UPDATED RUBRIC FOR SELF-EVALUATION (v.2.1)

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ABSTRACT

On November 13, 2015 the CDIO Council approved an updated version of the self-evaluation rubric. This paper will present the updated version of the rubric along with some general thoughts on how to work with it. In this paper we will also present the process that started with a paper in the 2014 CDIO world conference identifying inconsistencies in the version 2.0 of the CDIO rubric for self-evaluation and ended in the proposed rubric.

KEYWORDS

Self-assessment rubric, quality assessment, continuous improvement, CDIO rubric, CDIO standards, Standard: 12

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). As an aid for performing the self-evaluation a rubric was presented in 2010. In 2014 we presented our first paper on suggested changes (Bennedsen, Georgsson, & Kontio, 2014) that was followed by an updated proposal presented in (Georgsson, Kontio, & Bennedssen, 2015) and discussed at the CDIO Fall Meeting in Belfast in November 2015. The CDIO council approved the changes at their meeting on November 13 2015.

The outline of the paper is as follows: Firstly, the updated rubric will be presented, then an introduction on how to think about the levels of the rubric will be given along with some theoretical foundation. Lastly the process of developing the new rubric will be described.

THE UPDATED RUBRIC

Since this document is intended to serve as a description of the latest version of the CDIO rubric for self-evaluation it will be listed here in its entirety. We have chosen to list it alongside the old version of the rubric for comparison.

Table 1 Rubric for standard 1

Level	Old version of the rubric	New version of 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.	CDIO is implemented in one or more years of the program.
2	There is an explicit plan to transition to a CDIO context for the engineering program.	There is an explicit plan to transition to a CDIO context for the engineering program.
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.	There is a willingness to adopt the principle that CDIO is the context of engineering education.
0	There is no plan to adopt the principle that CDIO is the context of engineering education for the program.	There is no plan to adopt the principle that CDIO is the context of engineering education for the program.

Table 2 Rubric for standard 2

Level	Old version of the rubric	New version of 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 program learning outcomes and/or program goals based on changes in stakeholder needs.
4	Program learning outcomes are aligned with institutional vision and mission, and levels of proficiency are set for each outcome.	NO CHANGE
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 with key program stakeholders, including faculty, students, alumni, and industry representatives 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 learning outcomes at course/module level as well as program outcomes is accepted by program leaders, engineering faculty, and other stakeholders.
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 learning outcomes at course/module level and program outcomes are recognized and such a process has been initiated
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 learning outcomes at course/module level nor program outcomes that cover knowledge, personal and interpersonal skills, and product, process and system building skills.

Table 3 Rubric for standard 3

Level	Old version of the rubric	New version of the Rubric
5	Internal and external stakeholders regularly review the integrated curriculum and make recommendations and adjustments as needed.	NO CHANGE.
4	There is evidence that personal, interpersonal, product, process, and system building skills are addressed in all courses responsible for their implementation.	There is evidence that the students have achieved the intended learning outcomes concerning personal, interpersonal, product, process and system building skills.
3	Personal, interpersonal, product, process, and system building skills are integrated into one or more years in the curriculum.	The approved integrated curriculum concerning personal, interpersonal, product, process, and system building skills is in use.
2	A curriculum plan that integrates disciplinary learning, personal, inter-personal, 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 and a process has been initiated to implement the curriculum.
1	The need to analyze the curriculum is recognized and initial mapping of disciplinary and skills learning outcomes is underway.	NO CHANGE.
0	There is no integration of skills or mutually supporting disciplines in the program.	The curriculum has no courses known to integrate learning outcomes of personal, interpersonal, product, process, and system building skills.

