THE ROLE OF PEERS IN THE ASSESMENT OF STUDENTS' CDIO SKILLS

Ivan D'haese

University College Ghent, Service for Educational Development

Johan D'heer

University College Ghent, Faculty of Applied Engineering Sciences

ABSTRACT

At the University College Ghent, staff has gained expertise in peer assessment strategies for formative and summative assessment. Recently also online facilities have become available within the electronic learning platform, enabling flexible schemes in the use of peer assessment such as use of qualitative or quantitative scales, variable group size, variable assessment criteria, …. In the Faculty of Applied Engineering Sciences as well as in the Faculty of Technology peer assessment has mainly been practiced in the framework of design-implement projects. As reflected in the pilot survey, staff and students perceive peer assessment as a valuable manner to evaluate group dynamics, personal and interpersonal skills and to extend the evaluation process from "product" to "process". Some kinds of peer assessment appear to be an effective way in the acquirement of CDIO skills. The paper concludes with some guidelines for practitioners preparing to make use of peer assessment.

KEYWORDS

Online peer assessment, design-implement, student perceptions, coaches,

INTRODUCTION

In order to comply with the CDIO concepts and standards, the Faculty of Applied Engineering Sciences as well as in the Faculty of Technology redesigned their curricula, introducing design-implement projects from the first year onwards and introducing gradually all of the 12 CDIO-standard.

Together with the introduction of these new learning experiences, new assessment techniques needed to be implemented in alignment with these educational practice. It was opted to enrich the more traditional assessment methods with peer assessment. As found in many studies [1], peer assessment can be a valuable assessment practice in higher education although also problems occur, which can be prevented by combining peer assessment with self- assessment or co-assessment. Furthermore the CDIO vision includes the practice of a whole range of assessment methods that should be aligned with the specific teaching and learning outcomes [2].

Gaining expertise with peer assessment enabled the teaching staff to fine-tune their practice and to develop an appropriate online tool for peer assessment compatible with the Dokeos open source electronic learning environment.

IMPLEMENTATION OF PEER ASSESSMENT

The peer assessment experiences discussed in this paper include the practice linked to design-implement projects as implemented in the Faculty of Applied Engineering Sciences and the Faculty of Technology. In all the concerned curricula, peer assessment is conducted with the same online tool which has been integrated into the electronic learning platform. Although the assessment criteria may vary, the practice is based on the challenge to individualize group marks obtained for group work performances such as design-implement project and to include group process issues into the marking.

CDIO Students' Skills

The peer assessment mainly involves personal and interpersonal skills. This is related to standard 5, 7 and 11 of the CDIO syllabus [2], [3]. Standard 5 (design-implement experiences) offers a framework for acquiring these kind of skills. Standard 7 (integrated learning experiences) focuses on the integration of a range of skills including personal and interpersonal skills such as ability to work in team, communication skills, leadership, etc., while standard 11 (learning assessment) deals with assessment methods matched appropriately to all learning outcomes. The criteria assessed by the students in our peer assessment method include participation, collaboration, communication and problem-solving issues. The assessment criteria are shown more in detail in Table 1.

Table 1: Criteria used for peer assessment

Is alert , participates in the reasoning process, follows the train of thoughts, is task oriented
Takes initiative, is willing to engage in tasks
Is well prepared for meetings, contributes with useful information
Structures his/her information and gives a neatly arranged summary
Adds new ideas to the discussion
Has a critical attitude
Shows constructive engagement in problem solving, proposes appropriate solutions, is willing to accept compromises
Gives own views
Listens to the others and makes efforts to understand them
Contributes to a positive group climate

These criteria are all linked to one or more of the fore-mentioned CDIO standards and have been proved useful in testing competencies related to functioning in a team.

Online tool

The online tool for peer assessment was first introduced at the University College Ghent in 2007. Until then, peer assessment had been done by letting the students fill in a test form and manually processing these data. The work involved and the rigidness of the paper form made it virtually impossible to continue with this form of assessment. The present online tool has been build-in into the electronic learning platform Dokeos and allows flexible use in terms of group size, number of groups, assessment criteria, etc. and guaranties anonymity. It also allows for imposing a time span in which filling in the electronic evaluation form is allowed. Figure 1 shows a screenshot of the peer assessment tool when it is used for the first time.

