EVALUATING THE CDIO SELF-EVALUATION

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ABSTRACT

This article analyses the CDIO self-evaluation rubric. It analyses each of the rubrics associated to the standards. The analysis is done by the authors based on their experience in doing self-evaluations. The structure of the original rubric are kept (i.e. each standard are evaluated on a 0-5 point scale). Outcomes of the analysis are proposals for clarifications, precisions and extensions of the rubrics.

KEYWORDS

Self-evaluation, accreditation, quality assurance, Standards: 12

INTRODUCTION

All over the world, assessment of universities and study programmes are in focus. We all know of accreditation standards like ABET, EUR-ACE or CEAB. Several papers from the CDIO conferences have focused on alignment of the CDIO self-evaluation and other accreditation systems (see e.g.(Cloutier, Hugo, & Sellens, 2011; Malmqvist, 2009)).

In Europe improving the quality of higher education has been in focus since the Bologna declaration (European Ministers of Education, 1999). The Lisbon strategy and the Bologna declaration provided the main guidelines for increasing the competitiveness of European higher education. They called for improvements in the quality of education and emphasize the importance of Higher Education Institutions to provide education that answers to the competence requirements of working life. More recently improving European education and training system quality has been set as a key target in Europe's strategy to become a smart, sustainable and inclusive economy by (European Union, 2014). In this process external evaluation plays a key role.

Some time ago the CDIO organization discussed if we also should do accreditations. This was not found to be relevant; the way forward selected was to make a self-evaluation concept, where an institution or a study programme could self-evaluate how well it was doing on a six point scale.

For several years the CDIO initiative have been asking institutions and programmes to do a self-evaluation in order to support the continued improvement of the CDIO implementation at the institution/programme. It has become a de facto action to perform when applying for the membership of CDIO.

The process of creating the CDIO self-evaluation rubric was done in 2007 - 2010. Two of the tree authors took part in the final evaluation of the rubric used for the self-evaluation.

Now three years have passed and we have had real experience with using the rubric for several times and several programmes at our three institutions. In this article we will evaluate the self-evaluation from the view of a program responsible - are the descriptions understandable, are the descriptions on the same level, do we need extensions, clarifications, precisions…?

THE GENERAL GUIDELINES FOR THE SELF-EVALUATION

The self-evaluation is done on a six point scale. There is a general idea that the evaluation of the levels of all 12 standards should be compliant to Table 1

Table 1. Generic description of the six levels.

Level	Rubric
5	Evidence related to the standard is regularly reviewed and used to make improvements.
4	There is documented evidence of the full implementation and impact of the standard across program components and constituents.
3	Implementation of the plan to address the standard is underway across the program components and constituents.
2	There is a plan in place to address the standard.
1	There is an awareness of need to adopt the standard and a process is in place to address it.
0	There is no documented plan or activity related to the standard.

All twelve standards have a six-levelled hierarchy. The hierarchy is intended to be defined in such a way that being on level *n* also implies that the requirements for levels 0,1,…,n-1 is met.

An institution or a programme typically looks for arguments for the given level and the main benefit is not the level itself but the insights one gets from doing the evaluation.

EVALUATION OF THE RUBRICS OF THE TWELVE STANDARDS

In the following subsections we will evaluate and discuss each of the rubrics for the twelve standards.

Rubric of standard 1 – the context

The rubric of standard 1 is consistent with the general rubric and we do not see any need to propose changes to the rubric.

Table 2. Rubric of standard 1.

Level	Original rubric	Suggested change to the rubric
5	Evaluation groups recognize that CDIO is the context of the engineering program and use this principle as a guide for continuous improvement.	NO CHANGE PROPOSED.
4	There is documented evidence that the CDIO principle is the context of the engineering program and is fully implemented.	NO CHANGE PROPOSED.
3	CDIO is adopted as the context for the engineering program and is implemented in one or more years of the program.	NO CHANGE PROPOSED.
2	There is an explicit plan to transition to a CDIO context for the engineering program.	NO CHANGE PROPOSED.
1	The need to adopt the principle that CDIO is the context of engineering education is recognized and a process to address it has been initiated.	NO CHANGE PROPOSED.
0	There is no plan to adopt the principle that CDIO is the context of engineering education for the program.	NO CHANGE PROPOSED.

