

## Take Advantage of Survey Tools to Engage Younger Students in Process Safety and Ethics Topics

Process safety and ethics within Chemical Engineering continue to be strong topics of focus.<sup>[1]</sup> Students are challenged to be mindful of soft skill issues associated with being a professional engineer; however, the retention of that knowledge is low. The need to engage students at all year levels in process safety and ethics poses many challenges to the learning environment. Whether the setting is face-to-face or via remote/online discussion, the dissemination and retention of these topics must be balanced with requirements of the Chemical Engineering curriculum. At the freshman and sophomore levels, this can be tricky given that a significant number of core math, science, and Chemical Engineering courses occur during these two years. Many students take internships (3 months) or co-ops (6-8 months) after their sophomore year. Thus, having engaging discussions related to process safety and ethics with students before their working assignment should be viewed as highly important for training well-rounded engineers.

Increasing student awareness in process safety and ethics beyond the textbook requires innovative ways to bridge the discussion between fundamental course content and experiential learning. The integration of practical discussions can be pushed aside to ensure the learning outcomes are met, and this can be a disservice to the students as they prepare to enter industry positions. One approach to overcome the time constraints is to seed the conversation of process safety and ethics through scenario-based surveys using applications like SurveyMonkey. For example, what should you do as a lead engineer when a hurricane is approaching your chemical plant, and you must choose between staying to stabilize the operation or evacuating all employees to safety? Add to this the potential harm to the surrounding community, and such a question tends to spark lively debate among the students.

To create an engaging environment for younger students, it is important that the scenario centers around a recent occurrence or something that all students could potentially relate to in their own life. The connection helps spark a healthy conversation that will leave each person something to think about as they head out of the classroom. Since the goal is for complete engagement of all students, it is important to choose a subject that is not overly controversial to avoid marginalizing a particular group of individuals. Once the topic is chosen, you should develop the scenario that will lead to three or four choices. More choices require greater thought in deciding the best option, increasing the likelihood of a fruitful conversation within the time limits of the classroom.

Online survey tools make it easy to implement the scenario without too much preparation and execution time. For example, SurveyMonkey gives you the option of using templates to create your survey. Delivering the survey can be as easy as sharing the link with your class. In order to simulate the in-the-moment decision making process, students are not told in advance when a scenario will be posed. Instead, they are surprised and forced into a decision that some of them might not be comfortable making in the spur of the moment. This approach brings the practicality of engineering to life and shows students that being able to adapt to changing, or undesired, situations is a must, and that making ethical choices along the way leads to better engineering practices. The length of time students have to complete the survey will vary depending on the topic's depth. It is important to allow students just enough time to decide so that they can come to the discussion prepared to defend their choice. The survey results will provide a general trend of how the class is thinking about the scenario that will inform your discussion points. Use that information as a launch point for how you lead the class in understanding which choice was the best option considering all of the trade-offs involved.

There will inevitably be challenges when adding an extracurricular module to a course. Questions can include:

- How do I ensure the entire class is engaged in the activity?
- How do I time manage when I have to ensure the main outcomes of the course are met?
- How can I be sure that the process safety and ethics are appreciated by such a young group of students?

The honest answer is that you can only control so much. You have to know yourself and your capabilities. Maintaining priorities is essential when trying to be successful as a teacher. However, these extra tidbits can go a long way to building stronger relationships with your students as they develop professionally. The key is making sure the discussion is healthy and stimulates conversation beyond the classroom.

Discussions on process safety and ethics must start in the early years of a Chemical Engineering student's career. Waiting until their junior or senior year may become a missed opportunity should they head into the workplace uninformed of key points surrounding both subjects. While the early years contain many required courses that assess a student's potential to be successful in a Chemical Engineering program, there are ways we can have sidebar conversations of this type utilizing current technology. Such conversations can make the classroom more engaging for each individual. How you choose to implement the conversation is your choice. Just remember the potential positive outcomes from discussing these types of realistic engineering scenarios.

### REFERENCES

1. Bodnar C, Dringenberg E, Butler B, Burkey D, Anastasio D, and Cooper M (2020) Revealing the Decision-Making Processes of Chemical Engineering in Process Safety Contexts. *Chem. Eng. Ed.* 54(1): 22-30. □

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