

Submit a PDF copy of this completed Project Description Template to [ucite@case.edu](mailto:ucite@case.edu). The information in your project description should address the requested points, clarify your intentions, and concisely convey your goals.

The review committee will read applications as anonymous submissions. Please do not put your name anywhere in the text of your project description. You may include other details, such as your department and course titles.

**Project Title: Breadth of Engineering in Engineering Core Level**\_\_\_\_\_

## I. Project Nature & Goals

### Address the following questions as you describe the nature and goals of your project

*How will your project produce better teaching and deeper student learning? What scholarship about teaching and learning does your project engage with? What service learning opportunities may be possible through your project? How might your project align with the THINK BIG strategic plan or departmental goals?*

I am proposing development of new class topics and examples that relate Materials Chemistry basics taught in ENGR 145 to all the engineering departments. I have been teaching ENGR 145 (Chemistry of Materials) the last two Spring semesters. It is a compulsory class for all engineering students and most take it during the Spring, where the class population is generally over 350, and can reach to over 400. ENGR 145 is designed to be a core class for engineers as it teaches basics that are important to all engineers. During my tenure teaching the class, I made changes to achieve the following objectives: (i) To teach the freshman basics of materials chemistry, (ii) to relate the basics to applications and (iii) to introduce what “engineering think” is beyond learning how to solve certain types of problems. The last one is an issue that I observed while I was teaching the class. The students assume if they learn how to solve certain types of problems, they think they understand the concepts. Then when a different type of problem is provided which can be solved with the tools they learned in the class (which is what engineers supposed to do), they struggle. Almost all the students that take the class are freshman, most with only intended departments and some still completely unsure. When I collect the information at the beginning and at the end of the semester, I see a lot of changes in students’ intentions or the strength of their opinion on their choice. Therefore, I want to make sure that the class clearly relates to all engineering areas which strengthens it as a core class and help students get exposure to different engineering topics which may help them make a more informed decision on what they want to study. This in turn can help retainment of students.

Even though I have been making attempts to relate the topics to other engineering fields the limitations in my knowledge in what is being taught in the undergraduate classes of every engineering department and the expectation they have from ENGR 145, limits my efforts to improve this core class. This proposal targets overcoming this limitation. During the Fall 2020 semester, I would like to build an application base for all the basics I cover in the classroom in collaboration with faculty from different departments. These will be converted into class examples, and homework and exam questions. For example, I envision the HWs having at least one question per department that relates the topic to their specific area. This will enable both (i) a variety of opportunities to develop the “engineering think” and (ii) exposure to different engineering fields. Even though ABET outcomes are defined as skills acquired at the time of graduation, the proposed effort here will help achieve some of these outcomes, specifically “an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics” and “an ability to communicate effectively with a range of audiences”.

An undergraduate student who served as a teaching assistant in this class in the past will be hired to help with this conversion. One of the outcomes of the proposed research will be a more informed undergraduate freshman class in making their choices as well as understand what all the other engineering departments do. This is critical as both the industry and research world are becoming more interdisciplinary. Our graduates need to be able to communicate and understand engineers and scientists of different backgrounds and we need to instill the importance of it to the students early (i.e., freshman year). Therefore, the proposed work here addresses the first pathway of the “Think Big Initiative” (Ignite Interdisciplinarity).

## II. Professional Impact

*What is the relationship between your project and your teaching and/or research responsibilities at CWRU? Will your project have short-term or long-term impact on teaching and learning? How do you plan to maximize the number of students that may benefit from involvement in this project?*

This project directly relates to my teaching responsibilities as the instructor of ENGR 145. It will have a long-term impact in solidifying the class as a core to School of Engineering. Since this is a class taken by all the engineering students its outreach is great with nearly 400 students a year benefiting from the outcome. The project will help the students learn the breadth of engineering topics, relate the tools they learn to different problems, and learn “engineering think” and an interdisciplinary language. It will also help students to make a more informed decision in their choice of engineering departments and in turn help retainment of the students. The approach to the proposal which establishes relationships with all engineering departments forms a sustainable path that can continue in the future independent of a single instructor. This way all the engineering departments will be able to get the most out of this core class that will help students’ education even after they are done with this specific class. If successful this work can form a template for other core classes, or even compulsory basic science classes.