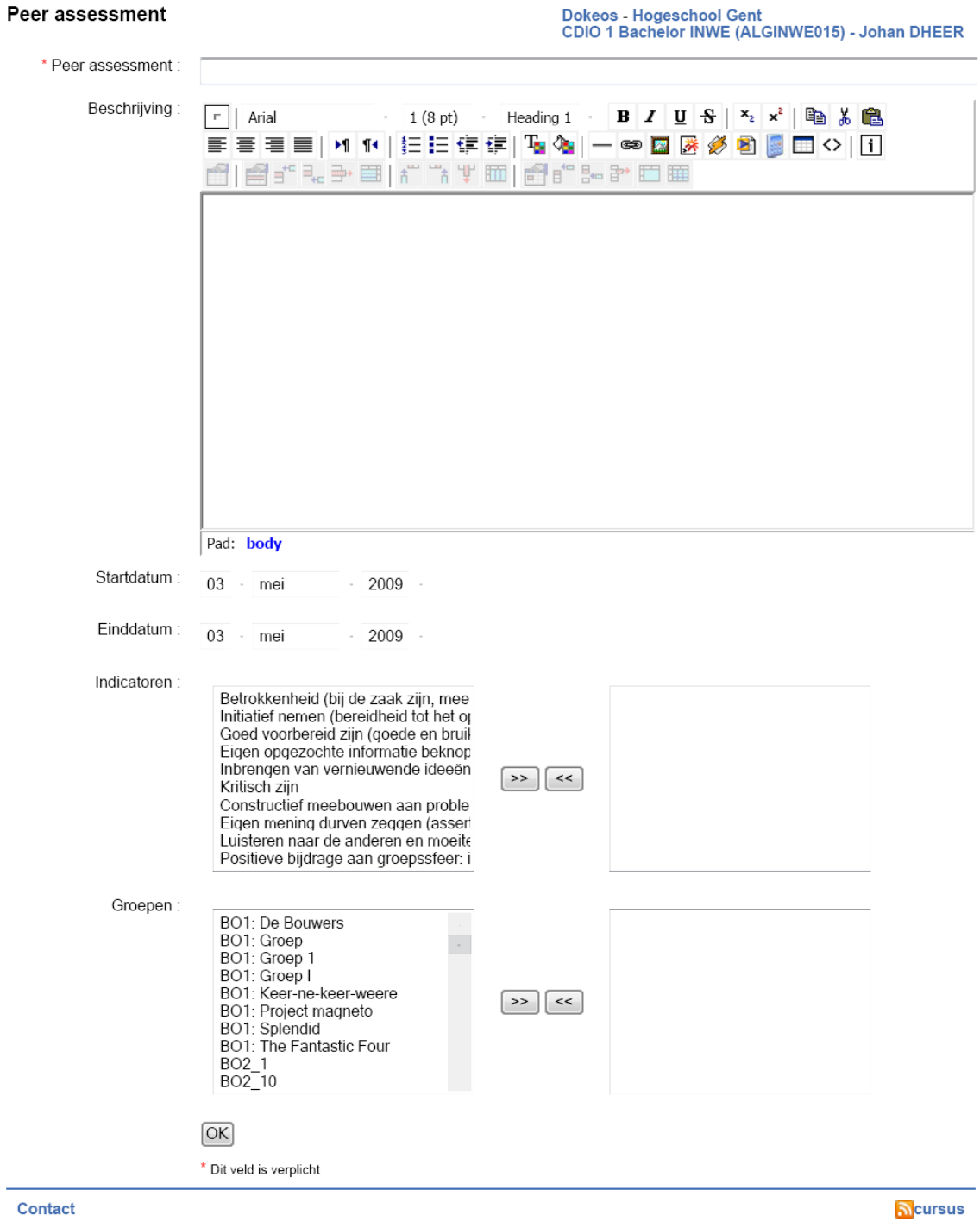

Figure 1. Preparing of a new peer assessment

The screenshot has been taken from the Dutch version of the online tool and illustrates the various options such as the possibility of creating multiple peer assessments with a short description (Peer assessment, Beschrijving), varying the start and end date (Startdatum, Einddatum) between which filling in the peer assessment is possible, the assessment criteria one can use (Indicatoren), the groups that can participate in the assessment (Groepen). The online tool allows also for the possibility of creating new assessment criteria and offers complete freedom in the composition of the various groups. The 5-point scale used for the criteria ranges from –1 (counterproductive) to +3 (better than rest of group), but is not fixed. Other scales can be easily introduced.

This tool has triggered the institutional wide use of peer assessment as it also substantially reduces the administrative workload compared to paper-based systems. This advantage of online peer assessment systems has also been reported in other research [4].

Case study

Students complete the online peer assessment form from their own computer any time between the fixed start and end date. Figure 2 shows a screenshot of the online form students have to complete when they start the assessment (student names are fictitious).