Table 4 Rubric for standard 4

Level	Old version of the rubric	New version of the Rubric
5	The introductory course is regularly evaluated and revised, based on feedback from students, instructors, and other stakeholders.	The introductory course is regularly evaluated and revised as needed, based on feedback from students, instructors, and other stakeholders.
4	There is documented evidence that students have achieved the intended learning outcomes of the introductory engineering course.	NO CHANGE
3	An introductory course that includes engineering learning experiences and introduces essential personal and interpersonal skills has been implemented.	NO CHANGE
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 and a planning process initiated.
0	There is no introductory engineering course that provides a framework for practice and introduces key skills.	NO CHANGE

Table 5 Rubric for standard 5

Level	Old version of the rubric	New version of the Rubric
5	The design-implement experiences are regularly evaluated and revised, based on feedback from students, instructors, and other stakeholders.	NO CHANGE
4	There is documented evidence that students have achieved the intended learning outcomes of the design-implement experiences.	NO CHANGE
3	At least two design-implement experiences of increasing complexity are being implemented.	NO CHANGE
2	There is a plan to develop a design-implement experience at a basic and advanced level.	NO CHANGE
1	A needs analysis has been conducted to identify opportunities to include design-implement experiences in the curriculum.	NO CHANGE
0	There are no design-implement experiences in the engineering program.	NO CHANGE

Table 6 Rubric of standard 6

Level	Old version of the rubric	New version of 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, students, teachers 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
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 remodelled spaces are in use.
2	Plans to remodel or build additional engineering workspaces have been approved by the appropriate bodies.	Workspaces, their functionality and purposefulness for teaching are being evaluated by internal groups including stakeholders
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
0	Engineering workspaces are inadequate or inappropriate to support and encourage hands-on skills, knowledge, and social learning.	NO CHANGE

Table 7 Rubric of standard 7

Level	Old version of the rubric	New version of 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.	There is evidence of the impact of the implementation of integrated learning experiences according to the integrated curriculum plan.
3	Integrated learning experiences are implemented in courses across the curriculum.	Integrated learning experiences are being implemented in courses across the curriculum according to the integrated curriculum plan.
2	Course plans with learning outcomes and activities that integrate personal and interpersonal skills with disciplinary knowledge has been approved.	NO CHANGE
1	Course plans have been benchmarked with respect to the integrated curriculum plan.	NO CHANGE
0	There is no evidence of integrated learning of disciplines and skills.	NO CHANGE

Table 8 Rubric of standard 8

Level	Old version of the rubric	New version of 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 active learning activities on outcome based learning 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 suitably all across the curriculum
3	Active learning methods are being implemented across the curriculum.	NO CHANGE
2	There is a plan to include active learning methods in courses across the curriculum.	There is a plan and 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 it is encouraged to introduce it across the curricula.
0	There is no evidence of active experiential learning methods.	NO CHANGE

Table 9 Rubric for standard 9

Level	Old version of the rubric	New version of the Rubric
5	Faculty competence in personal, interpersonal, product, process, and system building skills is regularly evaluated and updated where appropriate.	NO CHANGE
4	There is evidence that the collective faculty is competent in personal, interpersonal, product, process, and system building skills.	NO CHANGE
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.	The need of faculty competence development plan in personal, interpersonal, product, process and system building skills is recognized.
0	There are no programs or practices to enhance faculty competence in personal,	NO CHANGE

	interpersonal, product, process, and system building skills.	

Table 10 Rubric for Standard 10

Level	Old version of the rubric	New version of the Rubric
5	Faculty competence in teaching, learning, and assessment methods is regularly evaluated and updated where appropriate.	NO CHANGE
4	There is evidence that the collective faculty is competent in teaching, learning, and assessment methods.	There is evidence that the faculty is collectively working on their competences in teaching learning and assessment methods
3	Faculty members participate in faculty development in teaching, learning, and assessment methods.	Faculty members participate continously in faculty development in teaching, learning, and assessment methods.
2	There is a systematic plan of faculty development in teaching, learning, and assessment methods.	A systematic plan of faculty development in teaching, learning, and assessment methods is developed and budgeted.
1	A benchmarking study and needs analysis of faculty teaching competence has been conducted.	A need for enhancing teaching competences is recognized and accepted within the team
0	There are no programs or practices to enhance faculty teaching competence.	NO CHANGE

