

Assurance of Student Learning 2019-2020	
Ogden	School of Engineering and Applied Sciences
Mechanical Engineering, 543	
Program Coordinator: Chris Byrne	

<i>Use this page to list learning outcomes, measurements, and summarize results for your program. Detailed information must be completed in the subsequent pages.</i>				
Student Learning Outcome 1: Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.				
Instrument 1	Apply rubric to solution examples from selected course exams			
Instrument 2	Exit surveys of ME Seniors			
Instrument 3	Average grades in relevant courses			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 1.			Met	Not Met
Student Learning Outcome 2: 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.				
Instrument 1	Apply Rubric to Design Reports from selected courses			
Instrument 2	Exit surveys of ME Seniors			
Instrument 3	Average grades in relevant courses			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.			Met	Not Met
Student Learning Outcome 3: Ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions				
Instrument 1	Apply Rubrics to Artifacts (Lab reports in multiple ME courses)			
Instrument 2	Exit surveys of ME Seniors			
Instrument 3	Average grades in relevant courses			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			Met	Not Met
Program Summary (Briefly summarize the action and follow up items from your detailed responses on subsequent pages.)				
The assessment of student performance under Student Learning Outcomes 1, 2 and 3 is acceptable according to rubric-based evaluation of student work. In addition, graduates are completing relevant courses with good grades, and students have positive perceptions of skills learned. Program assessment indicates the curriculum for Mechanical Engineering prepares graduates with the abilities and skills needed to be successful practicing				

engineers. The WKU Mechanical Engineering Program will continue to prepare graduates with the same Student Learning Outcome activities and measures.

Student Learning Outcome 1

Student Learning Outcome	Graduates of the mechanical engineering program should show an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics		
Measurement Instrument 1	A scoring rubric specifically structured to directly assess the attributes stated in the outcome is applied to exam questions in the engineering science courses EM303, ME220, ME325, which capture key aspects of both the mechanical systems and thermo-fluid systems which mechanical engineering students' study. The rubric assesses 4 main attributes of problem solving. The selected courses have math and physics pre-requisites and utilize those specific skills in the solution of engineering problems. The mechanical systems component is captured by EM303, the thermo-fluids systems component is captured by both ME220 and ME325. The ME325 course is usually taken in the senior year and students have by then developed strong analytical skills and have experience applying math and science concepts in earlier design course projects and in earlier engineering science courses.		
Criteria for Student Success	Numerical results from applying the rubric to student work should reach a value of 3.0 on a 4.0 scale for senior level work. Scores of sophomore/junior level work may be somewhat lower, which can be used to track student development in the curriculum		
Program Success Target for this Measurement	Cohort average of 3.0 on a 4.0 scale	Percent of Program Achieving Target	Senior cohort score of 3.13
Methods	The exam solutions from each student in the course is reviewed separately from course grading. Select questions are identified and the outcome rubric applied to assess achievement. Values from each student are recorded, and a class average is determined. This approach captures every student graduating in the assessment year, and students who are rising to senior status. As such ME325 results give a representation of the graduating cohort for each academic year since it is offered once per year. Over the years the graduating cohorts have been as small as 18, and as large at 48 students.		
Measurement Instrument 2	Exit surveys of ME Seniors. One question on the Senior Exit Survey is used to assess their ability to apply knowledge of mathematics, science, and engineering, asking ME graduates about their awareness of this knowledge focused training in their program and their resulting ability to apply effectively.		
Criteria for Student Success	ME graduates self-report that they know about the mathematics, science, and engineering training they were receiving and are capable of performing at a level indicated by a numerical scale.		
Program Success Target for this Measurement	Score of 4.0 or higher on a 5.0 scale	Percent of Program Achieving Target	Score of 4.6 on a 5.0 scale
Methods	Graduating students complete a survey of their academic experience in the program while enrolled in their capstone course. A part of this survey is their assessment of the program learning outcomes. The December 2019 ME graduates self-reported that they knew about the mathematics, science, and engineering training they were receiving and could perform at a level of 4.6/5.0. (May 2020 graduate surveys lost due to online semester end) This self-		

