# IMPROVING THE CDIO SELF-EVALUATION BY UPDATING SELF-EVALUATION RUBRICS

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## ABSTRACT

In this paper some improvements of the Rubric associated with the 12 standards for CDIO are suggested. The suggestions are based on a comparative evaluation of the rubrics in relation to proposals for the description of the different levels in the rubric (Bennedsen, Georgsson and Kontio 2014). The evaluation was done by sending out a questionnaire to all CDIO collaborators representing the CDIO member universities and the representatives were asked to evaluate each of the 12 standards with respect to understandability and hierarchical consistency, i.e. if fulfilling level n of the rubric meant that the criteria for levels (0, … ,n-1) also was fulfilled. Furthermore the respondents to the survey were asked to evaluate our proposed changes of the rubrics. Based on the feedback, new rubrics for each of the 12 standards are proposed.

## KEYWORDS

Rubric, self-evaluation, standards.

## INTRODUCTION

One of the cornerstones of CDIO is a continuous improvement strategy. This is reflected in standard 12 — Program Evaluation: “A system that evaluates programs against these twelve standards, and provides feedback to students, faculty, and other stakeholders for the purposes of continuous improvement” (CDIO 2010).[1]

[1] In the context of this paper we use the term “program” to denote a study program which a student enrol in order to study for a degree (for instance a Bachelor degree in Mechanical Engineering). A study program is built by “courses” (for instance Calculus, C-Programming, etc).

The process of creating the CDIO self-evaluation rubric was done in 2007 - 2010. Since then, many more members have joined CDIO making the cohort of CDIO members even more diverse. Consequently, it is even more important to have a critical view on the rubric and to improve it if possible.

The authors of this paper have all experience in conducting self-evaluations on their own study programs and some of these experiences of using the CDIO rubric resulted in an article of their views on the rubric and associated descriptions for the different levels. In their role as regional co-directors of the European region of the CDIO, the authors have also been reviewing self-evaluations from schools applying for membership of the CDIO-initiative. Based on the authors' experience (both own and observed differences between the evaluated self-evaluations from others), some improvements were suggested (Bennedsen, Georgsson and Kontio 2014) and were presented at the CDIO World Meeting in Barcelona in 2014. At that point the CDIO council asked the authors to continue this development work aiming at new version of CDIO rubrics to the 12 standards. The goal is to produce CDIO standards with rubrics v. 3.0.

Based on the suggested proposals the authors wanted to get feedback from the CDIO community on the wordings of the Rubric. A few comments were received earlier, but for this paper the aim was to get feedback in a more systematic way. The purpose was to evaluate the proposed improvements and modifications among the other CDIO members and to hear whether they see the proposed changes necessary at all and whether the new proposed rubrics are more understandable. In addition, we wanted to see if there are needs to further modify and improve the rubrics.

The data collection was carried out in several ways. A web questionnaire was sent to all CDIO collaborators representing the CDIO member universities. Additional information and more detailed comments were acquired with a short semi-structured interview with selected CDIO collaborators and a session at the fall meeting with experienced CDIO members were held.

Based on the web questionnaire and the interviews, the proposed rubrics of the 12 CDIO standards were analyzed once more and necessary clarifications, improvements and corrections were provided. These proposed changes of the rubrics will eventually be the basis for a proposal of the CDIO standards with rubrics v. 3.0 that will be presented to the CDIO council for necessary actions.

## ACCREDITATION AND QUALITY ENHANCEMENT

Agencies or associations for accreditation of (engineering) programs and institutions are in place in many countries. They typically serve two purposes:

1. Ensuring that the education fulfills some quality level (accreditation)
2. Helping the institution/program with foci points for where to improve their quality (quality enhancement)

These two goals give rise to different requirements for the processes and tools used. If the focus is on accreditation, we need to ensure a high degree of reliability (consistency of research findings - will replicated measuring give the same result) since the goal is to do an objective evaluation. If the goal on the other hand is on quality enhancement within the organization, reliability is not in the same focus, since the precise outputs (the values of the

things being assessed) are not necessarily the most important issue but where to improve. However, if an institution needs to do continuous improvement, it is important that the evaluator can compare results from evaluation to the next evaluation.