Rubric of standard 2 – CDIO Syllabus Outcomes

The learning outcomes described in the standard are learning outcomes for a given engineering program. In one of our countries these are given by the law and as such the institution do not have any control over these. It is naturally possible to make them more specific, but they have to be compliant with the overall learning outcomes. What is normally seen as a good idea - and a help for students, teachers and course designers is learning outcomes on a course level and on a semester/term level, such that there will be alignment between the learning outcomes, the teaching and the exam. We therefore suggest that the rubric reflect this by changing all program learning outcomes to course and/or program learning outcomes.

When doing learning outcomes, an important issue is the depth of learning that a student needs to have; there is a big difference between being able to recite what a differential equation is, being able to apply it or create new theory relating to differential equations. We suggest that this is needed to be on level 3.

Table 3. Rubric of standard 2.

Level	Original rubric	Suggested change to the rubric
5	Internal and external groups regularly review and revise program learning outcomes, based on changes in stakeholder needs.	Internal and external groups regularly review and revise course and program learning outcomes …
4	Program learning outcomes are aligned with institutional vision and mission, and levels of proficiency are set for each outcome.	Program as well as course learning outcomes are aligned with institutional vision and mission

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3	Program learning outcomes are validated with key program stakeholders, including faculty, students, alumni, and industry representatives.	Course and/or program learning outcomes are validated … and levels of proficiency are set for each outcome.
2	A plan to incorporate explicit statements of program learning outcomes is accepted by program leaders, engineering faculty, and other stakeholders.	A plan to incorporate explicit statements of course and/or program learning outcomes…
1	The need to create or modify program learning outcomes is recognized and such a process has been initiated.	The need to create or modify course and/or program learning outcomes …
0	There are no explicit program learning outcomes that cover knowledge, personal and interpersonal skills, and product, process and system building skills.	There are no explicit course and/or program learning outcomes …

Rubric of standard 3 – integrated curriculum

We propose some changes to the rubric of standard 3. In level 0 we want to emphasize the curriculum and not just refer to the whole program. In level 2 we raise the requirement - instead of an approval of a curriculum plan we propose an approval of the integrated curriculum. The program reaches level 3 when the integrated curriculum is in use.

Table 4. Rubric of standard 3.

Level	Original rubric	Suggested change to the rubric
5	Internal and external stakeholders regularly review the integrated curriculum and make recommendations and adjustments as needed.	NO CHANGES NEEDED.
4	There is evidence that personal, interpersonal, product, process, and system building skills are addressed in all courses responsible for their implementation.	NO CHANGE NEEDED.
3	Personal, interpersonal, product, process, and system building skills are integrated into one or more years in the curriculum.	The approved integrated curriculum is in use.
2	A curriculum plan that integrates disciplinary learning, personal, interpersonal, product, process, and system building skills is approved by appropriate groups.	The curriculum that integrates learning outcomes of personal, interpersonal, product, process, and system building skills is approved.
1	The need to analyze the curriculum is recognized and initial mapping of disciplinary and skills learning outcomes is underway.	NO CHANGES PROPOSED.
0	There is no integration of skills or mutually supporting disciplines in the program.	The curriculum has no courses that integrate learning outcomes of personal, interpersonal, product, process, and system building skills.

Rubric of standard 4 – introduction to engineering

The rubric of standard 4 has some inconsistencies in levels one and two. We propose modification according to Table 5. In level one the need for an introductory course is recognized. In level two the plan for the introductory course is done and the implementation has been initiated.

Table 5. Rubric of standard 4.

