Student Assessment in Capstone Design

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Abstract

To ensure that the graduates of engineering schools in Canada have appropriate background in engineering design, the Canadian Engineering Accreditation Board (CEAB) [2] specifies that every engineering program should provide students with a significant design experience based on the knowledge and skills acquired in earlier course work, and give students an exposure to the concepts of team work and project management. Typically, these “capstone design” courses are inquiry-based learning [3] courses that involve considerable hands-on project work by student teams. As well, many capstone design courses also include classroom instruction on design methodology, design theory, and project management.

The open-ended nature of the capstone design course sets it apart from other courses in the engineering curriculum, but also presents a number of challenges to teaching faculty, the foremost being assessment.

When designing an assessment tool for any course, it is important to match the assessment tool with the learning objectives for the assessment [1, 5]. In this way, the instructor can determine the extent to which students have achieved the learning objective, and ideally, the learning objective can be reinforced for the student (e.g., via feedback within the assessment).

Given the nature of capstone design courses however, the design of student assessments can be a challenge. In particular, capstone design course instructors face the challenge of coordinating multiple student projects: each of which involves a separate student group and faculty “project advisor” or “coach”. The instructor must develop assessment tools that facilitate consistent assessment across multiple projects, multiple teams, and multiple assessors. Additionally, these tools must be appropriate for the typical range of student deliverables for capstone design courses: e.g., reports, presentations, reviews, written assignments, and/or prototypes.

Given these challenges one might ask, why assess project work at all? For example, in most capstone design courses the “project advisor” or “coach” and in some cases the project sponsor or “customer” serve as the examiners. Each of these individuals typically has intimate knowledge of the project and the team’s performance and could make a good argument that the team’s result is a foregone conclusion.

As Powell notes [6], there are a number of substantial challenges to this line of thinking. In particular, it is tricky being facilitator and judge at the same time. To address this, it is common to use a report or series of reports and design reviews for assessment [4]. The key advantage to this approach (over the “foregone conclusion”) is that the student team has the opportunity to defend their decisions and also learn from their mistakes.

The challenge to teaching faculty is to create assessment tools that, (1) have clear requirements, (2) are clearly linked to the course objectives, (3) are flexible, and (4) are fair.

In this paper we look at the role of classroom assessment in the context of capstone design courses. Examples are provided from the author’s experience teaching a mechanical and manufacturing engineering capstone design course and recommendations are made based on this experience.

References

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