

Purdue Engineer of 2020 Seed Grant Final Report

Michael Harris, ARMS

1. Project Information

Contact Name: Monica F. Cox

Project Title: Creation of an Instrument to Measure Selected Attitudes in Purdue's Engineer of 2020

Award Amount: \$40,000.00

Abstract:

This seed grant proposes to study undergraduate engineering and uses a mixed methods approach to examine undergraduate students' embodiments of the selected attributes. Using a mixed methods approach, the goals of this research are to (1) to identify, within academia and industry, observable outcomes that Purdue's Engineer of 2020 should demonstrate for three targeted attributes ("leadership," "recognize and manage change," and "synthesize engineering, business, and social perspectives"); and (2) to design, develop, and validate an assessment instrument of the identified outcomes. The results of this study will serve as the basis for the development of seminars and workshops, the inclusion of undergraduates in summer and academic-year research projects, and the creation of a new course aligned with the attributes targeted within this proposal. This research engages a variety of stakeholders (i.e., engineers in industry, engineering faculty, engineers in academia; and undergraduate students) in an empirical study of undergraduate engineering education. The proposed tool may be used to collect data which might be parsed by a variety of variables (e.g., gender, ethnicity) in an effort to note the similarities and differences in the current states of Purdue's Engineer of 2020 attributes. Although several of the Purdue 2020 attributes have been explored via existing centers and initiatives, this research is innovation because of its exploration of leadership and change-- topics that are not explicitly taught or researched at the undergraduate level within the College of Engineering.

2. Project Goals

Briefly state your project goals:

The goal of this research plan is to construct an assessment tool to measure Purdue's status regarding the following attributes: "leadership," "recognize and manage change," and "synthesize engineering, business, and social perspectives." Our research objectives are as follows:

- To identify, within academia and industry, observable outcomes that Purdue's Engineer of 2020 should demonstrate for the three targeted attributes; and
- To design, develop, and validate an assessment instrument of the identified outcomes

Please list the project's key results to date:

- Engineers in both contexts were more comfortable and familiar with leadership than with change and synthesis.
- The majority of respondents agree that leadership is an important attribute and should be developed by engineering students.
- Academicians are concerned about the placement of leadership in engineering courses. The majority do not believe that leadership should be an additional course added to the curricula.
- Faculty believe there are some elements of leadership in the curriculum (e.g., in capstone engineering courses).
- Several industrial experts believe that academia is not adequately preparing engineering students for leadership roles.

- The definition of change in engineering is not clear as well as the synthesis of engineering, business and social, perspectives.

3. Project Dissemination (check any that apply)

The PE2020 seed grant has resulted in new collaborations with:

- The Discovery Learning Research Center
- The Susan Bulkeley Butler Center for Leadership Excellence
- Engineering faculty at Purdue
- Industrial Representatives from a variety of settings

Programs created with the PE2020 seed grant have been exported to the following groups:

Because we are in the process of developing a tool, we have not had an opportunity to export our findings. We plan to extend our findings to other groups nationally in an upcoming NSF TUES Type I proposal. A NSF Type II project is pending.

Other:

A faculty member from Virginia Commonwealth University, Dr. Stephanie Adams, has co-authored a paper with the postdoc who was hired on the project and with the project PI.

4. External Dissemination

Please check any of the following that apply and provide appropriate details below.

Published Papers (complete reference)

Cox, M. F., Cekic, O., & Adams, S. G. (in-press). Developing leadership skills of undergraduate engineering students: Perspectives from engineering faculty. Invited paper for the *Journal of STEM Education: Innovations and Research*.

Submitted Papers

Conferences or Seminars

Cekic, O., Cox, M.F, & Zhu, J. (2010). Industry Expectations of Engineers as Leaders in Work Environments. *Proceedings for the Annual American Society for Engineering Education Conference*, Louisville, Kentucky.

Website address: _____

Other (explain below)

Cox, M.F., Cekic, O., Zhu, J., & Capabianco, B. (2009). *Measuring the Selected Attributes of Purdue's Engineer of 2020*. Poster presented at the 2009 Educating the Engineer of 2020 Workshop: Environmental & Societal Impact of Engineering Practice (September 22), Purdue University, West Lafayette, Indiana.

5. External Funding

Yes, we have applied for external funding

Funding agency: ___ NSF _____

Status: Awarded Pending Denied

If "Denied" do you plan to resubmit or submit elsewhere?

Yes. Agency name: _____

No. Reason for not resubmitting:

No, we did not apply for external funding.

If 'No', please list reasons:

6. Assessments

Please describe any assessment you have done on your project.

Currently we are developing the survey items for individual 2020 attributes (leadership, change, and synthesis), and we will work on the validity and reliability of the survey as a next step. We are in contact with a survey development specialist to validate the survey after the pilot testing.

Cases from some of the interviews with industrial experts have been translated into a class deliverable for a graduate ENE course, "Leadership, Policy, and Change in STEM Education." Students have expanded questions in which industrial experts operationized leadership into excellent cases that will be the basis for a new grant that will be submitted to NSF. Such cases can be implemented in undergraduate and graduate engineering courses.

7. Future Plans

What are your future plans for your project?

The Survey will be applied during fall 2010 semester to selected student population at Purdue. The survey results will be used to validate the instrument. Validated instrument will be used to gather data on a larger sample from multiple institutions, and, at this point we plan to apply for additional funding related to the dissemination of the tool itself.

A paper about the project will be submitted to the *Journal of Engineering Education* in the near future. The quality of the responses from the experts is rich.

8. Lessons Learned

What recommendations would you give to others interested in your project?

- Be realistic about the scope of the project. Conducting a mixed methods study can take longer to complete than anticipated.
- Understand that there may be a delay hiring staff for projects, especially if these staff are not presently on campus or do not represent the skill sets that you need to complete your projects.