

# Reflection in Engineering Education and Transformative Learning

**Educator:** Kimberley Mastako, Lecturer, Civil and Environmental Engineering

**Context:** In-class; Traffic Engineering

**Keywords:** learning styles, engineering practice, written reflection, end of term reflection

**Student Activity Time:** 15 minutes in-class

*Towards the end of the term, students reflected on their learning in the program and existing and emerging professional engineering practices.*

## Introducing the Reflection Activity

In the eighth week of a ten week course, upper-level civil and environmental engineering students participated in an anonymous self-reflection. The purpose of this reflection was for students to think about and reflect upon their learning in the program and thoughts about professional engineering practices, with particular emphasis on strengths and weaknesses of acceptable practices that continue to evolve with the profession.

Before assigning the reflection activity, the educator discussed with students the inspiration for this activity and the value of reflection. She described that the reflection activity was inspired by her involvement with a larger group of educators interested in supporting students in reflection activities (CPREE at Cal Poly). In talking with students about the purpose of reflection and guiding their reflections, she emphasized the importance of looking back on past experiences in service of personal transformation. A sketch was provided to illustrate the connection between reflection and personal transformation. The purpose of this discussion was to encourage students to move beyond simply evaluating her as an instructor or the class content. The scope of the reflection was expanded to include other courses taken in the current quarter. Additionally, this conversation coupled with not grading the reflections created a low-stakes, low-stress environment in which the reflection could take place. The educator asked the students to use 15 minutes in-class and reflect on their own learning and how it applies to their future professional engineering practice. In working towards this purpose, students thought about and responded to one or more of these questions:

1. What are your thoughts about your own learning processes (i.e., your approach to higher education)?
2. What are your thoughts about professional engineering practices (i.e., your approach with respect to these practices)?
3. What are your thoughts about surface transportation systems (i.e., your perceptions about these systems)?

4. What are your thoughts about grappling with loosely specified problems (i.e., your approach to these types of problems)?

In terms of outcomes, there was potential for students to better understand their learning, connect their learning to their future in academia and professional engineering, and prepare for their future in helping to advance the state of the practice. Furthermore, it was possible that by doing this reflection the students would challenge their a priori views of learning resulting in personal transformation.

#### Recreating the Reflection Activity

	Description
1	Engage the students in a discussion about reflection and the purpose of this reflection.
2	Give students time in class (~15 minutes) to respond to the reflection.
3	Invite students to anonymously return their reflections to a student facilitator with assurance of no formal grading component.
4	Thank students for participating in the reflection.

#### In the Words of the Educator: Tips and Inspiration

*Create a safe environment for the reflection activity to take place.* Before students reflect on their learning and professional engineering practice, discuss with them the value of reflection. In this discussion, emphasize the importance of students avoiding evaluating the educator or the course because this information is not the purpose of the reflection activity. Also, emphasize that the writing style, tone, and grammar are not important—bullet lists and sentence fragments are okay and there is complete forgiveness for all grammatical/spelling issues. As part of creating a safe environment, I suggest not grading the assignment (but if you decide to grade the assignment, use a credit/no credit approach to grading).

*Be transparent with students.* Be fully transparent with students about the reflection activity and any associated agendas. This transparency may contribute to students' buy-in of the reflection activity.

*Aim for a breadth type of reflection.* Give students multiple prompts to respond to, so that they can respond to what resonates most with them.

*Think about and understand the objective of the reflection activity.* In asking students to reflect, make sure you are clear on the objective of the reflection activity—what do you want students to get out of engaging in the reflection activity (i.e., student outcomes)?

*What was the inspiration for the reflection activity?* Even though I have been working with students at Cal Poly for over 20 years, this is the first reflection activity I

have used with students. After participating in Consortium to Promote Reflection in Engineering Education (CPREE) activities for educators at Cal Poly, I decided that it was important to implement a reflection activity into my teaching practice because it aligned with my teaching philosophy, particularly in helping students grapple with and succeed in solving loosely defined problems and coming to terms with the strengths and weaknesses of acceptable practices as they continue to evolve with advancement of the profession.