

# Reflection After Hands-On Activity

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**Context:** In-class; Foundations of Engineering Design I

**Keywords:** first-year experience, group reflection

**Student Activity Time:** 75 minutes in-class (60 min activity, 15 min reflection)

*First-year engineering students reflected after each of four laboratory-style activities, which were designed to build a particular engineering skill (e.g., using shop tools for basic prototyping or empirically determining a spring constant).*

## Introducing the Reflection Activity

In a required introduction to engineering course, first-year engineering students engaged in learning through a series of in-class laboratory-style activities. Each of the activities took about an hour of class time to complete and was designed to build a particular hands-on engineering skill. Student tasks (and the recordings of their findings) during each of the activities were guided by a worksheet that they completed in teams of 2 – 4 students. Reflection questions were included at the end of each worksheet in an effort to encourage students to discuss and think deeply about the purpose and implications of the activity.

At the end of the four group engineering skill building activities, students were asked to reflect on their learning as a way to encourage students to think about what happened, reinforcing what was learned. The reflection prompts asked students to take about 15 minutes to discuss in their groups and then respond in writing (on the worksheet) to questions like:

1. Describe several things that you learned from this activity?
2. How could you apply what you learned in your current design project?

In terms of outcomes, the purpose of the reflection component for these skill building activities was to reinforce learning. Historically as students engaged in these laboratory-style activities, they often became focused on the details. This reflection activity provided them with designated support to pull out from the details and see the broader perspective. There was also an opportunity for the educator to understand better what she expected students to learn, what they actually learned, and what they still needed to learn. After the reflection activities, the educator had valuable information that helped her adapt the class to the students' needs—a more dynamic approach to teaching that had the potential to align better with students' individual and collective needs, rather than a “one size fits most” approach.

### Recreating the Reflection Activity

	Description
1	Create a hands-on or laboratory-style activity that has a technical learning objective.
2	Ask students to reflect in groups on what they learned and how it connects to a specific design project they're working on now (in the same or another class) or previously worked on.
3	Debrief with students about themes that emerged from the reflections.

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

*Make reflection a priority.* In making reflection activities a priority, consider allotting class time for reflection activities and asking students to engage in them in-class.

*Be aware that too many class topics may impact the depth of topic coverage.* As an educator, it's important to be aware that when too many class topics are introduced, students' learning of the topics may remain surface. When trying to move beyond surface learning, reflection activities can help depth learning.

*Have a transparent approach to grading reflection.* I believe it is important to grade reflection activities because it motivates students, contributes to how serious students take the reflection activity, and places value on the assignment. While grading is important, (1) do not grade on accuracy (i.e., if they did not learn something or still have a misconception, they should not be penalized); (2) make the grade a minimal component of their overall grade (e.g., simply checkmark for effort and shows you read the reflection); and (3) be cautious about going down the sinkhole of grading in detail (i.e., provide some feedback, but not too much). I use the reflections as an opportunity to provide students with formative feedback—a way to identify for students any misconceptions in their learning.

*Debrief the reflection assignment.* When handing the written assignment back to students, take a few minutes to debrief what you saw in the reflections. This approach allows a dedicated time and space to discuss in a follow-up class such things as the big misconceptions that emerge from the reflections.

*What was the inspiration for the reflection activity?* This reflection activity was inspired by a couple of different experiences: (1) thinking about how students learn (2) trying to motivate students in their learning, and (3) trying to connect technical learning with application outside the current class, transfer to the other classes and to the “real world.”

In thinking about how students learn and how they retain information, over the years I've noticed that sometimes students can get lost in the details of what they are doing and not take the time to understand their learning. As educators,

I think it is our responsibility to reinforce the concepts we want students to learn. Therefore, I think the reflection activity is a good summarizing activity that helps students take the next step with their learning.

Second, I think it is important to motivate students in their learning. When I first started teaching, I would assign textbook reading and I had minimal success with this approach. Once I started providing students with guided learning reflection questions about those same readings, students started coming to class more prepared. I now use reflections to motivate student engagement on a particular topic. One approach I have found to be successful is an iterative reflection. At the start of a new content area, I ask students to reflect on their current state of knowledge on the topic, and then at the end of the module I ask students to reflect on what they learned about the topic and how it transfers to different contexts.