Chapter 10
Visual Tools for Analyzing and Organizing Engineering Data and Information

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ABSTRACT

The chapter examines the use of visual tools in inquiry-based learning in engineering education. Engineering information has traditionally been communicated using engineering drawings. The advancement of technology has empowered engineers to work with data to generate graphics where visual tools have been successfully employed in the industry. However, many educational institutions still rely on text-based learning, which rely on linguistic abilities to convey complex concepts. Using program logic theory, the authors evaluate how a poster can help learners acquire knowledge and know-how to represent complex ideas in a logical and consistent manner. Students reported benefits in poster exercise compared with a written assignment. This chapter also discusses the educational and managerial significance of using visual tools to greater effectiveness and the importance of communicating technical information.

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INTRODUCTION

Engineering information is conveyed in many ways. Traditionally, technical drawings or engineering graphics are used to convey information, ideas and facilitate visualization of the final product. For years, the teaching engineering graphics has been progressed from hand-drawn sketches and drawings to computer-aided design using software packages capable of solid modelling. Software packages are now capable of producing 3-D models with animation. Along with advancement in computing technology, the data used in the engineering drawings are now reliably linked with to management functions in construction and fabrication such as like scheduling and risk analysis. Apart from conveying information in drawings, engineers also required to present complex information in many other ways including the use of graphs, charts or process diagrams.

Problem solving and providing solutions are a big part of an engineer's skillset. However, in providing solutions, it should be noted that real-life engineering problems are part of bigger problems, some of which may not just technical. Ackoff (1974) noted no problem exists in isolation and every problem is a part of a system of problems. Providing solutions to engineering problems require interaction with and within social systems that encompass internal and external stakeholders. Problems encountered in these complex systems can be "ill-structured", "messy" or involving "social messes". The term "wicked problem" (Ackoff, 1974; Churchman, 1967; Horn, 2001) is used to describe an issue in systems that are complex, ambiguous, severely constrained, interconnected, are seen differently and even contradictory from different points of views (Rittel & Webber 1972; Simon 1984). Wicked problems are multi-facets and often change over time (Churchman, 1967).

Due to methodological limitations or data impediments, engineers and managers face challenges in incorporating their observations of all phenomena. Challenges include gathering data from stakeholders, consolidating and integrating data and making meaningful representations of these data. Therefore, finding a better way to consolidate data from observations, finding better ways of identifying any underlying patterns and synthesizing related data using analytical tools to identify root causes will lead to improvements and solutions.

Challenges in Communicating Technical Information and Opportunities

As technology advances, new approaches towards the visualization of data should be included in engineering graphics curricula. Although graphs, charts and diagrams are taught and used in most engineering subjects, there is really a need to revisit these visual methods of presenting engineering data and incorporate these as standard

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