SAINT LOUIS UNIVERSITY.

Program-Level Assessment: Annual Report

Program Name (no acronyms): Aerospace Engineering	Department: Engineering
Degree or Certificate Level: Bachelor of Science	College/School: Parks College
Date (Month/Year): 2021	Assessment Contact: Sanjay Jayaram
In what year was the data upon which this report is based collected? AY 2019-2021	
In what year was the program's assessment plan most recently reviewed/updated? AY 2019	

1. Student Learning Outcomes

Which of the program's student learning outcomes were assessed in this annual assessment cycle? (Please list the full, complete learning outcome statements and not just numbers, e.g., Outcomes 1 and 2.)

In this two-year assessment cycle, the program assessed three HLC student learning outcomes. We have identified HLC outcomes that were equivalent to the ABET outcomes, i.e., outcomes 1, 4 and 7. In the two year cycle, the following courses were assessed for outcomes 1, 4 and 7. Three courses were identified for each outcome (one early, one middle and one late), based on where the course is offered in the curriculum.

Outcome 1: ESCI 2100 (early), AENG 3220 (middle), AENG 4110 (late)

Outcome 4: AENG 1001 (early), AENG 2000 (middle), AENG 4014 (late)

Outcome 7: ESCI 2300 (early), AENG 3100 (middle), AENG 4004 (late)

2. Assessment Methods: Artifacts of Student Learning

Which artifacts of student learning were used to determine if students achieved the outcome(s)? Please describe and identify the course(s) in which these artifacts were collected. Clarify if any such courses were offered a) online, b) at the Madrid campus, or c) at any other off-campus location.

The artifacts collected include project reports, design reports, homeworks and exams. The artifacts were collected from following courses:
ESCI 2100 (early), AENG 3220 (middle), AENG 4110 (late)
AENG 1001 (early), AENG 2000 (middle), AENG 4014 (late)
ESCI 2300 (early), AENG 3100 (middle), AENG 4004 (late)

Madrid courses are not included in this assessment and no courses were offered at any other off-campus location.

3. Assessment Methods: Evaluation Process

What process was used to evaluate the artifacts of student learning, and by whom? Please identify the tools(s) (e.g., a rubric) used in the process and **include them in/with this report document** (do not just refer to the assessment plan).

Each of the courses were evaluated by the faculty member who taught the course and filled an assessment form (sample form attached) identifying whether the outcome was met or not. 70% - 75% of students must meet expectations of 70% or more to satisfy the outcomes requirement.
A faculty review committee, made of three faculty members reviewed all the courses in each outcome to evaluate and verify the assessment process, the appropriateness of the artifacts collected and any recommendations (sample form attached)

4. Data/Results

What were the results of the assessment of the learning outcome(s)? Please be specific. Does achievement differ by teaching modality (e.g., online vs. face-to-face) or on-ground location (e.g., STL campus, Madrid campus, other off-campus site)?

Outcome 1: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics – This outcome was assessed across three courses in the curriculum (freshmen to senior) with receiving an outcome achievement of 75% or more. (homeworks, exams and project reports)

Outcome 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 – This outcome was assessed across three courses in the curriculum (freshmen to senior) with receiving an outcome achievement of 75% or more (class activity/module, self-reflection on a topic in final exam, demonstrating ethical responsibility in design)

Outcome 7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies - This outcome was assessed across three courses in the curriculum (freshmen to senior) with receiving an outcome achievement of 75% or more (design reports, project reports and project portfolio)

5. Findings: Interpretations & Conclusions

What have you learned from these results? What does the data tell you?

The outcomes assessment from various courses across the curriculum indicates the students are achieving the desired program outcomes at the desired level of performance

6. Closing the Loop: Dissemination and Use of Current Assessment Findings

A. When and how did your program faculty share and discuss these results and findings from this cycle of assessment?

The program keeps all the relevant assessment documents and the evidence collected in T-drive. The AE and ME program faculty meets at least once every semester to discuss the assessment process and continuous improvement process.

B. How specifically have you decided to use these findings to improve teaching and learning in your program? For example, perhaps you've initiated one or more of the following:

Changes to the Curriculum or Pedagogies	• Course content • Teaching techniques • Improvements in technology • Prerequisites	• Course sequence • New courses • Deletion of courses • Changes in frequency or scheduling of course offerings
Changes to the Assessment Plan	• Student learning outcomes • Artifacts of student learning • Evaluation process	• Evaluation tools (e.g., rubrics) • Data collection methods • Frequency of data collection

Please describe the actions you are taking as a result of these findings.