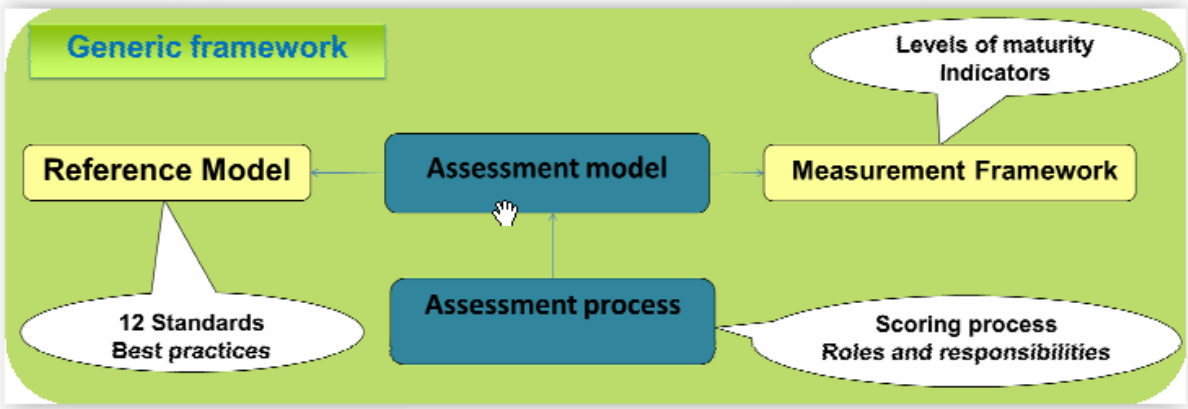


Figure 1. A Generic Assessment Framework proposed by Rouvrais et al. (2014).

In (Rouvrais and Lassudrie 2014) several weaknesses of the CDIO model are pointed out:

- Poor repeatability: different assessors often produce different scorings due to lack of guidance (samples of evidence are not sufficient and may have an anecdotic character). Ratings of engineering education program quality may thus differ depending on assessors. HEI program assessments are to be repeatable, as stated in SPICE-ISO 15504-2 standard for process assessment;
- Difficulty to produce a scoring because of the duality of some rubrics (for example, level 1 involves both awareness and process implementation);
- Lack of accuracy in the scoring: one cannot express that a level is only partially satisfied (e.g. satisfied only in some departments of the institution). As an example, CDIO Standard 1 contains the criteria "CDIO is adopted as the context for the engineering program […]" at a given compliance level. But, the assessor is left with the question of what would be "adopted as the context" (e.g. adopted by Management and/or program leaders, or even fully understood and adopted by the whole educational system and staff);
- The CDIO framework does not provide a complete quality management model, as it does not address aspects such as learners support, relationships between research and education, or human resource management. (p. 252-253)

The view of Rouvrais et. al. view seems much influenced by accreditation. However, our view is that CDIO is not primarily an accreditation system but a system for self-improvement. Thus, there is not the same requirement for reliability and the requirements for repeatability are a little exaggerated. The aim of our work is to make the CDIO rubric as useful as possible for persons trying to get some indicators for where to focus when improving their programs.

## DATA COLLECTION

Prior to the CDIO fall meeting in Santiago, Chile 2014, a questionnaire was sent out to institutions that would be present at the meeting, members of the global council and institutions that had shown prior activity within the CDIO network, that is, participated in conferences or performed review assignments for the CDIO community. Due to a limited number of responses (four) the survey was sent to all members of the CDIO after the fall

meeting. The participants of the survey could be anonymous but were asked to provide name and e-mail address. All participants did so.

In the questionnaire the participants was asked to

- Comment on if they thought that the original rubric (CDIO 2010) was easy to understand and if they thought the levels of the rubric was hierarchical.
- Compare wordings of the proposed changes as outlined in (Bennedsen, Georgsson and Kontio 2014) to the original rubric.
- State which wording, original vs. proposed, they preferred.

In all there were 15 responders that filled out the complete survey distributed over regions as followed: Asia 3, Europe 8, Latin America 2, North America 2 and UK-Ireland 1. On average the schools answering the survey had been member of the CDIO for 6,5 year (lowest 1 year, highest 15 years) and had on average conducted 3 CDIO self-evaluations (lowest zero evaluations, highest 10 evaluations).

