Helping engineering students learn through reflection: A sampler of techniques

When students reflect—or dedicate time to revisit and learn from past experiences—they can benefit more from their educational experiences and better prepare for future action.

Led by the University of Washington’s Center for Engineering Learning & Teaching, the twelve-campus Consortium to Promote Reflection in Engineering Education (CPREE) seeks to understand the many ways in which pre-engineering and engineering undergraduates can benefit from reflection and how educators can help them practice reflection. The reflection activities featured here are real examples from educators on campus. For more reflection activities or information about CPREE, contact Ken Yasuhara at yasuhara@uw.edu or see the web site at cpree.uw.edu.

As CPREE works with pre-engineering and engineering educators to enhance learning with reflection, consortium evaluation staff are surveying students and educators to examine impact. A limited number of students and educators are being invited to be interviewed for more details.

PRE-INTERNSHIP SKILLS REFLECTION

An internship can be a special opportunity for learning and development, and a little forethought can go a long way toward maximizing benefit. With this in mind, Arianna Aldebot has her internship-for-credit students write up learning objectives in advance, focusing on skills of their choice. For context and motivation, one of the write-up prompts asks, for each chosen skill,

Describe a prior experience where you began to learn this skill or realized its importance.

Reflection like this can help students recognize a continuity of learning, connecting the internship experience to the rest of their preparation as engineers, in courses and beyond.

Educator: Arianna Aldebot, Associate Director, Internships and Career Engagement, College of Engineering
Course: ENGR 321, Engineering Internship

COURSE-RETROSPECTIVE JOURNALING

For the last of a series of journal entries in a technical communication course, Kate Mobrand has her students list the key concepts and skills they learned. A second prompt connects the course to their academic and professional plans:

What concepts/skills do you think you’ll apply in other classes or the workplace and why?

Finally, to encourage students to reflect on the course as a whole and identify and describe the learning that they found especially compelling, the last prompt asks,

What advice would you offer to students who are about to take this course?

Educator: Kate Mobrand, Lecturer, Human Centered Design & Engineering
Course: HCDE 231, Introduction to Technical Communication

GETTING MORE OUT OF EXAMS WITH EXAM WRAPPERS

Many students only look at their graded exams to get their scores. Colleen Craig uses a method called exam wrappers to guide students in reflecting their exam performance and preparation. By analyzing strengths and weaknesses in their prep, exam taking, and results, students can better prepare for future exams and, ideally, develop metacognitive habits. Craig implements the exam wrapper as a web survey, with prompts like,

How much test-preparation time did you spend re-reading the textbook?...reviewing your lecture notes?...in a study group?

Students are also asked to analyze why they lost credit:

How much credit did you lose due to difficulty with the ideal gas law?...difficulty with thermodynamics definitions?...math errors?

Educator: Colleen Craig, Lecturer, Chemistry
Course: CHEM 152, General Chemistry
WHAT, SO WHAT, NOW WHAT?

In an intro engineering course with weekly guest presenters, Dan Feetham, Lauren Fryhle, and Malika Garouei use a catchy trio of prompts to help their students recognize what they’re learning and how it relates to them. After each guest presentation, the “what” prompt has students identify important takeaways. The “so what” prompt has them examine the significance of what they learned:

Why does this presentation matter, to you personally and/or the world?

The third prompt, “now what,” turns students attention toward implications:

How did this presentation change your thinking or plans?

Students write these reflections as one of a series of journaling exercises throughout the quarter.

Educators: Dan Feetham, Director, Advising & Student Engagement; Lauren Fryhle and Malika Garouei, Academic Advisers; College of Engineering
Course: ENGR 101, Engineering Exploration

EXAM REHEARSAL

Elaborating on the common practice of providing practice exams, Lynne Spencer puts her academic workshop students through a realistic exam-taking experience, complete with a time limit and proctoring. Immediately after the simulation, she facilitates a group reflection with prompts like,

What did you expect to see on the exam? What surprised you?

Did you work the exam front to back or skip around? Where did you spend most of your time?

These observations, coupled with the requirement to complete and correct their practice exam work, help students better prepare for the real exam. The rehearsal also helps Spencer identify students who are not as prepared as they seemed, early enough for her to offer them assistance.

Educator: Lynne Spencer, STEM Instructional Specialist/Workshop Leader, Engineering Academic Center, College of Engineering
Course: ENGR 197, Academic Workshop for Chemistry

THREE WORDS FOR TODAY’S TOPIC

Educators can learn a lot about students’ learning by having them synthesize, summarize, and express what they are learning in their own words. At the end of a day’s class session, Theresa Barker asks her students to reflect on the session with this prompt:

Think of a word or phrase (up to three words) that summarizes today’s topic for you.

Constraining this exercise to just a phrase encourages students to identify what was most salient to them and to be creative in their word choice. To steer students away from the notion that there is a “right answer” and to elicit details about how they understood the day’s class, Barker then asks students,

Explain in a one-paragraph description why you chose that particular phrase.

Educator: Theresa Barker, Affiliate Assistant Professor, Electrical Engineering
Course: EE 393, Advanced Technical Writing in Electrical Engineering

LETTER TO FUTURE SELF

Setting goals, making plans, and assessing progress are all important skills for engineers and all lifelong learners. In their courses, Dianne Hendricks and Alyssa Taylor ask each student to start the term by writing a private letter to themselves. In Hendricks’ version, students are asked to take a holistic view of their intellectual, personal, and professional development:

What questions/problems do you hope your future self will resolve this term? What advice do you hope you will follow this term?

Taylor’s version focuses on helping students assess and plan the development of specific professional skills during the course of a team project:

What teamwork and leadership skills do you want to work on this term? What changes do you hope to see by the end of the term?

Later in the term, the students open their respective letters, assess progress toward stated goals, and reflect on changes in perspective. Taylor has her students do this mid-term, to inform adjustments to their project work.

Educators: Dianne Hendricks and Alyssa Taylor, Lecturers, Bioengineering
Courses: BIO EN 410, Bioengineering Honors Seminar; GEN ST 197, Bioengineering Innovations

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