Bringing Feedback into the Course Development Loop

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Abstract

Student feedback contributes to course development through incorporation into a subsequent course design problem. The authors reviewed course-end critiques and identified two general trends. 1) Students found fluid mechanics concepts abstract and difficult to conceptualize and 2) students desired more realistic and challenging design opportunities. These two general comments were considered in the development of the subsequent course syllabus. The following semester course design problem directly addressed the first feedback trend above. Students were given the following problem statement: "Previous Fluid Mechanics students have identified the need for more visual demonstrations and experiments involving key Fluid Mechanics Concepts." Design groups were formed and assigned one of twelve key course concepts for which to design a solution or demonstration of the stated problem. This technique enhances the course in several ways. First, students that provided the original feedback are assured that their comments are indeed reviewed and considered important. Second, students accomplishing the design found that they had a truly open-ended, realistic and challenging problem to solve. Third, student motivation for the design was increased. Fourth, several of the final design products will be used in future semesters to enable students to more easily grasp fluid mechanics concepts.

I. Introduction

The United States Military Academy (USMA) must prepare its mechanical engineering graduates to meet diverse expectations in a technical army and in careers beyond the military. A primary mission of the academy is to develop "leaders of character" who have the capability to identify and solve complex problems. In fact, the military decision-making process is strikingly similar to many versions of design (or scientific, or problem-solving) processes as demonstrated in Figure 1.

The first step in any problem solving process is to define the need or identify the problem. Student feedback is an excellent method for gathering information and identifying shortfalls in many aspects of engineering instruction. Students at USMA complete a course-end survey for every course of instruction at the academy. Surveys completed for EM362A, Fundamentals of Fluid Mechanics, identified two shortfalls in the course that were addressed through the course design problem for the subsequent semester:

- a) Fluid mechanics concepts are abstract and difficult to conceptualize
- b) Students desired more realistic and challenging design opportunities

Incorporating this feedback when revising the syllabus for the following semester provided numerous benefits. Course improvement was immediately recognized in the motivation level of the students to produce a quality design product, students realized that their feedback is valued which led to improved feedback comments, and several of the design products will be incorporated in the future in order to aid student understanding of fluid mechanics.



Figure 1. Military Problem Solving

An important additional benefit is the practical demonstration of the continuous design process of course development, similar to the continuous process of assessment and development expected of leaders in today's rapidly changing army.

II. Using Feedback to Increase Rapport with Students

Feedback is an excellent tool for establishing rapport between the individual professor and students. This two-way communication is critical to the development of both parties – student learning and instructor effectiveness depend on a healthy rapport. The relationship often suffers when one side feels the other is not "listening" as often evidenced by the student attitude that "what I say doesn't matter so why should I bother?".

Credit for the design problem was clearly and explicitly attributed to the previous year's Fluids students, who are now seniors at the academy. The students were thanked for their thoughtful and insightful comments and informed of the plan to address their concerns for course improvement.

Demonstration of the willingness of instructors to value student input to the course resulted in greater participation throughout the semester leading to enhanced rapport as displayed in Figure 2, and elicited more creative ideas from students on their course surveys.



Figure 2. Student Rapport Feedback, Spring vs Fall 2000

III. The Design Problem

Students were given the following problem statement: "Previous Fluid Mechanics students have identified the need for more visual demonstrations and experiments involving key Fluid Mechanics Concepts." Design groups were formed and assigned one of twelve key course concepts for which to design a solution or demonstration of the stated problem.

The Fluid Mechanics course is among the first opportunities for design in the Mechanical Engineering program at USMA. The instructors are challenged to develop an open-ended design problem that is sufficiently guided to introduce the design process and enable the students to successfully use it in the development of their solutions. The unfortunate result is that many design problems, while fulfilling the requirements, are often viewed by students as artificial paper drills with no application to the "real" world.

Attacking a course shortfall identified by previous students of Fluid Mechanics by incorporating it into the course design problem assured the students that they were indeed tackling an issue that impacted them and their peers personally. They were able to realistically apply constraints and allocate resources to the project. Customers included their own peers, instructors and laboratory technicians with whom they could personally meet to discuss requirements and evaluate concepts. This design approach greatly enhanced the ability of students to see and understand the physical significance of fluid mechanics.

Instructors were able to guide the design process through numerous in-progress reviews with design teams in the form of customer briefings.

IV. Motivation

Individuals are motivated by a wide variety of influences. In order to provide a challenging and rewarding design experience on a large scale, instructors must know what factors will most likely inspire motivation in their students and attempt to address as many as possible. Students were motivated to produce quality design products through various incentives. Some students responded to the responsibility of improving the course for future students. Others saw fame and glory if "their product" was selected for incorporation into the course syllabus. Still others were inspired by the academic challenge of developing the best possible solution they could. Many were motivated by the confidence in them displayed by instructors who were willing to "give them a voice" in education at the academy.

Regardless of the specific motivation, learning centered more on the 'real world' and less on 'paper drills' resulted in a significant overall increase in motivation for further learning as displayed by the course survey results in Figure 3.



Figure 3. Student Motivation Feedback, Spring vs Fall 2000

V. Incorporating Student Design Products

To complete the loop and address the original problem of making fluids concepts less abstract, designs were evaluated and several were selected for inclusion to the Fluid Mechanics course in

the future. Some demonstrations were incorporated immediately for use during the following semester. Future course surveys will further assess their value.

VI. Conclusion

Feedback is often considered only on a personal level – students commenting on an individual professor or a professor giving individual assessment of a student's progress. It can be a powerful tool on a larger scale, especially for courses involving more than one instructor, by being incorporated in the course development loop on a continuing basis. This paper has described the use of student feedback as a source for development of a course design project due to the nature of the feedback received. Student feedback can also be an excellent source of information for other areas of course development.

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