## OVERALL ANALYSIS

On average for the twelve standards, 68% of the respondents agreed with the statement "Everything is clear" regarding how understandable the formulation of the Rubric version 2.0 (CDIO 2010) was. Standard 4 seemed to be the easiest to understand, where 88% agreed with the "Everything is clear" statement while 56% did so for standard 12, which seem to be the least understandable. Based on these data it does not seem to be a large demand to reformulate the Rubrics and develop a version 3.0, but still on average 59% of the respondents agreed with the statement "Did you find that the adjustments make the rubric more understandable" when asked to compare the official version 2.0 to our proposed changes of the Rubric as presented in (Bennedsen, Georgsson och Kontio 2014).

## STANDARD 1 - The Context

The first standard is about "Adoption of the principle that product, process, and system lifecycle development and deployment -- Conceiving, Designing, Implementing and Operating -- are the context for engineering education" (CDIO 2010).

**Table 1. 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. |

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| 0 | There is no plan to adopt the principle that CDIO is the context of engineering education for the program. | NO CHANGE PROPOSED. |

Even though we did not propose changes to the rubric, only 53% found it clear. Five persons commented on the rubric:
The interpretation of "Evaluation groups" is not clear. It should include representatives from industry. What is meant by “fully implemented”? "Context" has a very broad meaning.
It is not clear if this is an overarching standard, which is fulfilled when all the other standards are fulfilled.

Based on their comments, we suggest the following change:

**Table 2. New Rubric for 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. | Evaluation groups where all relevant stakeholders are represented endorse CDIO as the context of the engineering program and use this principle as a guide for continuous improvement. |
| 4 | There is documented evidence that the CDIO principle is the context of the engineering program and is fully implemented. | There is documented evidence that the CDIO principle is the context of the engineering program and is implemented in all years of the program |
| 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. | A process to address the principle that CDIO is the context of engineering education has been initiated. |
| 0 | There is no plan to adopt the principle that CDIO is the context of engineering education for the program. | NO CHANGE PROPOSED. |

We have not directly addressed the comment on the level of this standard - is it so that the standard is fulfilled if and only if all other standards are fulfilled?

**STANDARD 2 - Learning Outcomes**

The second standard is about “Specific, detailed learning outcomes for personal and interpersonal skills, and product, process, and system building skills, as well as disciplinary knowledge, consistent with program goals and validated by program stakeholders” (CDIO 2010).

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 |
| 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 … |

63% of the respondents agreed that the original reading of the Rubric for Standard 2 was clearly understandable but still 56% agreed that the proposed changes made the Rubric even clearer. Some comments given by the respondents indicate that the inclusion of courses (or *modules* in some national contexts) was appreciated, whilst one comment shows that focus should be solely on program level. One respondent suggested that at level 0 there should be only an **or** in "course and/or program", whilst it in levels 1-3 should read **and/or** and just **and** for level 4. The meaning of the term Evaluation Group is not clear to all respondents and should be further clarified.

Based on the comments of the survey we propose the following changes to the Rubric

Table 4. Updated Rubric based on questioner for 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 **and 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 or program learning outcomes … |

**STANDARD 3 - Integrated Curriculum**

The third standard is about "A curriculum designed with mutually supporting disciplinary courses, with an explicit plan to integrate personal and interpersonal skills, and product, process, and system building skills" (CDIO 2010).

**Table 5. 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 | The curriculum has no courses that |

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| | supporting disciplines in the program. | integrate learning outcomes of personal, interpersonal, product, process, and system building skills. |

All of the respondents found the original rubric to be the best. One respondent pointed out that in general the rubrics use both terms stakeholders and external group, but the difference is not clarified anywhere. Two respondents mentioned that the rubrics could be simplified and made clearer for example to what extent the skills are integrated. That was one of the key ideas we had with the new proposal, but since majority see the old one better we suggest that the original rubric is kept.

**STANDARD 4 - Introduction to Engineering**

The fourth standard is about "An introductory course that provides the framework for engineering practice in product, process, and system building, and introduces essential personal and interpersonal skills" (CDIO 2010).

**Table 6. 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 |

Most of the participants found the original rubric to be the best. We suggest that the original wording is kept with a minor change to level 1 since a process that addresses a need has as a prerequisite that the need is recognized:

Table 7. Change of level 1 in rubric of standard 4

| Level | Original rubric | Suggested change to the rubric |
|---|---|---|
| 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. | A process to address the need for an introductory course that provides the framework for engineering practice has been initiated. |

**STANDARD 5 - Design-Implement Experiences**

The fifth standard is about "A curriculum that includes two or more design-implement experiences, including one at a basic level and one at an advanced level" (CDIO 2010).