	assessed value is fairly consistent with the other measurements for this outcome.		
Measurement Instrument 3	Average grades in relevant courses. The mechanical engineering curriculum builds upon math and science courses with engineering science courses in both mechanical systems and thermo-fluids systems courses. These courses are indicators of student capabilities in this student learning outcome. At the time of this report the ME program is working with institutional research to create comprehensive reports of student grades to aid in this assessment method. That data is not yet available.		
Criteria for Student Success	The mechanical engineering student performance in these core classes are expected to be at a high C grade on average. This indirect instrument method helps to identify areas of weakness in student performance and is used on a continual basis to track student learning.		
Program Success Target for this Measurement	Average score of 2.8 out of 4.0	Percent of Program Achieving Target	NA
Methods	Grades in the math, science and engineering science courses are assembled and reviewed for each graduating mechanical engineering student. This includes the courses ME220, ME240, ME310, ME325, ME330, ME344, EM222, EM303, EM313, Math136, Math137, Math237, Math331, Phys255, Phys265, Chem120 (or Chem116). For the 2020 cohort average course grades are not available at time of writing report. However our quick survey of grades suggest this measurement method will indicate our success target will be met.		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		Met	Not Met
Actions (Describe the decision-making process and actions for program improvement. The actions should include a timeline.)			
The assessment of student performance under Outcome 1 is acceptable according to rubric-based direct evaluation of student work. Graduates are expected to be completing relevant courses with satisfactory grades in the curriculum assuring that ME graduates have the ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. The WKU Mechanical Engineering Program will continue to prepare graduates with the same curriculum content, and monitor this student learning outcome with these measures. Once our grade reports are made available that measure will be utilized to finalize this annual assessment. No need for programmatic adjustments has been found.			
Follow-Up (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.)			
The mechanical engineering faculty will continue with program assessment on an annual basis. The accrediting agency, ABET, requires continual improvement through systematic assessment of student learning outcomes.			
Next Assessment Cycle Plan (Please describe your assessment plan timetable for this outcome)			
This SLO is assessed annually			

Student Learning Outcome 2	
Student Learning Outcome	Graduates of the mechanical engineering program should show 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.

Measurement Instrument 1	Program faculty apply a scoring rubric, specifically structured to directly assess the attributes stated in the outcome, to selected student work from junior design (ME300) and senior capstone design (ENGR490 and ENGR491). These courses capture the many aspects of complicated design projects that are undertaken to prepare the students to be capable engineers. The rubric assesses 6 main attributes of design. The selected courses have engineering science pre-requisites and utilize those specific skills in the creation of feasible mechanical designs.		
Criteria for Student Success	Numerical results from applying the rubric to student work should reach a value of 3.2 on a 4.0 scale for senior level work. Scores of sophomore/junior level work may be somewhat lower, which can be used to track student development in the curriculum		
Program Success Target for this Measurement	Score of 3.2 out of 4.0	Percent of Program Achieving Target	Score 3.5 out of 4.0
Methods	The design reports from each team in the course is reviewed separately from course grading. The outcome rubric is applied to assess achievement. Values from each report are recorded, and a class average is determined. This approach captures every student graduating in the assessment year, and students who are rising to senior status. As such ENGR490/ENGR491 results give a representation of the graduating cohort through this capstone experience.		
Measurement Instrument 2	Exit surveys of ME Seniors are used as an indirect measure. One question on the Senior Exit Survey is used to assess their 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. They are asked about their awareness of this knowledge focused training in their program and their resulting ability to apply effectively		
Criteria for Student Success	ME graduates self-report that they know about the engineering design training they were receiving and are capable of performing at a level indicated by a numerical scale.		
Program Success Target for this Measurement	4.0 on a 5.0 scale	Percent of Program Achieving Target	Score of 4.5 out of 5.0
Methods	Graduating students complete a survey of their academic experience in the program while enrolled in their capstone course. A part of this survey is their assessment of the program learning outcomes. The December 2019 ME students self-reported that they knew about the engineering design training they were receiving and could perform at a level of 4.5/5.0. (May 2020 graduate surveys lost due to online semester end) This self-assessed value is fairly consistent with the other measurements for this outcome.		
Measurement Instrument 3	Average grades in relevant courses. The mechanical engineering curriculum builds upon math, science, and engineering science courses with engineering design courses from sophomore through senior capstone courses. These courses are indicators of student capabilities in this student learning outcome. At the time of this report the ME program is working with institutional research to create comprehensive reports of student grades to aid in this assessment method. That data is not yet available		
Criteria for Student Success	The mechanical engineering student performance in the core design courses are expected to be at a B grade on average. This indirect instrument method helps to identify areas of weakness in student performance and is used on a continual basis to track student learning and development in the program		