Level	Original rubric	Suggested change to the rubric
5	The introductory course is regularly evaluated and revised, based on feedback from students, instructors, and other stakeholders.	NO CHANGE PROPOSED
4	There is documented evidence that students have achieved the intended learning outcomes of the introductory engineering course.	NO CHANGE PROPOSED
3	An introductory course that includes engineering learning experiences and introduces essential personal and interpersonal skills has been implemented.	NO CHANGE PROPOSED
2	A plan for an introductory engineering course introducing a framework for practice has been approved.	A plan for an introductory engineering course introducing a framework for practice has been approved and a process to implement the plan has been initiated.
1	The need for an introductory course that provides the framework for engineering practice is recognized and a process to address that need has been initiated.	The need for an introductory course that provides the framework for engineering practice is recognized.
0	There is no introductory engineering course that provides a framework for practice and introduces key skills.	NO CHANGE PROPOSED

Rubric of standard 5 – design-implement experiences

We don't propose any changes to the rubric of standard 5. The rubric is consistent and understandable.

Table 6. Rubric of standard 5.

Level	Original rubric	Suggested change to the rubric
5	The design-implement experiences are regularly evaluated and revised, based on feedback from students, instructors, and other stakeholders.	NO CHANGE PROPOSED
4	There is documented evidence that students have achieved the intended learning outcomes of the design-implement experiences.	NO CHANGE PROPOSED
3	At least two design-implement experiences of	NO CHANGE PROPOSED

	increasing complexity are being implemented.	
2	There is a plan to develop a design-implement experience at a basic and advanced level.	NO CHANGE PROPOSED
1	A needs analysis has been conducted to identify opportunities to include design-implement experiences in the curriculum.	NO CHANGE PROPOSED
0	There are no design-implement experiences in the engineering program.	NO CHANGE PROPOSED

Rubric of standard 6 – Engineering workspaces

If we suppose that there is no need to remodel or build anything new in order to have satisfactory engineering workspaces, then it is difficult to score higher than level 2 for standard 6, if we were to strictly follow the rubric. This is not an unrealistic scenario for some branches of engineering (for instance software engineering), where normal university buildings could provide adequate workspaces. Therefor we suggest that the rubric of standard 6 is changed according to Table 7.

Table 7. Rubric of standard 6.

Level	Original rubric	Suggested change to the rubric
5	Internal and external groups regularly evaluate the impact and effectiveness of workspaces on learning and provide recommendations for improving them.	NO CHANGE PROPOSED
4	Engineering workspaces fully support all components of hands-on, knowledge, and skills learning.	NO CHANGE PROPOSED
3	Plans are being implemented and some new or remodelled spaces are in use.	If engineering workplaces initially were deemed unsatisfactory, plans are now being implemented and some new or remodeled spaces are in use.
2	Plans to remodel or build additional engineering workspaces have been approved by the appropriate bodies.	If engineering workplaces are deemed unsatisfactory, plans to remodel or build additional engineering workspaces have been approved by the appropriate bodies.
1	The need for engineering workspaces to support hands-on, knowledge, and skills activities is recognized and a process to address the need has been initiated.	NO CHANGE PROPOSED
0	Engineering workspaces are inadequate or inappropriate to support and encourage hands-on skills, knowledge, and social learning.	NO CHANGE PROPOSED

Rubric of standard 7 – integrated learning

The rubric of standard 7 correlates in general with the generic rubric, but there is a discrepancy at level 3 where full implementation is expected although the generic rubric dictates that

implementation should be underway. In addition, the formulation in relation to level 4 of the rubrics makes it unclear if one is supposed to show evidence of the positive effects of integrated learning in general or specifically the actual implementations of integrated learning at the current study programme. We suggest that this is clarified according to Table 8.

Table 8. Rubric of standard 7.