Table 8. 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 increasing complexity are being implemented. | NO CHANGE PROPOSED |
| 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 |

81% of the respondents thought that the original wording of the Rubric to standard 5 was clear. However, one respondent pointed out that there were issues with the hierarchical properties of the Rubric: Being on level 4 makes levels below irrelevant and being on level 5 does not mean level 4 is fulfilled.

Based on the comment we propose the following change to the Rubric

Table 9. Updated Rubric for Standard 5 based on questioner

| 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 increasing complexity are being implemented. | Unless level 4 is met, at least two design-implement experiences of |

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| | | increasing complexity are being implemented. |
| 2 | There is a plan to develop a design-implement experience at a basic and advanced level. | Unless level 4 is met, there is a plan to develop a design-implement experience at a basic and advanced level. |
| 1 | A needs analysis has been conducted to identify opportunities to include design-implement experiences in the curriculum. | Unless level 4 is met, a needs analysis has been conducted to identify opportunities to include design-implement experiences in the curriculum. |
| 0 | There are no design-implement experiences in the engineering program. | NO CHANGE PROPOSED |

**STANDARD 6 - Engineering Workspaces**

The sixth standard is about "Engineering workspaces and laboratories that support and encourage hands-on learning of product, process, and system building, disciplinary knowledge, and social learning" (CDIO 2010).

**Table 10. 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 |

60 % of the respondents found the original rubrics clearly understandable, but almost half of those still considered the new rubrics better. Altogether 53 % of respondents found the new rubrics better. The respondents requested explanation of the terms internal and external

groups. At level five the rubric refers to impact and effectiveness but leaves it open how these are measured. Based on the comments we propose following change to the Rubric.

**Table 11. Updated Rubric for standard 6 based on the comments**

| 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. | The program leaders and external stakeholders regularly evaluate the functionality and purposefulness of workspaces on learning and provide recommendations for improving them. |
| 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. | Development plans of engineering workplaces are 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. | Development plans of remodeling /building 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 |

**STANDARD 7 - Integrated Learning Experiences**

The seventh standard is about "Integrated learning experiences that lead to the acquisition of disciplinary knowledge, as well as personal and interpersonal skills, and product, process, and system building skills" (CDIO 2010).

**Table 12. 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 | NO CHANGE PROPOSED |

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| | knowledge has been approved. | |
| 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 |

In general the reviewers did not find this standard to be problematic and the changes were seen as better. However, two reviewers commented on the evidence of the impact of learning experience at level 4 whereas level 5 do not have a requirement for impact - just that courses are evaluated and revised. Level five includes learning outcomes, something that should belong to standard 2. Based on those comments we suggest that level 3, 4 and 5 is changed to the following:

**Table 13. Updated description of level 3,4 and 5 in 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. | Courses are regularly evaluated and revised regarding their integration of learning experiences and the impact of these experiences. |
| 4 | There is evidence of the impact of integrated learning experiences across the curriculum. | NO CHANGE PROPOSED |
| 3 | Integrated learning experiences are implemented in courses across the curriculum. | Integrated learning experiences are being implemented in courses across the curriculum. |

**STANDARD 8 - Active Learning**

The eighth standard is about “Teaching and learning based on active experiential learning methods” (CDIO 2010).

**Table 14. 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 student learning. | There is documented evidence that active learning has been implemented all across 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 | There is an awareness of the benefits of active learning and a process is in place |

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| | active learning methods in the curriculum is in process. | to introduce it across the curricula. |
| 0 | There is no evidence of active experiential learning methods. | NO CHANGE PROPOSED |

75% of the respondents agreed that the version 2.0 Rubric of standard 8 was clearly understandable and 63% still agreed that the proposed changes made the Rubric even more understandable. However there were comments on what level a "process should be in place" (level 1) in relation to "there is a plan" (level 2). It was argued that a process in place should be on a higher level than the existence of a plan.

Based on comments from the questioner we propose the following changes to the Rubric of Standard 8

**Table 15. Updated 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 student learning. | There is documented evidence that active learning has been implemented all across 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. | There is a process to include active learning methods in courses across the curriculum. |
| 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 plan is in place to introduce it across the curricula. |
| 0 | There is no evidence of active experiential learning methods. | NO CHANGE PROPOSED |

**STANDARD 9 - Enhancement of Faculty Competence**

The ninth standard is about "Actions that enhance faculty competence in personal and interpersonal skills, and product, process, and system building skills" (CDIO 2010).