## III. Evidence of Project Goals & Student Learning

*What evidence will you seek to collect and analyze to determine how well or to what extent project goals were achieved? How will you measure evidence of student learning and/or teacher change?*

The evaluation of the implementation of the project will have two layers. The first one will be implemented at the end of the semester through the end of year evaluations completed by the students. Additional questions will be introduced by the instructor that measures the effectiveness of the approach. These questions will be in the line with examples such as:

- 1- Did this class help you better understand what each engineering field studies?
- 2- Did this class help you to make a more informed decision in choosing your field of study (or strengthen your decision if you have already decided prior to the class)?

These types of questions are not normally a part of the evaluation and ENGR 145 being a core class, I believe, it is critical for the class to address them. Each year I taught the class, I had over hundred students submit the evaluations which provides good statistics to evaluate the effectiveness of the approach.

The second layer of evaluation will be done in sophomore/junior classes in all engineering departments that require or depend on ENGR 145. In collaboration with the instructors of those classes an in-class survey will be provided to the students at the end of the related semester to evaluate how ENGR 145 helped them in the following classes and how this relationship can further be improved. An example of such a class is EBME 306 on “Introduction to Biomedical Materials” taught by Prof. Shoffstall (see the support letter).

## IVa. Budget Narrative & Timeline

*How will Nord Grant funds be used to support the project – for materials/equipment, for student stipends, or for something else? What support, if any, will the project receive from other sources, including on-campus (e.g. department funds) or beyond-campus (e.g. discipline-specific awards) funds? What is the proposed timeline for the project? Is this a new project or is the work already underway?*

The funds will support an undergraduate student who served as a teaching assistant for ENGR 145 and therefore who is familiar with the class. My contributions as well as the contributions of all the faculty from each department (listed below) will be in-kind support. Support letters from the faculty listed below are also submitted with this proposal.

The tasks for the student is to (i) attend all the meetings with different faculty, (ii) work with me to convert the topics discussed in these meetings to HW and Exam questions, (iii) create lecture slides related to these topics and (iv) research the internet for helpful content (e.g., YouTube videos) to provide to the students. The faculty listed below will be the initial point of contact in each department. They will be involved with both choosing the correct applications related to their fields, as well as providing the necessary contacts for instructors of sophomore/junior classes that require ENGR 145 as a prerequisite.

The expected commitment from the student will be 20hrs/week for 14 weeks. At \$12 per hour the total cost becomes \$3360. After the initial meeting with the faculty from different departments and a meeting with me on how to convert the topics to questions, the student will work on creating additional questions with the solution sets to generate a database useful beyond a single year.

The faculty contacts from each department is listed below: **(FROM UCITE: PI name redacted in reviewer copy, until review process is over, and letter from Shoffstall is on file.)**

- PI name**, Materials Science and Engineering
- Bryan Schmidt, Mechanical and Aerospace Engineering
- Christian Carloni, Civil Engineering
- Michael Hore, Macromolecular Science and Engineering
- Burcu Gurkan, Chemical Engineering
- Chris Zorman, Electrical Engineering
- Andrew Shoffstall, Biomedical Engineering

## IVb. Budget Details

### Expenses (round to the nearest dollar amount).

|   |                |
|---|----------------|
| Undergraduate student at \$12/hr for 14 weeks<br>20hrs/week | \$3360         |
| <b>Total Nord Grant Expenses</b>                            | <b>\$ 3360</b> |

### Cost Sharing

|  |                          |
|--|--------------------------|
| All the support by the faculty will be in kind support | \$                       |
| <b>Total Cost Sharing</b>                              | <b>\$ (total amount)</b> |
| <b>TOTAL PROJECT COST</b>                              | <b>\$ 3360</b>           |