Level	Original rubric	Suggested change to the rubric
5	Courses are regularly evaluated and revised regarding their integration of learning outcomes and activities.	NO CHANGE PROPOSED
4	There is evidence of the impact of integrated learning experiences across the curriculum.	There is evidence of the impact of the implementation of integrated learning experiences across the curriculum.
3	Integrated learning experiences are implemented in courses across the curriculum.	Integrated learning experiences are being implemented in courses across the curriculum.
2	Course plans with learning outcomes and activities that integrate personal and interpersonal skills with disciplinary knowledge has been approved.	NO CHANGE PROPOSED
1	Course plans have been benchmarked with respect to the integrated curriculum plan.	NO CHANGE PROPOSED
0	There is no evidence of integrated learning of disciplines and skills.	NO CHANGE PROPOSED

Rubric of standard 8 – active learning

The rubric of standard 8 roughly correlates with the generic rubric of Table 1. However, the formulation of the rubric regarding active learning methods makes it unclear if one should review the impact of active learning in general or if it is the current implementation of active learning methods that should be quality assured. There is, of course, a wide acceptance of the fact that active learning enhances student learning, but the issue here is to establish if the current programme has components of active learning incorporated into its courses. One further question is the need for both external and internal groups to meet (level five) - what additional value does it give to have both internal and external groups; could the same level of quality be achieved with just e.g. internal (to the study programme) groups to meet? These uncertainties are visible in levels one, four and five of the rubric. We suggest that the rubric for standard 8 is changed according to Table 9.

Table 9. Rubric of standard 8.

Level	Original rubric	Suggested change to the rubric
5	Internal and external groups regularly review the impact of active learning methods and make recommendations for continuous improvement.	Internal and/or external groups regularly review the implementation of active learning activities across the curricula and make recommendations for continuous improvement
4	There is documented evidence of the impact of active learning methods on	There is documented evidence that active learning has been implemented all across

	student learning.	the curriculum
3	Active learning methods are being implemented across the curriculum.	NO CHANGE PROPOSED
2	There is a plan to include active learning methods in courses across the curriculum.	NO CHANGE PROPOSED
1	There is an awareness of the benefits of active learning, and benchmarking of active learning methods in the curriculum is in process.	There is an awareness of the benefits of active learning and a process is in place to introduce it across the curricula.
0	There is no evidence of active experiential learning methods.	NO CHANGE PROPOSED

Rubric of standard 9 – enhancement of faculty competence

The original formulation of the rubric of standard 9 is difficult to relate to if we assume that the staffs initially has a high competence in personal and interpersonal skills etc. The formulation of levels two and three assumes that there is no such competence present amongst the staff. We suggest that the rubric for standard 9 is changed according to Table 10.

Table 10. Rubric of standard 9.

Level	Original rubric	Suggested change to the rubric
5	Faculty competence in personal, interpersonal, product, process, and system building skills is regularly evaluated and updated where appropriate.	NO CHANGE PROPOSED
4	There is evidence that the collective faculty is competent in personal, interpersonal, product, process, and system building skills.	NO CHANGE PROPOSED
3	The collective faculty participates in faculty development in personal, interpersonal, product, process, and system building skills.	Where needed, the faculty participates in faculty development in personal, interpersonal, product, process, and system building skills.
2	There is a systematic plan of faculty development in personal, interpersonal, product, process, and system building skills.	Where needed, there is a systematic plan of faculty development in personal, interpersonal, product, process, and system building skills.
1	There is an awareness of the benefits of active learning, and benchmarking of active learning methods in the curriculum is in process.	NO CHANGE PROPOSED
0	There is no evidence of active experiential learning methods.	NO CHANGE PROPOSED

Rubric of standard 10 – enhancement of faculty teaching competence

The rubric of standard 10 suffers from the same underlying assumption as the rubric of standard 9: If the staff already have a high competence in teaching we can not assess the

level to a value of 4 without firstly creating a plan etc. We suggest that the rubric for standard 9 is changed according to Table 11.

