Activity

4

Client – Consultant Mathematics Project

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Context: Out of class; Engineering 250 – Numerical Methods
Keywords: teams, communication, interdisciplinarity
Student Activity Time: 3-4 hours for customers, 6-8 hours for consultants

Students take on the roles of client and consultant to explore problem solving in linear algebra.

Introducing the Reflection Activity

Applying and communicating mathematics and using a programming language to do so can be complicated, but it's a highly desirable skill set for engineering students to develop. Two educators implemented a Client-Consultant project in the numerical methods course. The purpose of this activity was for students to reflect on the course material and other science and engineering courses to identify problems that can be solved using linear equations and MATLAB.

The numerical methods course, a requirement for engineering students, included two course projects. This particular course project was designed to allow students to take on two kinds of roles in the same project: client and consultant. The educators introduced the project and distributed examples of quality client requests, consultant reports, and the rubric. The educators then separated students into groups of 3-5 and gave the first deadline of completing the client request for the next class period (two days). Each group submitted the client request and the educators reviewed each of the requests for an appropriate level of complexity, and assigned each group a client request to respond to. The educators gave the students a full week to complete the consultant's report for their assigned client requests. The educators then collected, graded, and returned the reports. Each group also graded the response they received from their consultant group with a rubric.

The client request portion of the activity allowed students an opportunity to reflect on the course material in numerical methods, and the material in other courses that could be addressed with the knowledge of numerical methods. By completing the client request and consultant's report, students were also able to practice their technical communication skills, and apply their knowledge to practical technical problems. As a result of the entire project experience, students are able to identify and express the value of numerical methods and its applicability to various kinds of engineering problems.

DIGITAL LIBRARY CONTENT

- 4.1 Client Customer Project Requirements
- 4.2 Numerical Methods Prompt
- 4.3 Sample Consultant Report

Recreating the Reflection Activity

	Description
1	Assign and distribute the client-consultant assignment description and rubric.
2	Separate the class into groups of 3-5 students.
3	Give students 2 days to develop their customer request.
4	Give students a week to respond to the customer request they were given as consultants.
5	Have students grade their consultant's report using a rubric.
6	Collect, grade, and return student reports.

In the words of the Educator: Tips and Inspiration

Provide clear instructions and requirements. This project is more complex than most projects, so providing clear instructions and requirements is essential. I give the students some detailed instructions and a rubric. Students really want to know how their grade will be calculated since the project can be very ambiguous. They also have limited experience in writing technical documents. Explaining what the requirements are for a good report is essential for students to do well with the project. It is also helpful to give examples for the kinds of problems that can be proposed and the report that consultants should submit.

Set clear minimum and maximum requirements. Since the project is fairly open ended, you want to set some clear requirements. Some groups will propose a really complex problem, while other groups may propose a simpler problem. You have to be quick to look over their prompts to assess what is reasonable, what's not, what can be solved, and what cannot. That can impact how much time you as an educator spend preparing for and grading the project.

What was the inspiration for the reflection activity? This is a project that has been happening in the numerical methods course for a while, but we recently redesigned it for CPREE to include more reflective elements. The students acting as clients are asked to reflect on the course material to date, and identify a problem that involves the math that we have been doing. They are also allowed to look at other coursework for engineering students such as physics, statics, and other classes to identify problems that can be solved with linear systems. The students acting as consultants have to solve the problem of their client, and sometimes that means looking at classes or material that they may not be as familiar with.