Program Success Target for this Measurement	3.0 out of 4.0	Percent of Program Achieving Target	NA		
Methods	Grades in the design courses are assembled and reviewed for each graduating mechanical engineering student. This includes the courses ME200, ME300, and the 2 semester capstone sequence ENGR490/ENGR491. For the 2020 cohort average course grades are not available at time of writing report. However our quick survey of grades suggest this measurement method will indicate our success target will be met.				
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.			<table border="1"> <tr> <td style="background-color: #90EE90;">Met</td> <td>Not Met</td> </tr> </table>	Met	Not Met
Met	Not Met				
Actions (Describe the decision-making process and actions planned for program improvement. The actions should include a timeline.)					
The assessment of student performance under Outcome 2 is acceptable according to rubric-based direct evaluation of student work. Graduates are completing relevant courses with satisfactory grades in the curriculum assuring that ME graduates have the 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. The WKU Mechanical Engineering Program will continue to prepare graduates with the same curriculum content, and monitor this student learning outcome with these measures. Once our grade reports are made available that measure will be utilized to finalize this annual assessment. No need for programmatic adjustments has been found.					
Follow-Up (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.)					
The mechanical engineering faculty will continue with program assessment on an annual basis. The accrediting agency, ABET, requires continual improvement through systematic assessment of student learning outcomes.					
Next Assessment Cycle Plan (Please describe your assessment plan timetable for this outcome)					
This SLO is assessed annually					

Student Learning Outcome 3			
Student Learning Outcome	Graduates of the mechanical engineering program should show an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (ABET SLO 6)		
Measurement Instrument 1	Program faculty apply scoring rubrics, specifically structured to directly assess the major attributes supporting the outcome, to selected student work from several key mechanical engineering courses. These courses capture the many aspects of engineering experimentation that prepare the students to be effective practitioners. The rubrics assess the Design, Inquiry, Analysis and Application aspects of this outcome. The selected courses have students create artifacts which represent those specific skills.		
Criteria for Student Success	Numerical results from applying the rubric to student work should reach a value of 3.2 on a 4.0 scale for senior level work. Scores of sophomore/junior level work may be somewhat lower, which can be used to track student development in the curriculum.		
Program Success Target for this Measurement	3.2 out of 4.0	Percent of Program Achieving Target	Score of 3.32 out of 4.0

Methods	The written reports from each student or team in the course is reviewed separately from course grading. The outcome rubric is applied to assess achievement. Values from each report are recorded, and a class average is determined. This approach captures every student graduating in the assessment year, and students who are rising to senior status. As such ME333 results give a representation of the graduating cohort through this capstone experience. The “Experimentation” was assessed by artifacts from ME347, ME332 and ME333, which gave a combined average score of 3.4. The ME347 work was assessed by extensometer reports (3.4/4), ME331 by conservation law reports (3.46/4), and ME333 by convection experiment reports (3.32/4).		
Measurement Instrument 2	Exit surveys of ME Seniors are used as an indirect measure. One question on the Senior Exit Survey is used to assess their to ability develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions . They are asked about their awareness of this knowledge focused training in their program and their resulting ability to apply effectively.		
Criteria for Student Success	ME graduates self-report that they know about the engineering Experimentation training they were receiving and are capable of performing at a level indicated by a numerical scale.		
Program Success Target for this Measurement	4.0 out of 5.0	Percent of Program Achieving Target	Score of 4.2 out of 5.0
Methods	The assessment of student performance under Outcome 3 is acceptable according to rubric-based direct evaluation of student work. Graduates are completing relevant courses which produce assessable experimentation artifacts within the ME curriculum assuring that ME graduates have the ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. The WKU Mechanical Engineering Program will continue to prepare graduates with the same curriculum content, and monitor this student learning outcome with these measures. No need for programmatic adjustments has been found.		
Measurement Instrument 3	Average grades in relevant courses. The mechanical engineering curriculum builds upon math, science, and engineering science courses and laboratories with engineering experimentation lab courses from sophomore through senior year. The lab courses ME241, ME347, ME332 and ME333 are indicators of student capabilities in this student learning outcome. At the time of this report the ME program is working with institutional research to create comprehensive reports of student grades to aid in this assessment method. That data is not yet available		
Criteria for Student Success	The mechanical engineering student performance in the core laboratory courses are expected to be near a B grade on average. This indirect instrument method helps to identify areas of weakness in student performance and is used on a continual basis to track student learning and development in the program		
Program Success Target for this Measurement	3.0 out of 4.0	Percent of Program Achieving Target	NA
Methods	Grades in the lab courses are assembled and reviewed for each graduating mechanical engineering student. This includes the courses ME241, ME347, ME332, and ME333. For the 2020 cohort average course grades are not available at time of writing report. However our quick survey of grades suggest this measurement method will indicate our success target will be met.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.			Met
			Not Met

