

# CHAPTER SEVEN

## STUDENT LEARNING ASSESSMENT

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### INTRODUCTION

The last three chapters have discussed answers to the second of the two questions central to the reform of engineering education: *How can we do better at ensuring that students learn these skills?* Integrated curriculum, design-implement experiences, integrated learning, and active and experiential learning are the main components of a reformed engineering education that better ensures that students reach the intended outcomes required of all engineering graduates. Implicit in the question “*How can we do better . . .*” is an additional question: *How do we know that we are doing better?*

- How do we know that students are achieving the intended learning outcomes?
- How do we know that our engineering programs are effective?

We answer the first part of the question in this chapter on student learning assessment, and then return to address the second part of the question later in Chapter Nine on program evaluation. Student learning assessment measures the extent to which each student achieves specified learning outcomes. Faculty members plan and implement student learning assessment with respect to the outcomes within their courses. In contrast, program evaluation examines the key success factors of CDIO programs in terms of both the overarching student learning outcomes and the adoption of the CDIO Standards.

Learning is assessed before, during, and after instructional activities. Formative assessment collects evidence of student achievement while students are in the process of learning. Results of formative assessment inform students about their progress, help monitor the pace of instruction, and indicate areas of instruction that may need to be changed. Summative assessment gathers evidence at the end of an instructional event, such as a major project, a course, or an entire program. Results of summative assessment indicate the extent to which students have achieved the intended learning outcomes of the project, course, or program. If the instructional event will be repeated with other students, summative assessment, as well as formative assessment, is

used to improve curriculum, teaching-learning methods, and the design and use of learning spaces.

Assessment of student learning in personal and interpersonal skills, in process, product, and system building skills, and in disciplinary knowledge has four main phases:

- Specification of learning outcomes
- Alignment of assessment methods with curriculum, learning outcomes, and teaching methods
- Use of a variety of assessment methods to gather evidence of student achievement
- Use of assessment results to improve teaching and learning

The importance of specifying learning outcomes and aligning them with teaching and learning has been highlighted in previous chapters. The focus now is on assessment methods appropriately matched to curriculum and teaching methods. Effective learning assessment is aligned with intended learning outcomes, that is, the knowledge, skills, and attitudes that students are expected to master as a result of their educational experiences.

We use a variety of methods for collecting evidence that students are achieving intended learning outcomes, such as, written and oral questions, performance ratings, product reviews, journals, portfolios, and other self-report measures. These methods can collect evidence of student progress and achievement in a variety of teaching-learning environments. Gathering data and discussing information from multiple and diverse sources make it possible to know with confidence what students have learned. However, the learning assessment process is not complete until assessment results are used to improve students' educational experiences.

In this chapter, we emphasize the idea that in a culture that is cooperative, collaborative, and supportive, learning assessment is used to diagnose and promote learning. Teaching and learning are intertwined, and students and faculty learn together. We look, in detail, at the learning assessment process, describe selected assessment methods, and give examples of student learning assessment in representative programs. Finally, we identify key challenges to effective learning assessment, and point the way to addressing these challenges.

## CHAPTER OBJECTIVES

This chapter is designed so that you can

- implement learning assessment processes
- create a plan to align assessment with intended learning outcomes and teaching-learning methods
- describe a variety of assessment methods that provide evidence of student learning