A Comparison of the CDIO and EUR-ACE Quality Assurance Systems

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ABSTRACT

The CDIO approach intends to raise the quality of engineering education programs, worldwide by including a number of quality assurance (QA) tools such as the CDIO Standards, Syllabus, and self-evaluation model. CDIO programmes are also evaluated by external standards. Therefore, a CDIO programme needs a quality assurance system that fulfills external requirements and is able to produce the necessary evidence and documentation with minimal additional effort above and beyond the CDIO QA components. Efficient execution of this task requires understanding the similarities and differences between the CDIO and external quality assurance systems, in this case, the European Accreditation of Engineering Programmes (EUR-ACE) system. This article compares and contrasts these two QA approaches, in particular the CDIO Syllabus and the EUR-ACE programme outcomes and the CDIO Standards and EUR-ACE accreditation criteria. Also considered are the pros and cons of a continuous improvement rating scale-based system and a threshold-based accreditation model.

INTRODUCTION

The Conceive-Design-Implement-Operate (CDIO) approach is intended to raise the quality of engineering education programs, world-wide (Crawley et al., 2007). Thus, CDIO includes a number of quality assurance (QA) tools such as the CDIO Standards (a set of twelve education practices that characterize CDIO programmes), Syllabus (a list of student learning outcomes), and self-evaluation model.

At the same time, CDIO programmes are accredited and evaluated by external national QA standards such as those of the United States Accreditation Board of Engineering and Technology (ABET, 2000) and the Swedish National Agency for Higher Education (HSV) (HSV, 2006). A CDIO programme needs a quality assurance system that fulfills these national requirements and that is able to produce the evidence and documentation needed for a national accreditation and/or evaluation with minimal additional effort. Efficient execution of this task requires understanding of the similarities

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and differences between the CDIO and national quality assurance systems.

Earlier work has compared the CDIO Syllabus with the ABET criteria (ABET, 2000), the UK-SPEC criteria (Crawley et al., 2007), and the Swedish engineering degree requirements (Malmqvist, 2006). A common finding was that the CDIO syllabus states more encompassing and detailed learning outcomes for engineering education than these other QA schemes. The CDIO Standards and the associated self-evaluation model have been used as part of a Swedish national evaluation of engineering degree programmes by the Swedish National Agency for Higher Education, demonstrating that they can be applied for systematic comparisons of key issues across a large number of programmes (Malmqvist et al., 2006; Malmqvist & Sadurskis, 2009).

There are also international QA schemes that impact engineering programmes. In this article, we compare and contrast the quality assurance framework of CDIO with an international quality assurance system, namely, the European Accredited Engineering (EUR-ACE) programmes system as described in the European Network for Accreditation of Engineering Education (ENAEE) Framework Standards for the Accreditation of Engineering Programmes (ENAEE, 2008). In particular we discuss the CDIO Syllabus and the EUR-ACE programme outcomes and the CDIO Standards and EUR-ACE accreditation criteria.

The EUR-ACE quality assurance system was developed as part of the Bologna process, and will be of growing importance in the future, at least in the European context. We are specifically comparing the documentation required for EUR-ACE accreditation with that produced by a CDIO quality assurance system, and discuss the principal differences between threshold-based quality assurance systems and rating scale-based quality assurance systems.

The objectives of this article are to:

- Identify the strengths and weaknesses of each model.
- Identify future development routes for both the CDIO and EUR-ACE quality assurance systems.

The remainder of the article is structured as follows. In the next section, we review the CDIO quality assurance system, focusing on the CDIO Syllabus, Standards and self-evaluation model. A similar review is then presented for the EUR-ACE framework. This is followed by a comparison and discussion. Finally, conclusions are listed.

**THE CDIO QUALITY ASSURANCE SYSTEM**

Improving educational quality is a fundamental goal of the CDIO approach and is embodied the 12 CDIO Standards (CDIO, 2010). In particular, CDIO Standard 12 -- Program Evaluation, states that a CDIO programme should have a system that evaluates the programme against the twelve standards, and provides feedback to students, faculty, and other stakeholders for the purposes of continuous improvement. This standard further suggests that multiple methods should be used to evaluate the programme, including course evaluations, instructor reflections, entry and exit interviews, reports of external reviewers, and follow-up studies with graduates and employers (Crawley et al., 2007). However, three components can be said to constitute the core of the quality assurance system of a CDIO programme:

- The use of CDIO Syllabus to define the programme’s goals, that is, what the programme aims to achieve.
- The use of the CDIO standards as a guideline when designing and operating the programme, that is, how the programme goals are achieved.
- The use of the CDIO self-evaluation to measure the programme’s progress towards fulfilling the CDIO standards, that is, how well is the programme performing.
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