Actions (Describe the decision-making process and actions planned for program improvement. The actions should include a timeline.)
The assessment of student performance under Outcome 3 is acceptable according to rubric-based direct evaluation of student work. Graduates are completing relevant courses with satisfactory grades in the curriculum assuring that ME graduates have the ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. The WKU Mechanical Engineering Program will continue to prepare graduates with the same curriculum content, and monitor this student learning outcome with these measures. Once our grade reports are made available that measure will be utilized to finalize this annual assessment. No need for programmatic adjustments has been found.
Follow-Up (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.)
The mechanical engineering faculty will continue with program assessment on an annual basis. The accrediting agency, ABET, requires continual improvement through systematic assessment of student learning outcomes.
Next Assessment Cycle Plan (Please describe your assessment plan timetable for this outcome)
This SLO is assessed annually

Student Learning Outcome 1: Upon graduation, our students have the ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.				
	Capstone 4	Milestones		Benchmark 1
		3	2	
Calculation (Quantitative Literacy VALUE Rubric)	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.)	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem.	Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem.	Calculations are attempted but are both unsuccessful and are not comprehensive.

Define Problem (Problem Solving VALUE Rubric)	Demonstrates the ability to construct a clear and insightful problem statement with evidence of all relevant contextual factors.	Demonstrates the ability to construct a problem statement with evidence of most relevant contextual factors, and problem statement is adequately detailed.	Begins to demonstrate the ability to construct a problem statement with evidence of most relevant contextual factors, but problem statement is superficial.	Demonstrates a limited ability in identifying a problem statement or related contextual factors.
Identify Strategies (Problem Solving VALUE Rubric)	Identifies multiple approaches for solving the problem that apply within a specific context.	Identifies multiple approaches for solving the problem, only some of which apply within a specific context.	Identifies only a single approach for solving the problem that does apply within a specific context.	Identifies one or more approaches for solving the problem that do not apply within a specific context.
Evaluate Potential Solutions (Problem Solving VALUE Rubric)	Evaluation of solutions is deep and elegant (for example, contains thorough and insightful explanation) and includes, deeply and thoroughly, all of the following: considers history of problem, reviews logic/reasoning, examines feasibility of solution, and weighs impacts of solution.	Evaluation of solutions is adequate (for example, contains thorough explanation) and includes the following: considers history of problem, reviews logic/reasoning, examines feasibility of solution, and weighs impacts of solution.	Evaluation of solutions is brief (for example, explanation lacks depth) and includes the following: considers history of problem, reviews logic/reasoning, examines feasibility of solution, and weighs impacts of solution.	Evaluation of solutions is superficial (for example, contains cursory, surface level explanation) and includes the following: considers history of problem, reviews logic/reasoning, examines feasibility of solution, and weighs impacts of solution.