The outcomes assessment review indicates students have achieved the desired level of performance. The AE and ME program has revised and developed a new curriculum to include the University CORE requirements as well as course changes to satisfy ABET requirements. These new courses will be assessed from Fall 2021 assessment cycle. We are also in the process of developing a new, simplified rubrics for assessment.

If no changes are being made, please explain why.

N/A

7. Closing the Loop: Review of Previous Assessment Findings and Changes

A. What is at least one change your program has implemented in recent years as a result of assessment data?

Though students achieved desired outcomes, the review identified some deficiencies that should be resolved, like, lack of proficiency in trigonometry and units conversions, multiple-choice questions under timed interval was difficult for students to complete (final exam).

B. How has this change/have these changes been assessed?

Discussion with math and physics department faculty to identify proper remedies and request them to implement. The next cohort of students will be assessed to see if improvements are identified.

C. What were the findings of the assessment?

Not done yet

D. How do you plan to (continue to) use this information moving forward?

Continue to develop the performance indicators and scoring rubrics to streamline the assessment process and methods. Put emphasis on the performance indicators and scoring rubrics to assess the outcomes achievement.

IMPORTANT: Please submit any assessment tools (e.g., rubrics) with this report as separate attachments or copied and pasted into this Word document. Please do not just refer to the assessment plan; the report should serve as a stand-alone document.

CRITERIA 1

AEME ABET Assessment Review Form

This form is to be used to record review group thoughts about assessment materials collected, including: appropriateness of materials gathered, recommendations for course changes, and recommendations for adjusting the assessment process.

Program (AE or ME): **AE** Date materials reviewed: Sept 27 – Oct 6, 2021

Criterion reviewed (circle one): 1 2 3 4 5 6 7

Criterion period (circle one): **Early** Middle Late

Semester(s) reviewed: ESCI 2100 (Statics) / Spring 2019, Fall 2019, Spring 2020, Fall 2020, Spring 2021

Reviewers: Theodosios Alexander, Srikanth Gururajan, Jeff Ma

Appropriateness of materials gathered:

A range of materials are collected, including homework, midterms and final exams. It may be more helpful to identify a particular problem/concept and tracked consistently.

Recommendations for course changes:

Students are meeting the objectives, and appropriate actions are already being implemented (inclusion of additional exercise problems). So, the committee makes no further recommendations.

Recommendations for adjusting assessment process:

As noted, it would be appropriate to isolate questions/concepts on the assignment/exam that are pertinent to this topic and archive only those items.

Other:

N/A

AEME ABET Assessment Review Form

This form is to be used to record review group thoughts about assessment materials collected, including: appropriateness of materials gathered, recommendations for course changes, and recommendations for adjusting the assessment process.

Program (AE or ME): **AE** Date materials reviewed: Sept 27 – Oct 6, 2021

Criterion reviewed (circle one): 1 2 3 4 5 6 7

Criterion period (circle one): Early **Middle** Late

Semester(s) reviewed: AENG 3220 (Aerodynamics) / Spring 2020, Spring 2021

Reviewers: Theodosios Alexander, Srikanth Gururajan, Jeff Ma

Appropriateness of materials gathered:

The materials gathered for this assessment is consistent over the period it was evaluated, and it is appropriate for this criteria.

Recommendations for course changes:

No additional recommendations over the potential recommendations that have been suggested by the instructor to "*create a math-only rubric to isolate mathematical problems*"

Recommendations for adjusting assessment process:

None.

Other:
N/A

AEME ABET Assessment Review Form

This form is to be used to record review group thoughts about assessment materials collected, including: appropriateness of materials gathered, recommendations for course changes, and recommendations for adjusting the assessment process.

Program (AE or ME): **AE** Date materials reviewed: Sept 27 – Oct 6, 2021

Criterion reviewed (circle one): 1 2 3 4 5 6 7

Criterion period (circle one): Early Middle **Late**

Semester(s) reviewed: AENG 4110 (Flight Vehicle Structures) / Fall 2020

Reviewers: Theodosios Alexander, Srikanth Gururajan, Jeff Ma

Appropriateness of materials gathered:

Material gathered for this assessment is appropriate, for this level

Recommendations for course changes:

None

Recommendations for adjusting assessment process:

None

Other:
N/A

CRITERIA 4

AEME ABET Assessment Review Form

This form is to be used to record review group thoughts about assessment materials collected, including: appropriateness of materials gathered, recommendations for course changes, and recommendations for adjusting the assessment process.