Table 11 Rubric of standard 11

Level	Old version of the rubric	New version of the Rubric
5	Internal and external groups regularly review the use of learning assessment methods and make recommendations for continuous improvement.	NO CHANGE
4	Learning assessment methods are used effectively in courses across the curriculum.	There are evidence of aligned learning assessment methods
3	Learning assessment methods are implemented across the curriculum.	Learning assessment methods are aligned with the learning goals across the curriculum.
2	There is a plan to incorporate learning assessment methods across the curriculum.	There is a plan to align learning assessment methods with the curriculum.
1	The need for the improvement of learning assessment methods is recognized and benchmarking of their current use is in process.	The need for the improvement of learning assessment methods is recognized.
0	Learning assessment methods are inadequate or inappropriate.	Learning assessment methods are inadequate, inappropriate or not aligned

Table 12 Rubric of standard 12

Level	Old version of the rubric	New version of the Rubric
5	Systematic and continuous improvement is based on program evaluation results from multiple sources and gathered by multiple methods.	There is documented evidence that systematic and continuous improvement is based on continuous program evaluation results.
4	Program evaluation methods are being used effectively with all stakeholder groups.	There is documented evidence that program evaluation methods are being used with key stakeholders including students, faculty, program leaders, alumni and working life representatives.
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 including 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.
0	Program evaluation is inadequate or inconsistent.	Program evaluation is non-existing.

HOW TO WORK WITH THE LEVELS OF THE RUBRIC

There are six levels in the rubric describing levels of maturity. As shown in Table 13, the levels range from 0: there is no documented plan or activity related to the standard, to 5: evidence related to the standard is regularly reviewed and used to make improvements. In general, in order to be at level n, level n-1 should also be fulfilled. In this sense the levels of the rubric form a hierarchy, as described in Figure 1.

Table 13. A generic description of the CDIO rubric.

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 the 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 an a process is in place to address it.
0	There is no documented plan or activity related to the standard.

