

**IUPUI Program Review and Assessment Committee
Assessment Project Proposal
COVERSHEET**

Name and rank/title of Project Director:

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Mechanical Engineering

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Project Title:

Assessment of dissimilar scheduling strategies to deliver Mechanical Engineering Laboratory Course

Project Dates (all projects must be completed within one year of award):

Dec 2014 – Sep 2015

Project Checklist:

Statement of support from Dr. Jie Chen, Chair (submitted)

Budget (\$2500 requested to purchase supplies to conduct the lab assessment)

IRB consulted (IRB application will be submitted).

Assessment of dissimilar scheduling strategies to deliver Mechanical Engineering

Laboratory Course

Abstract

This proposal describes a plan to assess student learning outcomes in Mechanical Engineering 397 Lab course, a recently introduced 1-credit course that is part of a student's required courses to obtain the Bachelor of Science in Mechanical Engineering (B.S.M.E.) Current lab space, lab scheduling and budgets are constraints on the current instruction of students in Mechanical Engineering Department's laboratory courses. Several methods of laboratory instruction need to be analyzed to improve student learning outcomes and the Principles of Undergraduate Learning (PUL). Completion of this assessment would aid the department's decision making processes to develop better lab experiences for the students, the teaching assistants, and the professors.

Aims, objectives, and measurable outcomes

Our current course ME 397 Mechanical Engineering Labs has 14 experiments; one experiment per week is used to complete them during the semester. Currently the course has three course sections, with expected expansion to five sections in the near future. Each course section has the capacity of 20 students. Ideally each section is divided into groups of four students. This enables each student in the group to be involved with the experiment. Students have expressed concerns that they do not get to touch the equipment, and are merely data collectors. To alleviate this problem, we would like to do some assessment research. We also would like to analyze different approaches to lab teaching. There are several ways laboratory experiments can be conducted during one lab section. Students would be divided into groups of four students and then: (i) have four stations with the identical experiment, (ii) have two stations of two different experiments, or (iii) have four different experiments for the each group to complete. In all scenarios all

students would complete all four labs within four weeks. Another issue is a lack of lab space and availability. Lab course sections may have to increase from 20 to 25 students. Some students' schedules are becoming inflexible to put up with these changes. Creative ways are needed to accommodate students' schedules. This would be most beneficial to all concerned.

Description of the assessment methods that would be used in the project

For this research project we will focus on one lab assignment. It deals with the fatigue of a sample that is rotated in a fatigue tester apparatus. We will teach a lab experiment in three different ways:(i) all students in one class section will complete the fatigue tester lab in four weeks (with 4 groups, one group per week will complete that lab), (ii) all students in one class section will assemble the components and do the fatigue tester lab in one week's session, or (iii) students in one section of the course will complete the fatigue tester lab in one class session (with the help of 4 fatigue tester apparatus). Students would be asked to volunteer for this study. The volunteers would complete surveys before and after the 'fatigue tester' lab. The assessment of the effectiveness of those methods will also be assisted with peer evaluations forms, instructor observations, conducting student interviews, and evaluating project quality. Additional qualitative assessment will be conducted based on group lab reports. Observations from this study will be analyzed to explore how the different ways of conducting the experiment influences the PUL, 'Critical Thinking.'

Uses to be made of findings for program improvement

The findings will be useful for the IUPUI ME Department. We have over 50 lab experiments and increasing number of students in our program. Change is going to happen so it is necessary for the department to make decisions that are best for the students. We currently have some faculty

and student feedback to make decisions, however a mixed methods research project to determine better learning outcomes would be more helpful. This work would be written up and submitted to peer-reviewed journal such as Journal of Engineering Education.

Data Analysis Approach Utilization

Survey data obtained from the students will be analyzed for errors and outliers. Statistics will be used to ensure that the data is usable and that the data size is feasible. Our hypothesis is that students with more hands-on lab experiences will have better learning outcomes. This can be supported with an after-course survey that shows a trend that a student that had more experience with the lab experiments had a better lab experience and learning outcomes.

Contributions to an assessment plan for enhancing student learning

Mechanical Engineering courses are designed to give graduating engineers a sense of confidence. Students operating in an environment with older equipment may feel frustrated. Frustration, a longtime companion to learning outcomes, does still impact one's confidence levels. The performance of labs simultaneously enables peer evaluations to be conducted, which contribute to better student assessments and learning.

Budget: Appropriateness of proposed expenditures

We request the entire amount of \$2,500 for parts to build 3 additional lab stations for ME 397 Mechanical Labs course. It would assist in funding and obtaining materials to make 3 additional 'fatigue testing' machines. These machines would be constructed during several lab sessions and would help the department in the future, regardless of the research outcome.

Newness of the idea

Typically schools rely on commercial teaching aides for laboratory experiments. These devices are very expensive; however they are built to last several decades. Newer technologies such as 3d printers (plastic printers) can quickly fabricate new laboratory apparatus parts. The funding of this project would allow us an additional benefit (additional apparatus) and to see if this concept is realistic.

Intended use of findings

The department will share the information from the outcomes of this project. We also feel that a conference proceeding or a journal article can be created from the data obtained. At the very least a final report will be submitted to Program Review and Assessment Committee within one year.