Program (AE or ME): **AE** Date materials reviewed: Sept 27 – Oct 6, 2021

Criterion reviewed (circle one): 1 2 3 **4** 5 6 7

Criterion period (circle one): **Early** Middle Late

Semester(s) reviewed: AENG 1001 (Introduction to AE/ME) / Spring 2019, Fall 2019, Spring 2020

Reviewers: Michael Swartwout, Srikanth Gururajan, Chi Hou Lei

Appropriateness of materials gathered:

The Play Pumps assignment is appropriate/effective; but the entire assignment should not be used. Rather, the specific questions associated with Outcome 4 should be identified and separately collected.

Recommendations for course changes:

None. As an introductory-level assignment/assessment, this is appropriate. Students are engaging with the material and meeting our objectives.

Recommendations for adjusting assessment process:

As noted above, isolate the questions on the assignment that are pertinent to this topic and archive only those items.

At the next review, determine whether the current expectation is too low, as almost all students are meeting it.

Other:
N/A

AEME ABET Assessment Review Form

This form is to be used to record review group thoughts about assessment materials collected, including: appropriateness of materials gathered, recommendations for course changes, and recommendations for adjusting the assessment process.

Program (AE or ME): **AE** Date materials reviewed: Sept 27 – Oct 6, 2021

Criterion reviewed (circle one): 1 2 3 **4** 5 6 7

Criterion period (circle one): Early **Middle** Late

Semester(s) reviewed: AENG 2000 (Intro to Aeronautics & Astron) / Fall 2019, Fall 2020

Reviewers: Michael Swartwout, Srikanth Gururajan, Chi Hou Lei

Appropriateness of materials gathered:

(Fall 2019) Students were tasked with team projects on a model rocket (written in AIAA format) and the futuristic flight vehicle model. Students got the opportunity to explore non-technical aspects.
(Fall 2020) An essay question evaluated students' performance in the final exam. Each student deliberated the border and social impacts of a current aerospace engineering issue, with an example chosen by the students.
The gathering of material is appropriate.

Recommendations for course changes:
N/A

Recommendations for adjusting assessment process:
The assessment can be based on a team project than an exam. Students are observed and evaluated over a more extended period of the semester.

Other:
N/A

AEME ABET Assessment Review Form

This form is to be used to record review group thoughts about assessment materials collected, including: appropriateness of materials gathered, recommendations for course changes, and recommendations for adjusting the assessment process.

Program (AE or ME): **AE** Date materials reviewed: Sept 27 – Oct 6, 2021

Criterion reviewed (circle one): 1 2 3 **4** 5 6 7

Criterion period (circle one): Early Middle **Late**

Semester(s) reviewed: AENG 4014 (Senior Design II) / Spring 2020, Spring 2021

Reviewers: Michael Swartwout, Srikanth Gururajan, Chi Hou Lei

Appropriateness of materials gathered:

The materials gathered are appropriate for this evaluation
Senior Design Final reports (2020 and 2021) – These reports give a detailed view of student teams' design and evaluation processes
External evaluators' assessment

Recommendations for course changes:

1. It *could* be useful to try to have the external (industry) evaluators be more involved with the student teams during the entire two course sequence. This could give them a more complete picture of the teams' design thinking and constraints they are operating under.

Recommendations for adjusting assessment process:

None

Other:

N/A

CRITERIA 7

AEME ABET Assessment Review Form

This form is to be used to record review group thoughts about assessment materials collected, including: appropriateness of materials gathered, recommendations for course changes, and recommendations for adjusting the assessment process.

Program (AE or ME): **AE** Date materials reviewed: Sept 27 – Oct 6

Criterion reviewed (circle one): 1 2 3 4 5 6 **7**

Criterion period (circle one): **Early** Middle Late

Semester(s) reviewed: ESCI 2300 (Thermodynamics) / Fall 20, Spring 20, Spring 21

Reviewers: Krishnaswamy Ravindra, Jenna Gorlewicz, Chi Hou Lei

Appropriateness of materials gathered:

Outcome 7 is: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Spring 2019 - (21/25 AE students met or exceeded 70%) over two sections; Final Exam problem involving one of the main concepts in the course (conservation of energy) on a typical work producing device (turbine)

ESCI 2300 Fall 20 - 9/11 AE students met or exceeded - final exam problem involving some of the main concepts in the course (conservation of energy, entropy calculations, use of property tables) on a typical heat exchanging device (heat exchanger)

Spring 20 - 46/55 students (AE vs. ME breakdown not given) met or exceeded; Two homework problems

Spring 21 - 22/26 AE students met or exceeded expectations; Final exam problem

Recommendations for course changes:

Perhaps an assignment (summary report or pptx) such as Thermodynamics of Geothermal energy, Thermodynamics in human body, etc., where students go beyond the textbook should be assessed.

