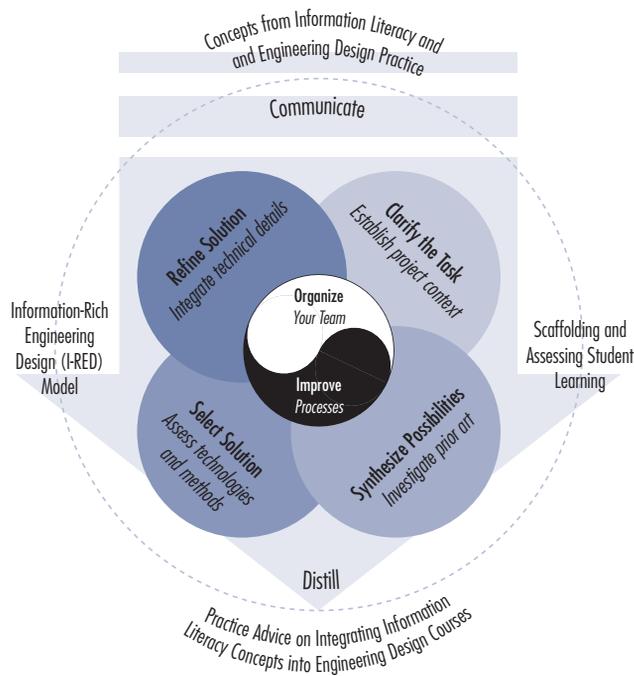


# INTRODUCTION

This handbook is structured in three distinct parts. Chapters 1 through 3 assemble key concepts about information literacy, engineering design and how engineers use information. These chapters draw on the relevant bodies of literature and are written in a scholarly style. Specifically, Chapter 1 views the engineering design process from several quite different perspectives. The goal is not to settle on a preferred model of design but to identify generic characteristics that are common to most normative descriptions of how design is done. Chapter 2 is an overview of concepts and definitions in information literacy, and Chapter 3 provides some evidence of what practicing engineers and engineering students actually do when carrying out design activities. Chapter 4, the final chapter in Part I, presents the pivotal idea of this book, the Information-Rich Engineering Design (I-RED) model. This model synthesizes concepts from the first three chapters to create a generic model of the elemental activities in engineering design and the corresponding information-seeking and -creating activities.

Part II, Chapters 5 through 14, provides specific practical advice and tools on how students can be guided in learning to manage and integrate information based on each phase of a design project, from conception to realization, based on the elements in the I-RED model. This includes addressing ethical considerations (Chapter 5) and team and knowledge management decisions (Chapter 6), problem scoping through eliciting user feedback (Chapter 7), gathering background information about the project (Chapter 8), and investigating professional best practices (Chapter 9). It also includes investigating prior art (Chapter 10), evaluating the quality of information and incorporating it to making evidence-based design decisions (Chapter 11), actually searching out materials and components to embody the design concept (Chapter 12), and organizing and documenting evidence so that a convincing argument can be made to support the design concept (Chapter 13). Finally, in order for students (and their organization) to benefit most fully from the design experience, they



**FIGURE I.1** Roadmap for this handbook.

must reflect on the process and identify lessons learned and opportunities to improve processes (Chapter 14). This material is broken out by stage of the design process most relevant for the information activities to enable engineering educators and engineering librarians to support students as they learn to use information effectively as an integral part of doing design. Part III, Chapter 15, offers guidance on how to prepare students to incorporate information into engineering-related decision-making activities as a precursor to full-on informed design projects and how to assess student learning outcomes.

A particular feature of this handbook is that each chapter begins with a list of expected learning outcomes. This approach reflects good pedagogical practice and is intended to explicitly orient readers at the outset to the things they should be able to do after actively engaging with the content of each chapter. The best way for

readers to accomplish the learning objectives is to go beyond just reading the material and to experiment with it in their own educational practice and to use the suggested reading lists to explore the topics covered more broadly. Figure I.1 provides a conceptual roadmap for this handbook.

Throughout this book the term *design* is used intentionally as a verb (the action of designing) rather than as a noun (the outcome of that action). This was done to emphasize the fact that design is an activity, a process, rather than a product. This distinction is made not only to avoid confusion but also to highlight the creative and imaginative act of design. This focus on the act of design is reflected in the choice of verb-noun chapter titles in Parts II and III.

The contents of this handbook can be used to embed information literacy in a standalone design course such as an introduction to engineering project course in the first-year or a cap-

stone design experience. Equally, the tools and techniques presented can be deployed throughout a year-on-year design sequence, from first year to final year. This latter application enables increasingly sophisticated knowledge and skills about the use of information in design to be developed and reinforced over an extended period.

The types of design information referred to are not limited to the obvious sources such as materials selection data, commercial off-the-shelf components and products, patents, and other archived text-based materials that are usually associated with design work. On the contrary, this book strives to include the broadest possible range of types of design information which are gathered in diverse ways and stored in many forms of media. For example, it includes information gathered from the clients and users through interviews and observation and from the literature on local demographics, sociopolitical factors, culture, and geography. Such information might be in the form of field notes, sketches, photographs, videos, maps, statistical data, and so forth.

Design information is also taken as being embedded in physical objects, such as existing artifacts of all types, and physical and virtual prototypes made during the design process to

test ideas, as well as resultant components, products, or systems. Similarly, software used in, or resulting from, a design project contains design information. This includes the database of information from the design project itself.

A central tenet of this book is that design is a learning activity whereby existing information is consumed and new information is created. In the process, new knowledge is constructed by each of the parties involved—the client, users, and other stakeholders, members of the design team, and people involved in the final realization of the design solution, as well as others who come in contact with the design solution throughout its life cycle.

Throughout this handbook we have endeavored to keep the tone informal and readable and, ultimately, practical. If we have succeeded, readers should be able to incorporate new activities into their courses that encourage students to take a more informed approach to their design projects, which will then lead to more grounded, practical, and higher quality solutions.

In order to keep this book current, we are maintaining an online site (<http://guides.lib.purdue.edu/ired>) with materials and suggestions for using the I-RED model.