Student Learning Outcome 2: Upon graduation, our students have the ability to apply engineering design to produce solutions that meet specific needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

	Capstone 4	Milestones		Benchmark 1
		3	2	
Acquiring Competencies (Creative Thinking VALUE Rubric)	Reflect: Evaluates creative process and product using domain-appropriate criteria.	Create: Creates an entirely new object, solution or idea that is appropriate to the domain.	Adapt: Successfully adapts an appropriate exemplar to his/her own specifications.	Model: Successfully reproduces an appropriate exemplar.
Solving Problems (Creative Thinking VALUE Rubric)	Not only develops a logical, consistent plan to solve problem, but recognizes consequences of solution and can articulate reason for choosing solution.	Having selected from among alternatives develops a logical, consistent plan to solve the problem.	Considers and rejects less acceptable approaches to solving problem.	Only a single approach is considered and is used to solve the problem.
Embracing Contradictions (Creative Thinking VALUE Rubric)	Integrates alternate, divergent, or contradictory perspectives or ideas fully.	Incorporates alternate, divergent, or contradictory perspectives or ideas in a exploratory way.	Includes (recognizes the value of) alternate, divergent, or contradictory perspectives or ideas in a small way.	Acknowledges (mentions in passing) alternate, divergent, or contradictory perspectives or ideas.
Connecting, Synthesizing, Transforming (Creative Thinking VALUE Rubric)	Transforms ideas or solutions into entirely new forms.	Synthesizes ideas or solutions into a coherent whole.	Connects ideas or solutions in novel ways.	Recognizes existing connections among ideas or solutions.
Implement Solutions (Problem Solving VALUE Rubric)	Implements the solution in a manner that addresses thoroughly and deeply multiple contextual factors of the problem.	Implements the solution in a manner that addresses multiple contextual factors of the problem in a surface manner.	Implements the solution in a manner that addresses the problem statement but ignores relevant contextual factors.	Implements the solution in a manner that does not directly address the problem statement.
Identifying specific project objectives, standards, and constraints based on general project requirements	All important objectives, standards, and constraints are identified and clearly implemented	Most important objectives, standards, and constraints are identified and implemented with minor deficiencies	Some objectives, standards, and constraints are identified with some deficiencies	Objectives, standards, and/or constraints not clearly identified or contain significant deficiencies

Student Learning Outcome 3: Upon graduation, our students have the ability to communicate effectively with a range of audiences.				
Written Communication	Capstone 4	Milestones		Benchmark 1
		3	2	
Context of and Purpose for Writing (Written Communication VALUE Rubric)	Demonstrates a thorough understanding of context, audience, and purpose that is responsive to the assigned task(s) and focuses all elements of the work.	Demonstrates adequate consideration of context, audience, and purpose and a clear focus on the assigned task(s) (e.g., the task aligns with audience, purpose, and context).	Demonstrates awareness of context, audience, purpose, and to the assigned tasks(s) (e.g., begins to show awareness of audience's perceptions and assumptions).	Demonstrates minimal attention to context, audience, purpose, and to the assigned tasks(s) (e.g., expectation of instructor or self as audience).
Content Development (Written Communication VALUE Rubric)	Uses appropriate, relevant, and compelling content to illustrate mastery of the subject, conveying the writer's understanding, and shaping the whole work.	Uses appropriate, relevant, and compelling content to explore ideas within the context of the discipline and shape the whole work.	Uses appropriate and relevant content to develop and explore ideas through most of the work.	Uses appropriate and relevant content to develop simple ideas in some parts of the work.
Control of Syntax and Mechanics (Written Communication VALUE Rubric)	Uses graceful language that skillfully communicates meaning to readers with clarity and fluency, and is virtually error free.	Uses straightforward language that generally conveys meaning to readers. The language in the portfolio has few errors.	Uses language that generally conveys meaning to readers with clarity, although writing may include some errors.	Uses language that sometimes impedes meaning because of errors in usage.
Interpretation (Quantitative Literacy VALUE Rubric)	Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information.	Provides accurate explanations of information presented in mathematical forms. <i>For instance, accurately explains the trend data shown in a graph.</i>	Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units.	Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means.
Content	Technical/Professional information at an appropriate level for course, Key concepts and terms explained clearly. Research and/or analysis of topic clearly evident Reader gains significant new knowledge and insight	Technical/Professional information at an appropriate level for course, some concepts not completely clarified, research and/or analysis of topic generally evident. Reader gains some new knowledge and insight.	Technical/Professional information at a marginal level for course, many concepts unclear or not discussed. Reader gains little new knowledge or insight	Technical/Professional information unacceptable for course, most concepts unclear or not discussed, reader gains no new knowledge or insight