Peer assessment

Indicator	Bracke Frederik	De Backer Andy	De Cock Jorg	De Keulenaere Jelle
1. Enthousiasme en participatie	2	2	3	2
2. Ideeën aanbrengen	1	1	1	2
3. Begrip van wat verwacht wordt	1	1	2	1
4. Inhouden correct en duidelijk kunnen uitleggen	3	3	3	2
5. Bijdrage aan het functioneren als team	2	2	2	1
6. Groep organiseren en sturen	3	3	-1	1
7. Planmatig en doelgericht werken	1	1	2	2
8. Precisie en nauwkeurigheid	0	0	0	0
9. Respecteren van afspraken	2	2	3	3
10. Doorzettingsvermogen	2	2	2	2

Opslaan

Overzicht van de scores

- 3 : beter dan de rest van de groep
- 2 : gemiddeld van de groep
- 1 : niet zo goed als de rest van de groep
- 0 : geen hulp voor de groep
- -1 : hinder voor de groep

Figure 2. Start screen peer assessment (student view)

Column 1 (Indicator) shows the various criteria. Column 2 shows the self assessment marks, while in the following columns the marks given to the other team members.. The bottom of the screen shows the 5-point scale and its meaning. Multiple occurrences of the same score for a criterion are possible, but attributing the highest score to every team member results in a warning given by the online tool. Scores out of range of the scale are not accepted.

Once the assessment is completed, students can consult their scores via the same online tool. Figure 3 offers a typical screenshot of the scores of an arbitrary student. The second column shows the scores for the various criteria (column Indicator), while column 3 (Gemiddelde) shows the mean of the group. To diminish the effect of favour or dislike between students, a correction factor is applied to this mean, giving the corrected mean as shown in column 4 (Gemiddelde na correctie). The student also sees the comments (Commentaar) from his/her coach. The online tool guarantees anonymity and never shows scores of team members.

Peer assessment

Indicator	Bracke Frederik	Gemiddelde	Gemiddelde na correctie
1. Enthousiasme en participatie	2	2.33	2
2. Ideeën aanbrengen	1	1.33	1
3. Begrip van wat verwacht wordt	1	1.33	1
4. Inhouden correct en duidelijk kunnen uitleggen	3	2.67	3
5. Bijdrage aan het functioneren als team	2	1.67	2
6. Groep organiseren en sturen	3	1	0
7. Planmatig en doelgericht werken	1	1.67	2
8. Precisie en nauwkeurigheid	0	0	0
9. Respecteren van afspraken	2	2.67	3
10. Doorzettingsvermogen	2	2	2

Commentaar :

Je hebt jezelf goed ingeschat.

Je pluspunten : organisatie en sturing, respecteren van afspraken.

Verbeterpunt : precisie en nauwkeurigheid.

Overzicht van de scores

- 3 : beter dan de rest van de groep
- 2 : gemiddeld van de groep
- 1 : niet zo goed als de rest van de groep
- 0 : geen hulp voor de groep
- -1 : hinder voor de groep

Figure 3. Scores peer assessment (student view)

Coaches have access to all results, including individual scores given by all team members, allowing them to intervene if necessary and providing feedback to the team. Figure 4 offers a screenshot of the coaches' view of the scores for a particular student and his team members. Column (a) shows the scores of the student, column (b) shows the mean of the team, column (c) shows the individual scores of the other team members, column (d) shows the corrected mean, while column (e) shows the final scores of his fellow team members. The weight of the contribution of the student to the team result is measured by a peer assessment factor for the uncorrected scores (f) and for the corrected scores (g). The mark each particular student will get for his work is given by the product of his corrected peer assessment factor (g) and the corrected mean (column (d)) (here: 0.85 x 16.00 = 13.6).

Peer assessment

Student : Bracke Frederik

Peer assessment : Peerassessment1

Indicator	Bracke Frederik	Gemiddelde	De Backer Andy	De Cock Jorg	De Keulenaere Jelle	Gemiddelde na correctie	De Backer Andy	De Cock Jorg	De Keulenaere Jelle
1. Enthousiasme en participatie	2	2.33	2	3	2	2.00	2	-	2
2. Ideeën aanbrengen	1	1.33	1	1	2	1.00	1	1	-
3. Begrip van wat verwacht wordt	1	1.33	1	2	1	1.00	1	-	1
4. Inhouden correct en duidelijk kunnen uitleggen	3	2.67	3	3	2	3.00	3	3	-
5. Bijdrage aan het functioneren als team	2	1.67	2	2	1	2.00	2	2	-
6. Groep organiseren en sturen	3	1.00	3	-1	1	0.00	-	-	-
7. Planmatig en doelgericht werken	1	1.67	1	2	2	2.00	-	2	2
8. Precisie en nauwkeurigheid	0	0.00	0	0	0	0.00	0	0	0
9. Respecteren van afspraken	2	2.67	2	3	3	3.00	-	3	3
10. Doorzettingsvermogen	2	2.00	2	2	2	2.00	2	2	2
Totaal	17	16.67	17	17	16	16.00	11	13	10
		(a)	(b)	(c)		(d)		(e)	

Peer asessment factor : 0.83	(f)
Peer assessment factor na correctie : 0.85	(g)

Figure 4. Scores peer assessment (coach view)

STUDENTS' AND TEACHERS' PERCEPTION OF PEER ASSESSMENT.