Level	Original rubric	Suggested change to the rubric
5	Faculty competence in teaching, learning, and assessment methods is regularly evaluated and updated where appropriate.	NO CHANGE PROPOSED
4	There is evidence that the collective faculty is competent in teaching, learning, and assessment methods.	NO CHANGE PROPOSED
3	Faculty members participate in faculty development in teaching, learning, and assessment methods.	Where needed, faculty members participate in faculty development in teaching, learning, and assessment methods.
2	There is a systematic plan of faculty development in teaching, learning, and assessment methods.	Where needed, a systematic plan of faculty development in teaching, learning, and assessment methods is developed.
1	A benchmarking study and needs analysis of faculty teaching competence has been conducted.	NO CHANGE PROPOSED
0	There are no programs or practices to enhance faculty teaching competence.	NO CHANGE PROPOSED

Rubric of standard 11 – assessment

In the rubric of standard 11 there is an inconsistency with in relation to the generic rubric as presented in Table 1. The rubric of standard 11 states at level 3 that a full implementation of assessment methods is needed while the generic rubric states that implementation should be underway for a level 3 agreement with the rubric. We suggest that the rubric is changed according to Table 12.

Table 12. Rubric of standard 11.

Level	Original rubric	Suggested change to the rubric
5	Internal and external groups regularly review the use of learning assessment methods and make recommendations for continuous improvement.	NO CHANGE PROPOSED
4	Learning assessment methods are used effectively in courses across the curriculum.	NO CHANGE PROPOSED
3	Learning assessment methods are implemented across the curriculum.	Learning assessment methods are implemented in key courses of the curriculum.
2	There is a plan to incorporate learning assessment methods across the curriculum.	NO CHANGE PROPOSED
1	The need for the improvement of learning assessment methods is recognized and benchmarking of their current use is in process.	NO CHANGE PROPOSED

| 0 | Learning assessment methods are inadequate or inappropriate. | NO CHANGE PROPOSED |

Rubric of standard 12 – Program evaluation

The rubric of standard 12 is consistent with the generic rubric, but we would like to propose some modifications to the wordings to make it clearer and easier to understnad. All the proposed changes are shown in Table 13.

Table 13. Rubric of standard 12.

Level	Original rubric	Suggested change to the rubric
5	Systematic and continuous improvement is based on program evaluation results from multiple sources and gathered by multiple methods.	Systematic and continuous improvement is based on continuous program evaluation results.
4	Program evaluation methods are being used effectively with all stakeholder groups.	NO CHANGE PROPOSED.
3	Program evaluation methods are being implemented across the program to gather data from students, faculty, program leaders, alumni, and other stakeholders.	Program evaluation methods are being implemented across the program to gather data from majority of the stakeholders (such as students, faculty, program leaders, alumni, working life representatives)
2	A program evaluation plan exists.	A continuous program evaluation plan exists.
1	The need for program evaluation is recognized and benchmarking of evaluation methods is in process.	NO CHANGE PROPOSED.
0	Program evaluation is inadequate or inconsistent.	Program evaluation is inadequate, inconsistent or non-exsisting.

FUTURE WORK

The self-evaluation rubrics are important. Therefore we need to make quality assurance of it. This can be seen as a first step; following this one we need to make a much broader evaluation of the understandability and usefulness of it. We did a pilot study of this at the regional meeting in Gothenburg in January 2014; however such an evaluation needs more time in order to be of good quality (i.e. the participants were shown the rubric of a given standard in less than one minutes and afterwards asked about their view on the rubric)

CONCLUSION

Doing a self-evaluation is seen as a major quality improvement factor. This naturally puts big requirements on the self-evaluation rubric such that the rubric helps people in their reflection on the quality of the study programme. In this paper we have evaluated the twelve rubrics of the CDIO standards. Our goal was to analyze the rubrics and their understandability, consistency and usability for the CDIO self-evaluation. In general, the rubrics are understandable, consistent and usable. However, our analysis found several possible changes to the rubrics

that could further improve the usability of the rubrics and could support the CDIO self-evaluation.

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