Recommendations for adjusting assessment process:

Outcome 7 is: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. The current course may not be suitable for assessing objective 7. Perhaps AENG 2000 is better suited.

Measurement of new knowledge application is measured through solving a complex problem. It's a bit difficult to assess this acquisition unless we assume that the baseline is that they do not know how to do this or we have a pre-post type of setup. Something to consider for the future.
Additionally, on our evaluation sheets it says "lifelong learning" which doesn't really capture this outcome's intent.

Other:
N/A

AEME ABET Assessment Review Form

This form is to be used to record review group thoughts about assessment materials collected, including: appropriateness of materials gathered, recommendations for course changes, and recommendations for adjusting the assessment process.

Program (AE or ME): **AE** Date materials reviewed: Sept 26 – Oct 6, 2021

Criterion reviewed (circle one): 1 2 3 4 5 6 **7**

Criterion period (circle one): Early **Middle** Late

Semester(s) reviewed: AENG 3150 (Astrodynamics) / Fall 19, Fall 20
AENG 3100 (Computer Aided Engineering) / Spring 19, Fall 19, Spring 20, Fall 20, Spring 21

Reviewers: Krishnaswamy Ravindra, Jenna Gorlewicz, Chi Hou Lei

Appropriateness of materials gathered:

AENG 3150
Students were tasked with case study on a space mission / contractor project. Students researched on the topics, learned the pros/cons, and proposed their own ideas / suggestions for future implementations. Materials collected are written reports of students, which is appropriate.

Spring 19 - ¾ teams met expectations. Presentation and elevator pitch for reinvigorating the national space program. It was noted that this assignment wasn't a great fit for assessing outcome 7 by the instructor.

Spring 20 - 40/42 students met expectations; A case study of a space mission was presented; Instructor noted significant improvement over S19 assessment and that this project was a better fit but that the rubric needed to be more detailed

Spring 21 - 32/33 students met expectations; Case study project of space mission; Instructor notes that the assessment should be modified to isolate the lifelong learning piece

CAE
Students learnt various techniques in computational engineering analysis. They were then assigned projects where they solved new engineering problems with the said skills.

Fall 19 - 100% of students met expectations (7/7 AE and 19/19 ME) - a project was assigned that was presented through a ppt

Fall 20 - 100% of students met (8/8 AE) - project presentation

Spring 21 - 100% of students met (22/22 AE and 1/1 ME) - project presentation

Recommendations for course changes:

NA

Recommendations for adjusting assessment process:

We need to request for the number of AE and ME students to be listed on the evaluation form

We also need to consider what we are really measuring in this outcome and consider developing some consistency across the different courses that are being used to assess it.

In AENG 3150, the instructor has committed to continuously improve the assessment by fine-tuning the requirements for the students.

It seems that both courses are suitable to meet outcome 7. It is suggested that the department stays with one of these two courses in the future.

Other:
N/A

AEME ABET Assessment Review Form

This form is to be used to record review group thoughts about assessment materials collected, including: appropriateness of materials gathered, recommendations for course changes, and recommendations for adjusting the assessment process.

Program (AE or ME): **AE** Date materials reviewed: Sept 26 – Oct 6, 2021

Criterion reviewed (circle one): 1 2 3 4 5 6 **7**

Criterion period (circle one): Early Middle **Late**

Semester(s) reviewed: AE 4004 (Senior Design I) / Fall 2019, Fall 2020

Reviewers: Krishnaswamy Ravindra, Jenna Gorlewicz, Chi Hou Lei

Appropriateness of materials gathered:

AENG 4004 is the first half of a year-long sequence on senior design, where the students researched previous designs and developed plans for their own products (space research, rockets and aero-vehicles). Students acquired new skills throughout the semester. Their end-of-semester presentations were evaluated by practicing aerospace engineers from partnering industries.
The materials gathered are students' reports and evaluation forms filled by these external evaluators, which is commendable.

Fall 19: 100% of the student teams (not sure on AE vs. ME) were able to demonstrate usage of engineering tools, manufacturing of vehicles and components, and/or testing techniques, although in many cases this work came to full fruition in AENG 4014 Senior Design II.

Fall 20 - 100% of students met - based on final project report and project presentation

Recommendations for course changes:
Observation: In both AE and ME design presentations, it is observed that many students do not pay attention to significant digits for relevant quantities.
Suggestion: Focus on the importance of expressing significant digits in engineering design and presentation.

Recommendations for adjusting assessment process:
It was noted by the instructor that it might be worth including senior design part II into this evaluation.

Other:
N/A