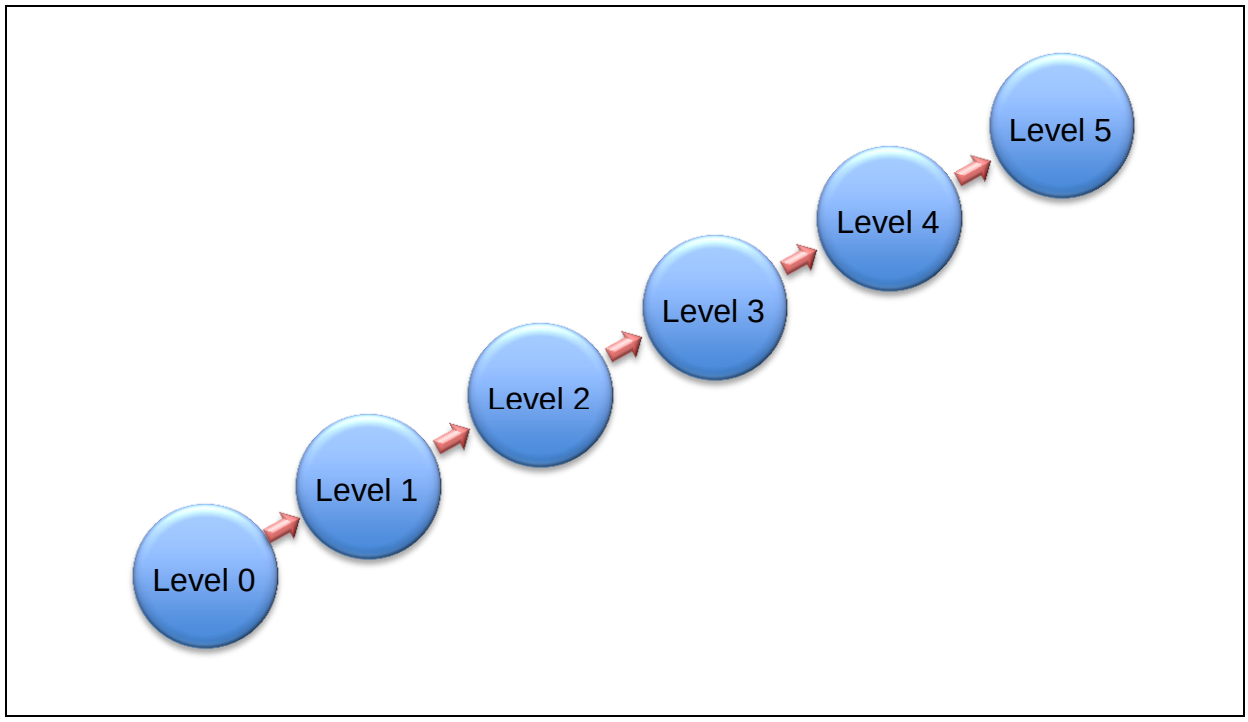

Figure 1 A hierarchical view of the levels of the rubric

One problem with this view is that you could be tempted to view level 5 as a final state, indicating that you in some way have "finished" your quality work when you self-assess yourself at this level (as indicated in Figure 1). It can even be so that you run into trouble when it comes to level 4: There is documented evidence of full implementation, which tells us that we have reached a satisfactory implementation of the standard and you might be tempted to stop the developing process there. At this point we must stress that the correct interpretation of level 5 is that you have made sure you have a satisfactory level of implementation (level 4) and that you have processes in place that guarantee continued improvements, i.e. you can never state that you are finished when it comes to improving yourself.

We suggest that it could be helpful to think about the levels of the self-assessment rubric as shown in Figure 2: First we have to conceive what the standard is all about, during that process we are at level 1. When we start designing how we should address the implementation of the standard we are at level 2. When we start implementing the design we are at level 3. After level 3, we leave the linear implementation phases and enter an operation phase where we repeatedly assess that we have an accepted level of implementation (level 4) but still systematically address the shortcomings of our implementations (level 5). With this view of self-assessment it is obvious that we never will be finished.

