

# Aligning Engineering Design Education with Accreditation Requirements

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## ABSTRACT

*This paper focuses on aligning engineering design with accreditation requirements in engineering education. To be an accredited curriculum, education programs must incorporate graduate attributes required by program accrediting professional bodies. Graduate attributes are the required benchmarks for students to attain their specific qualities and abilities within a higher education institute. Most higher education institutions identify a list of expected graduate attributes or outcomes that are incorporated in their educational programs to be accredited by an accrediting professional body such as Engineers Australia (EA), Accreditation Board of Engineering and Technology (ABET) in the United States, and the European Accreditation of Engineering Programs (EUR-ACE) in Europe. This paper evaluates the program educational objectives, student outcomes, assessment methods and evaluation of different undergraduate engineering programs. It assesses how engineering design is practiced and incorporated as an important element of the graduate attributes through project oriented design based learning curriculum aligned with professional accreditation requirements.*

**Keywords:** *Accreditation Requirements, Design Based Learning, Engineering Design, Project-Oriented Design Based Learning*

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## INTRODUCTION

Accreditation is a periodic assessment of an education program for any discipline against the accreditation standards. Appropriately trained and independent practicing engineers from both industry and academic are normally selected as peer reviewers for a professional accreditation

panel. In regards to the higher education sector, the Australian higher education institutions have identified a list of expected graduate attributes or outcomes that are incorporated in their educational programs to be accredited by Engineers Australia. Graduate attributes are the required benchmarks for students to attain their specific qualities and abilities

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within a higher education institute. Engineers Australia is a professional accreditation body for graduate and higher education programs in engineering. When students graduate from an accredited engineering program, they are required to be assessed by the relevant professional accrediting body to become qualified engineering graduates. Design based learning (DBL) is an approach for learning and teaching which is employed in engineering education. There are many research studies that justify the benefits of DBL in engineering education. By looking at the focus on design based learning by world accreditation bodies, this research identifies the need to enhance important skills such as innovation and creativity through a holistic learning process that incorporates design based learning features. The in-depth analysis involved undergraduate engineering programs at Deakin University which covered the program educational objectives, student outcomes, assessment methods and evaluation of different engineering programs.

## ENGINEERING DESIGN

Engineering design is one of the fundamental processes and activities in engineering and all other engineering activities relate to it. Studying engineering involves not only learning scientific knowledge and technological skills; it also necessitates learning the language, established practices, beliefs, and professional values of engineering culture that makes an engineer. Richard M Felder (Felder, 1988) identifies 'Engineering Design' as a systematic, intelligent process in which designers generate, evaluate, and specify concepts for devices, systems, or processes whose form and function achieve clients' objectives or users' needs while satisfying a specified set of constraints.

Engineering design problems are classified as open-ended problems that generally have multiple correct solutions (Dym, 2005). A formal systematic problem-solving methodology is useful for these types of problems. Design is a continuous process of problem solving

which could involve multiple iterations (de Vere, 2009). The design process starts with identifying the problem. This allows students to search for possible opportunities to assist them in understanding the problem and therefore develop a design brief (Jonassen, 2009). Through research, students can then gather information on different methods, approaches and ideas to allow them to seek new solutions. When a new solution is implemented, a model or a prototype is developed. The prototype is then tested and evaluated against the specifications developed in the design brief for functionality.

## ACCREDITATION REQUIREMENTS ON ENGINEERING DESIGN

The implementation of the graduate attributes in professional education programs varies from one institution to another. Each attribute has a range of elements that students must demonstrate depending on the comprehensive program structure requirements. When identifying graduate attributes particularly for undergraduate engineering programs in Australia, the program accrediting body (EA) initiates a set of attribute elements specified in "Stage 1 competencies and elements of competency" (EA, 2012). It states that one of the important engineering abilities is the application of systematic engineering synthesis and design processes. Every unit outcomes in all engineering courses should meet the standards required by the newly introduced Tertiary Education Quality and Standards Agency (TEQSA) and the Australian Qualifications Framework (AQF) to provide a high quality education to students. Figure 1 shows the overall percentage of the standards imposed by three professional accrediting bodies in incorporating the engineering design outcomes in accredited engineering programs.

Figure 1 illustrates the engineering design competency expected by selected accreditation bodies; Engineers Australia (6%), Accreditation Board for Engineering and Technology (18%) (ABET, 2012-2013), and the European

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