Abstract

A two-part survey was conducted in 1995 and 1997 in order to examine the teaching practices of engineering economy educators. The first survey was sent to the mailing lists of the Council of Industrial Engineering Academic Department Heads and the Engineering Economy Division of the American Society for Engineering Education. The first survey yielded 45 useable responses. Twenty-eight of the respondents also participated in the second survey. In total, the survey participants teach 165 sessions of engineering economy on average each year to over 10,000 students. A statistical analysis was performed on the data to examine the effect of the instructor’s discipline and class size on teaching methods. Detailed findings have been previously reported. The purposes of this paper are to discuss existing teaching practices in engineering economy as uncovered by our two-part survey and to suggest methods of improvement based on relevant literature.

Introduction

Based on the authors’ work in surveying engineering economics instructors, three central issues emerge as a semester’s plan is being developed: “Am I attempting to cover too much material?”, “Am I lecturing from a single text?” and “Am I encouraging active learning in my classroom?” In this paper we will address each of these questions and attempt to provide a perspective from the pedagogy survey work done and detailed previously.

Content: How much is too much?

The average engineering economy class is covering 14 chapters of material. Engineering economy educators should evaluate whether too much material is being covered too quickly in their courses. The question that instructors should ask themselves is whether students can effectively learn, apply and master the course material being planned. Is the engineering economy student better served by mastering a higher fraction of fewer topics or a lesser fraction of more topics? Wankat explains that “content tyranny exists when the need to cover material rather than to encourage student learning dominates educator’s teaching and testing styles”.

Avoid relying solely on the “textbook lecture”

Eighty-nine percent of the engineering economy courses examined in this research use a single text. Only 44% of respondents supplement the single text with other materials such as personal notes, articles or cases. Six of the respondents supplement their textbooks with case studies. On average, case studies only account for 2% of the final grade. This small percentage may signify a lack of importance being placed on case studies in engineering economy education.
Chinowsky and Robinson discuss the importance of the case study approach to engineering education. These authors state that an important contrast between engineering education and the engineering profession is the use of over-simplified examples within the classroom. Perhaps increasing the use of case studies and the weight of importance being placed on them may help to lessen the gap between the education and profession of engineering.

It is encouraging that 58% of respondents utilize projects in their engineering economy courses. However, the importance of project work is not reflected in the final grade percentage weight (8%). Projects provide students with the opportunities to explore in depth a topic of their choice and to work on communication skills. Wankat and Oreovicz, in their book, Teaching Engineering, suggest that class projects should account for 25% of the final course grade. Engineering economy educators may need to evaluate whether the importance and prevalence of project work in the “real world” are being stressed in the classroom.

An additional concern in average final grade weights is that 75% of the final grade consists of an individual student’s performance on exams and quizzes. While groups are being utilized by 44% of the respondents, students are being evaluated primarily on their individual performances in the course. Current trends in engineering education encourage students to work together in a cooperative learning environment where they work in groups to maximize learning and mimic processes used in engineering practice.

Recently, engineering education researchers have expressed the need to integrate research and education. Less than half (46%) of the respondents are conducting research in the field of engineering economy. Eighty-five percent of these faculty members are currently integrating their work into the classroom. This positive finding demonstrates a successful integration between research and education among the respondents who are actively conducting engineering economy research.

Active Teaching, Active Learning

More than 82% of the respondents are incorporating “new” teaching methods to encourage active learning in their classroom. Sixty-four percent are incorporating more than one method. In active learning, active signifies that students do not simply listen and watch but participate through discussing, questioning, arguing, brainstorming, or reflecting. Johnson, et al., recommend group problem solving, turn-to-your neighbor exercises, and periodically turning questions back to the class to keep students actively engaged intellectually. These teaching methods are being utilized in 54%, 25% and 18% of the respondents’ courses respectively. Five-minute quizzes are being used in 46% of the responding courses. This type of assessment is useful to the instructor to determine what the students are learning and can help to focus students’ attention and help them to reflect on the class period.

Seventy-six percent of the respondents are utilizing spreadsheets in their courses. Fifty percent of the faculty respondents have the students build their own spreadsheets. Student-made spreadsheet assignments can promote an active learning environment, provide a focus on the “process” of engineering analysis and problem solving and remove the mundaneness and
It is encouraging that half of the respondents are promoting active learning by incorporating student-made spreadsheet coursework in their classes.

Future Trends

Johnson, et al., \(^8\) state “The real challenge in college teaching is not covering the material for the students; it’s uncovering the material with the students”. Engineering economy educators need to be aware of the current trends in engineering education, looking at which of these methods have been proven effective and assess which methods work best for them and their students. Forty-seven percent of the respondents are currently involved in reworking how engineering economy is being taught with 5% of them planning to incorporate more active learning techniques. A detailed discussion of these results will be presented at the 1999 American Society for Engineering Education Annual Conference in Charlotte, North Carolina.

Bibliography


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