Workshops

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Techniques In Teaching Engineering Ethics And Professional Responsibility

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TECHNIQUES IN TEACHING ENGINEERING ETHICS AND PROFESSIONAL RESPONSIBILITY

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1   BACKGROUND AND RATIONALE

Engineering education has evolved to include engineering ethics and professional responsibility as integral to the curriculum. Accreditation requirements emphasize this part by including the broader impact of engineering, especially ethics, as a major part of student educational outcomes. As a result, engineering educators and instructional designers have developed innovative techniques and methods to deliver engineering ethics during undergraduate engineering education and beyond. This is despite the inherent challenges associated with any engineering curriculum, particularly capacity and integration. Regarding curriculum capacity, engineering curricula are always jampacked with content, making adding more content another optimization problem during instructional design. Meanwhile, components' integration is always needed to help combat and reduce the problem of knowledge and skills compartmentalization taking place cognitively and practically among students due to many inherent factors. Furthermore, the integration problem is augmented by the challenge of teaching non-technical content as part of a technical course or curriculum. Therefore, teaching engineering ethics and professional responsibility takes extra effort to be included and integrated into engineering.

Many techniques and methods exist to teach engineering ethics. Also, many experts have been teaching ethics for a while. However, many new instructors and engineering trainers have joined the workforce. The goal of this workshop is to refresh the basic concepts and foundational ideas for teaching engineering ethics and professional responsibility, as well as an overview of available techniques and levels of engagement, which could be employed by different instructors based on their own curricular context. The workshop will expose participants to foundational topics and relevant techniques in teaching engineering ethics and professionalism. Participants will be engaged in active learning guiding them to plan their offering of engineering ethics to engineering students, at their respective institutions and curricular context, with consideration of the unique cultural and societal aspects of different geographical locations, and with a view on how to integrate engineering ethics across the curriculum as an essential part of engineering knowledge.

2   WORKSHOP DESIGN

The workshop was designed to include the following topics:

- Fundamentals of engineering ethics education
- Techniques and methods to teach engineering ethics
- Design and planning different modules for classroom delivery
- Assessment evaluation integration.

To achieve the goals and cover these topics, the structure of the workshop had three phases:

1. The frame: goal and limitations of teaching engineering ethics
2. The content: selection of material and delivery technique
3. The product: building an integrated teaching module (content, delivery and assessment).

The workshop started by asking the participants four questions using SpeakUp poll service, in order to capture the challenges related to teaching engineering ethics.

Participants were allowed to vote for multiple answers for each of the four questions, including the reasons for teaching ethics, challenges and limitations in teaching ethics, priority issues in ethics education and techniques in the delivery of ethics education content.

A team activity was implemented in the second part of the workshop through which the participants were asked to brainstorm and design a draft module for teaching ethics in engineering education courses.

3   RESULTS OF THE WORKSHOP

The first question asked the participants for the reasons for teaching ethics. The participants could vote for multiple answers from seven predefined choices. The three most often voted reasons for teaching ethics were the following (n=15):

- Educate engineers about professional responsibility (93%)
- Build moral reasoning among engineers (80%)
- Sensitize engineers to potential ethical issues (73%).

The second question asked about the challenges and limitations of teaching engineering ethics. From the nine options, the participants' (n=17) top-voted choice was *Curriculum is at capacity (full) preventing any additions* (73%). Other answers included:

- Non-technical topic between technical subjects (41%)
- Lack of institutional support (29%)
- Students don't like ethics (24%)
- I don't have time to plan implementation (24%).

In the third question, the participants (n=19) were asked to choose what is a priority in teaching engineering ethics from eight options. The answers were divided more equally with three top choices being: *Understanding evolving issues* (58%), *Why needed* (53%) and *Know how to practice proper engineering* (47%).

Finally, the fourth question asked the participant (n=19) about the techniques available to teach engineering ethics, with nine options to choose from. The most often voted choices were

- Module or more (58%)
- Spiral – more focus as the students progress through the curriculum (53%)

The third place was shared by three choices *Case study based*, *Added to a course*, and *From outside engineering (other department)* (42%).

Before the workshop's group work, some examples from existing implementations of ethics on courses were presented. In the actual workshop activity, 12 teams with 2-4 team members, created in 20 minutes a plan for a module to teach engineering ethics. Teams designed both incremental as well as innovative new implementations during the activity and shared their designs with others.

4   CONCLUSIONS AND SIGNIFICANCE FOR ENGINEERING EDUCATION

This workshop focused on providing the space for educators and course designers to share their experiences and explore potential solutions to hurdles when it comes to integrating ethics into engineering education. Engineering ethics enthusiasts are painfully aware of how compact and dense the engineering curriculum is, and as the results of the introductory questions suggest, it is obvious that most find this aspect most difficult when it comes to adding new content.

Nevertheless, the enthusiasm persists and, as participants of the workshop have also confirmed, educating the next generation of engineers about professional responsibility as well as building moral reasoning into how engineering is conceptualised, is highly important.

The workshop managed to create a space for discussing these points among engineering educators and, more importantly, there was a moment in which solutions could be discussed in a practical and tangible way.