**Table 16. 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 |

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|---|---|---|
| 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 | A benchmarking study and needs analysis of faculty competence has been conducted. | NO CHANGE PROPOSED |
| 0 | There are no programs or practices to enhance faculty competence in personal, interpersonal, product, process, and system building skills. | NO CHANGE PROPOSED |

60 % of the respondents agreed that the old 2.0 Rubric of standard 9 was clearly understandable. At the same time 60 % agreed that proposed changes make the rubric better. Most of the critical comments focused on rationality of the "where needed" –clauses at the levels 2 and 3 of the new proposal. Those clauses were the only modifications of suggested new rubrics. In addition, there were comments on the hierarchy of the rubric: Respondents stated for example that you can move from level 0 to higher levels even without doing a benchmarking study. Based on the comments we propose keeping the rubrics of all other levels except level 1.

**Table 17. Updated level 1 rubric for standard 9.**

| Level | Original rubric | Suggested change to the rubric |
|---|---|---|
| 1 | A benchmarking study and needs analysis of faculty competence has been conducted. | The need of faculty competence development plan in personal, interpersonal, product, process and system building skills is recognized. |

**STANDARD 10 - Enhancement of Faculty Teaching Competence**

The tenth standard is about "Actions that enhance faculty competence in providing integrated learning experiences, in using active experiential learning methods, and in assessing student learning" (CDIO 2010).

**Table 18. Rubric of standard 10**

| 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 |

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|---|---|---|
| 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 |

66 % found the new wording better than the old one. One comment on the old description included a concern about who will do the regular evaluation at level five since the board/person managing the program has limited influence over the development of the faculty competence. One comment on the new version included a concern that it is difficult to evaluate if there is a need. The first comment has more to do with the organization of universities. For the second comment, on level 1 a benchmarking study has been done giving the criteria for when development is needed.

We suggest that the rubric will be updated according to the suggested changes.

**STANDARD 11 - Learning Assessment**

The eleventh standard is about "Assessment of student learning in personal and interpersonal skills, and product, process, and system building skills, as well as in disciplinary knowledge" (CDIO 2010).

**Table 19. 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 |

63% of the respondents agreed on that the version 2.0 Rubric was clearly understandable and still 56% thought that the proposed change made the Rubric more understandable.

Comments regarding how to identify key-courses were presented. The comments regarding what should constitute a key-course makes sense, but we believe that it should be up to the managers of the program to decide what should constitute a key course and feel that no additional change is needed. We suggest keeping the proposed changes.

### STANDARD 12 - Program Evaluation

The twelfth standard is about "A system that evaluates programs against these twelve standards, and provides feedback to students, faculty, and other stakeholders for the purposes of continuous improvement" (CDIO 2010).

**Table 20. 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-existing. |

53% of the respondents think that the version 2.0 rubrics are clear, but 47 % see some need for making the rubrics clearer. It seems that the new rubrics are more understandable, because 80 % of the respondents agreed that the new rubrics are better than the version 2.0 rubrics. Still, the respondents commented that the difference between levels 4 and 5 should be improved. Based on the comments we propose keeping the original level 5 rubric instead of the new one.

### CONCLUSION

In this article we have evaluated the rubric for the CDIO self-evaluation. The evaluation was done by key users of the rubric; almost all of them with a good knowledge of making self-evaluations. The evaluation has led to suggested changes in the rubrics for the 12 standards. The respondents provided very useful comments and arguments for the development of the rubrics. One point the repeatedly came up was the usage of terminology. The terminology has to be checked once more to make the usage of different terms consistent and

understandable. For example terms stakeholders and external groups have been used and this confused the respondents a bit.

We have not focused on the usage of the rubric for accreditation. If it should be used for that, we for example need a more formal evaluations process and indicators for each of the standards such that different evaluators will have a much higher chance of getting the same result (what we normally call inter-rater reliability).

The next step towards CDIO standards v.3.0 proposals is to combine the standard descriptions and the new rubrics into one document and check the language consistency. Once that work is done the proposal can be introduced to the CDIO council for final decision.

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