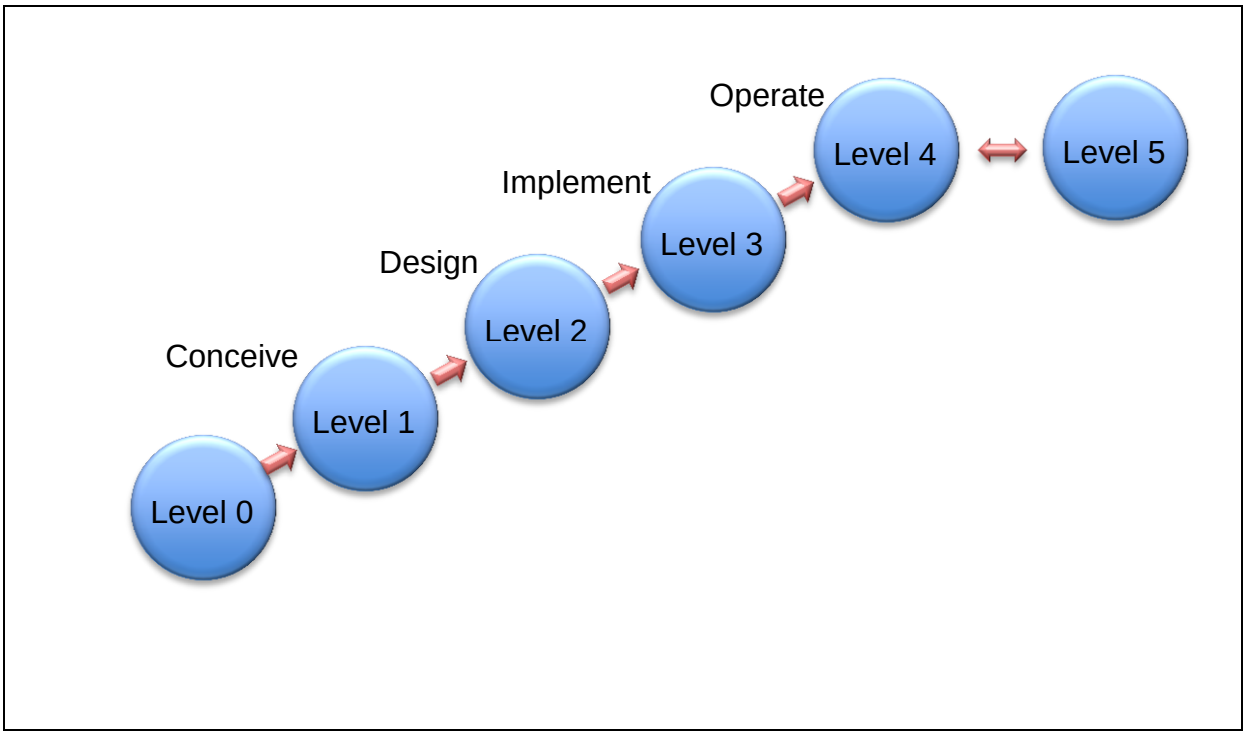

Figure 2 Process focus of the levels of the rubric

THE RUBRIC VS. OTHER QUALITY ACCREDITATION SYSTEMS

Improving quality of the higher educational systems, its universities and programmes are very much in focus all over the world. In many (most?) countries, accreditation bodies are in place that will ensure the quality of a program or an institution. Such bodies exist in many shapes and forms; private bodies like ABET (ABET, 2016), public bodies like the Danish Accreditation agency (The Danish Accreditation Institution, 2016), bodies covering one country like (CTI, 2016) and bodies covering many countries like EURACE (ENAEE, 2016). All of these have their own accreditation system. For a description of accreditation systems see (Bennedsen, Clark, Rouvrais, & Schrey-Niemenmaa, 2015)

The accreditation systems of today are mostly inspired by quality models like EFQM (EFQM) or the Capability Maturity Model used for software development (Paulk, Curtis, Chrissis, & Weber, 1993) where the focus is on process maturity and continuous improvement rather than a measurement of the current status (although the evaluation of the current state is an important part of the quality process).

Boele at al. (Boele, Burgler, & Kuiper, 2008) describe the EFQM model like this:

> *The EFQM (European Foundation for Quality Management) model basically looks at an organization, its results, and the way the results lead to learning, improvement and innovation. It was developed for firms but can be applied to any kind of organization.*

An accreditation system typically consists of an assessment model, an assessment process and a measurement framework (Rouvrais & Lassudrie, 2014). The assessment process

describes how and when the assessment is done (how data is collected and validated and how the planning is done). The process focuses on the roles and responsibilities of the involved stakeholders, the inputs and the outputs. The assessment process is supported by an assessment model. The assessment model is based on a reference model that defines a set of best practices (or standards) related to the domain that needs to be assessed. It is measurement against these standards that is important as this is then the basis for improving quality. The measurement framework defines the maturity levels to be considered and contains a set of assessment indicators which support the ratings against the various standards. The CDIO rubric is therefore NOT an accreditation system; we have only described the measurement framework and that even without a set of indicators that could be used to indicate on what level a given programme/institutions is with respect to a given standard.

We have chosen NOT to include these elements since the rubric's main purpose is for internal use. It is therefore not important that it is reliable (i.e. that the rubric gives the same score when applied by different individuals on the same programme and/or that it is possible to compare self-evaluations from different institutions)

THE METHOD, MATERIAL AND DATA OF UPDATING THE RUBRIC

The process for updating the rubric has had several cycles. At the beginning the authors were discussing about CDIO self-evaluation and compared their experiences in using CDIO standards for self-evaluation. It became obvious that CDIO standards with the rubrics were in active use in the authors' universities, but we all had noticed some challenges with the exact definition of the rubric levels, usability of the rubrics as well as the coherence of the rubrics. The discussion started a development process where each of the authors worked with four standards and produced a new proposal of those rubrics. The standards were then cross-checked and at the end first modified version of the rubrics was published in CDIO conference in Barcelona (Bennedsen, Georgsson & Kontio, 2014). The feedback received in Barcelona showed that rubrics still need modifications and especially opinions from other CDIO collaborators were hoped. We ourselves shared this opinion and wanted to get feedback from the CDIO community. The CDIO council asked the authors to continue this development work aiming at new version of CDIO rubrics to the 12 standards. The goal was set to produce CDIO standards with rubrics v. 2.1.

