Mapping the Relationship Between the CDIO Syllabus and the CEAB Graduate Attributes: An Update

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ABSTRACT

The recently introduced Canadian Engineering Accreditation Board (CEAB) requirements for Graduate Attributes require demonstrated learning outcomes for the first time. The Conceive, Design, Implement, Operate (CDIO) approach includes a set of outcomes in the form of the CDIO Syllabus. The Syllabus also provides guidance on how to document outcomes in order to meet the requirements of the CEAB Graduate Attributes. This article provides a framework for Canadian engineering programs to satisfy the CEAB requirement to demonstrate learning outcomes through a mapping of the CDIO Syllabus topics to the CEAB Attributes, and verification of the completeness of that list. An engineering program can meet all of the CEAB Graduate Attribute requirements by addressing a subset of the CDIO syllabus; however, a CEAB accredited program may not meet all of the CDIO standards.

Keywords: Accreditation, Canadian Engineering Accreditation Board (CEAB), Curriculum Mapping, Graduate Attributes, Program Assessment

INTRODUCTION

The CDIO (Conceive, Design, Implement, Operate) approach is an international initiative in engineering education developed over the last decade and focused on the principle that the professional engineering practice of conceiving, designing, implementing, and operating practical products, processes and systems must provide the context of engineering education (Crawley et al., 2007) (CDIO.org). The 12 CDIO Standards provide a framework for evaluation and continuous improvement of engineering programs.

CDIO Standard 2 stipulates learning outcomes based on a syllabus that has been validated by program stakeholders and most CDIO programs have used the CDIO Syllabus (version 1) as the basis for developing their own outcomes. Version 2.0 of the Syllabus,
presented in its final form at 2011 CDIO International Conference (Crawley et al., 2011), is the first major revision of the original. The mapping presented here replicates much of the content of the original (Cloutier et al., 2010) for completeness sake while incorporating the changes adopted in version 2.0 of the Syllabus.

CDIO is not the only engineering education initiative developing outcomes based approaches and most national and international accreditation organizations are moving towards approaches that are compatible with the CDIO Syllabus. The Canadian Engineering Accreditation Board published new guidelines in 2008 (Engineers Canada, 2008), including a set of attributes specifying general program outcomes for the first time, while still retaining criteria based on instructional hours and content. Section 3.1 of the guidelines specifies a set of twelve Graduate Attributes that all students should have on completion of an accredited program in engineering. They are:

3.1.1 A knowledge base for engineering
3.1.2 Problem analysis
3.1.3 Investigation
3.1.4 Design
3.1.5 Use of engineering tools
3.1.6 Individual and team work
3.1.7 Communication skills
3.1.8 Professionalism
3.1.9 Impact of engineering on society and the environment
3.1.10 Ethics and equity
3.1.11 Economics and project management
3.1.12 Life-long learning

All of them elaborate on demonstrated competence, an ability, or an understanding without detailing the level to be attained in each particular aspect. This leaves room for individual institutions to establish their own priorities among the attributes as long as all are adequately addressed, usually within the context of complex problems.

Under the International Engineering Alliance (IEA), various international agreements govern mutual recognition of engineering qualifications and professional competence. These agreements are based on the recognition of substantial equivalence in the accreditation of qualifications: the Washington Accord (1989) in professional engineering, co-signed by Engineers Canada; and the Sydney Accord (2001) in engineering technology and the Dublin Accord (2002) in technician engineering, both co-signed by the Canadian Council of Technicians and Technologists. In June 2009, the Japanese Accreditation Board for Engineering Education and the Institution of Engineers Japan hosted the Kyoto meeting. The ensuing meeting paper (International Engineering Alliance, 2009) describes graduate attributes and professional competencies. It also formally defines terms like complex problem and simple to complex activities used in the CEAB documents. The International Engineering Alliance (IEA) paper (2009) details 12 graduate attributes, that is, “components indicative of the graduate’s potential to acquire competence to practice at the appropriate level” (p. 2), which the CEAB uses explicitly to honour their commitment to the Washington Accord. The IEA paper also defines 13 professional competencies require for one to “demonstrate that he/she is able to practice competently in his/her practice area to the standard expected of a reasonable Professional Engineer” (International Engineering Alliance, 2009, p. 11).

OBJECTIVES

There is broad consensus on directions in engineering education that are consistent with CDIO objectives. The comparisons in this article will show that the new CEAB Graduate Attributes are consistent with and complementary to the CDIO syllabus.

Version 2.0 of the CDIO Syllabus groups topics in four primary areas, 1 – 4 which subdivide into 19 major topics at the second level, 1.1 – 4.8, at a level of detail comparable to the CEAB Graduate Attributes. These 19 topics are elaborated further to a third and fourth level of detail that includes over 600 individual CDIO
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