinators for possible action, and the results are fed back to CQI in a closed-loop process. The entire process is communicated to the whole faculty at least once per year during a department meeting. The chair is closely involved in this process.

V. SUPPORTING DOCUMENTS

Additional documentation, when provided, is stored in the internal Academic Program Assessment of Student Learning SharePoint site.