The next development cycle started with the aim of getting feedback in a more systematic way. We wanted to evaluate the proposed improvements and modifications among the other CDIO members. We wanted 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 had two phases: a web questionnaire and short semi-structured interviews with selected CDIO collaborators. The web questionnaire was sent to all CDIO collaborators representing the CDIO member universities at the end of 2014. In addition, more detailed comments were acquired with a short semi-structured interview with selected CDIO collaborators and a session at the 2014 fall meeting with experienced CDIO members. Based on the feedback an improved version of CDIO rubrics was presented and processed in a workshop during the CDIO conference in Chengdu 2015 (Georgsson, Kontio & Bennedssen, 2015). The workshop in Chengdu once more processed, checked and provided input for final improvements.

The third development cycle used the results of the Chengdu workshop and tuned the final nuances of the rubrics. The final version of the rubrics was presented in CDIO council meeting in Belfast 2015. The proposed changes were accepted as presented in this paper. The whole process of rubrics development is shown in Figure 3.

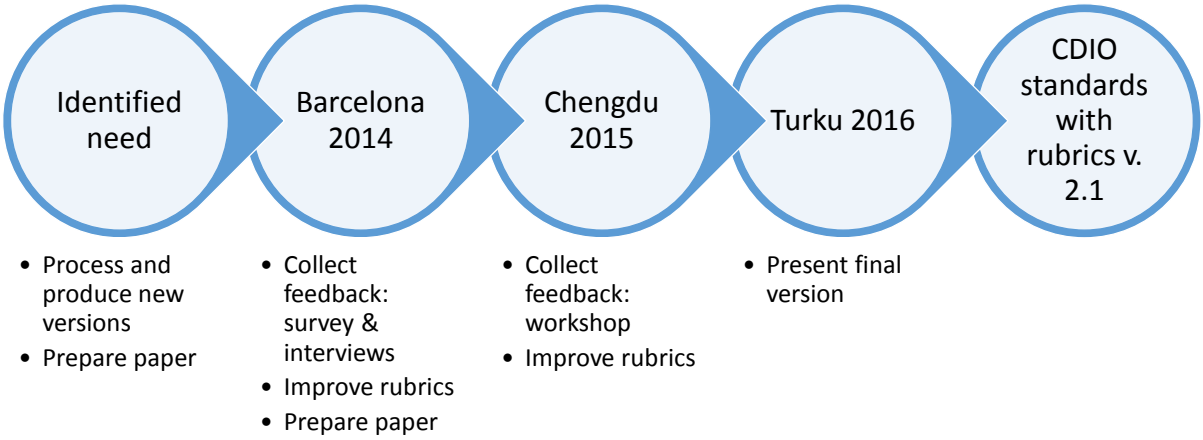

Figure 3. Overall process of rubrics development.

CONCLUSION

Based on the rubrics development the overall change process within CDIO-framework can be generalized into following:

1. Have an idea on what to change
2. Find others that are willing to discuss it
3. Inform the council about the wish to change
4. Perform an analysis – that is analyze current presentation based on theory, existing documents etc.
5. Conduct a survey or in some other way collect the opinion of the CDIO-members
6. Document including analysis and proposed changes, normally together with additional CDIO collaborators that want to contribute. The style of the paper should be to clearly compare what exist to what is proposed and for every change clearly justify why it is proposed.
7. Present at CDIO conference, preferably in workshop-format where you collect feedback on proposed changes in a structured comparative way.
8. Revise suggestion based on feedback and present to the council.
9. Once the change is accepted by the council, report the final version at a CDIO-world conference.

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BIOGRAPHICAL INFORMATION

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