

CHAPTER TWO

OVERVIEW

INTRODUCTION

The objective of engineering education is to educate students who are “ready to engineer,” that is, broadly prepared with the pre-professional skills of engineering, and deeply knowledgeable of the technical fundamentals. It is the task of engineering educators to continuously improve the quality and nature of undergraduate engineering education in order to meet this objective. Over the past 25 years, many in industry, government, and university programs have addressed the need for reform of engineering education, often by stating the desired outcomes in terms of attributes of engineering graduates. By examining these views, we identified an underlying need: to educate students to understand how to Conceive-Design-Implement-Operate complex value-added engineering products, processes and systems in a modern, team-based environment.

The CDIO approach reforms engineering education to meet this underlying need. The value of this approach to students is built on three premises, which reflect its goals, vision, and pedagogical foundation:

- That the underlying need is best met by setting goals that stress the fundamentals, while at the same time making the process of conceiving-designing-implementing-operating products, processes, and systems the context of engineering education.
- That the learning outcomes for students should be set through stakeholder involvement, and met by constructing a sequence of integrated learning experiences, some of which are experiential, that is, they expose students to the situations that engineers encounter in their profession.
- That proper construction of these integrated learning activities will cause the activities to be *dual-impact*, facilitating student learning of critical personal and interpersonal skills, and product, process, and system building skills, and simultaneously enhancing the learning of the fundamentals.

The CDIO approach incorporates comprehensive and broadly applicable processes for improving curriculum, teaching and learning, and workspaces, and is supported by robust assessment, and change processes.

This overview chapter outlines the key premises and features of the CDIO Initiative. It begins with a discussion of the motivation for improvement in engineering education, including a discussion of the needs of our students, the historical environment of our education, and the requirements for an effective program of reform. The second section describes the Initiative in some detail: its goals, vision, and pedagogical foundation. The structure of this second section serves as the framework for many of the remaining chapters of the book, which go into more detail on the topics of setting goals for learning, improving curriculum and workspaces, teaching and learning, and conducting student assessment and program evaluation. The final part of the chapter describes approaches to development, including the available resources and collaboration approach, and underscores the need to recognize educational reform as a process for organizational and cultural change at the university.

CHAPTER OBJECTIVES

This chapter is designed so that you can

- recognize the contemporary motivation for engineering education reform
- explain the underlying goals, vision, and pedagogical foundation
- describe the key characteristics of a CDIO program
- explain the approach to the development of the CDIO Initiative

MOTIVATION FOR CHANGE

Engineers build things that serve society. To quote Theodore von Kármán [1], “*Scientists discover the world that exists; engineers create the world that never was.*” The 1828 charter of the Institution of Civil Engineers [2] states that engineering is “the art of directing great sources of power in nature for the use and convenience of man.” Creation of new products and direction of natural resources remain the tasks of engineers today.

What modern engineers do

Modern engineers are engaged in all phases of the lifecycle of products, processes and systems that range from the simple to the incredibly complex, but all have one feature in common. They meet a need of a member of society. Good engineers observe and listen carefully to determine the needs of the member of society for whom the benefit is intended. They are involved in conceiving the device or system.

Modern engineers design products, processes, and systems that incorporate technology. Sometimes this is state-of-the-art technology, pushing new frontiers, and creating new capabilities. That is the stuff of startups and