Students as well as teachers may be more motivated to involve themselves in peer assessment when they have positive opinions on the advantages it can bring to the learning and/or assessment process [5].

Questionnaire

In order to get an idea on how students and teachers perceive peer assessment, a questionnaire adapted from a previous recent research [6] with 12 questions (Likert type 5 point scale) on advantages and disadvantages of peer assessment was administered to first year engineering students (n= 211) and their coaches (n= 9). The response was coded from 1 (strongly disagree) to 5 (strongly agree).

Findings

From our pilot study, we can draw the following conclusions:

- Students and coaches perceive peer assessment as an authentic evaluation method that closely parallels a possible career situation.
- Students and coaches agree that peer assessment encourages students to critically analyse work done by others.
- Students as well as coaches are worried friendships might influence the markings in peer assessment.
- Students find peer assessment helpful for clarifying assessment criteria, while coaches don't express a clear outspoken opinion about this.
- Coaches do think students have the necessary skills to evaluate each other. Students however are less convinced about their ability to do this.
- Coaches and students think peer assessment offers a wider range of feedback, i.e. more people and more criteria are involved in the marking compared to more traditional evaluation methods.
- Coaches feel strongly peer assessment is a way for students to learn from each other. Students agree but are less outspoken about this.

From these findings and from previous experiences with our form of peer assessment, we can formulate some guidelines for practitioners. These guidelines confirm those found in the literature [1] [7].

SOME GUIDELINES FOR PRACTITIONERS

- From our initial use of peer assessment in 2005 we find it should be combined with self-assessment and co-assessment. The results of self assessment disclose the functioning or malfunctioning of an individual in the group. It can also disclose the self perception from an individual group member about his functioning in the team. In this respect, the use of radar charts can be very illuminating. The outcomes of this self assessment should be in line with observations from the coaches and, if necessary, adjusted by them. This justifies the need for combining peer assessment with co-assessment.
- Some form of peer assessment training could be helpful. Determining the criteria jointly by staff and students could increase students' confidence in assessing their peers and themselves appropriately.
- The initial paper based peer assessment tool, introduced in 2005, used a 5-point "absolute" scale, without the possibility of giving negative scores. After examining the results of the peer assessment, coaches felt the need for the possibility of giving negative scores. From 2006 onwards, a 5-point "relative" scale, ranging from −1 to +3, was

introduced. In a relative scale, criteria are evaluated against the mean of the group. This scale is still in use, much to the satisfaction of coaches and students.

- When using peer assessment as part of the overall evaluation of design-implement experiences, it is important to find a balance between the score for the peer assessment and the scores obtained for other aspects such as finished product, oral presentations and written reports. When we started with design-implement experiences, the score for the peer assessment contributed for 40% of the total grade. Coaches felt to much weight was given to the peer assessment. Now this weight has been reduced to 20%. This enables us to make peer assessment more acceptable to sceptical coaches and still evaluate the functioning of students in a team.
- To reduce peer pressure it is strongly advised to ensure anonymity. This will help students to give honest markings to other members of their team.
- Explicitly inform students about the reasons for and the benefits of peer assessment. This helps to override the initial reluctance against this evaluation method.
- Avoid using paper based forms of peer assessment! Electronic forms reduce considerably the workload for coaches.

CONCLUSION

From our pilot study, we can conclude that coaches and students have a positive attitude towards peer assessment. This evaluation method adds a new dimension to the overall evaluation process by allowing for "process" evaluation through marking personal and interpersonal skills.

REFERENCES

[1] Dochy, F., Segers, M. and Sluijsmans, D., "The Use of Self-, Peer and Co-assessment in Higher Education: a Review", Studies in Higher Education, Vol. 24(3), 1999, pp 331-350.

[2] Crawley, E., Malmqvist J., Ostlund, S. and Brodeur, D, Rethinking Engineering Education. The CDIO approach. Springer Science + Business Media, New York, 2007.

[3] "The CDIO standards", link at website http://www.cdio.org.

[4] Li, A. and Steckelberg, A., "Perceptions of Web-mediated Peer Assessment", Academic Exchange Quarterly. Vol. 10(2), 2006, web version.

[5] Wen, M. L., and Tsai, C., "University students' perceptions and attitudes towards (online) peer assessment", Higher Education, Vol. 51, 2006, pp 27-44.

[6] Karaka, E., " An Evaluation of Teacher Trainees' Opinions of the Peer Assessment in Terms of some Variables", World Applied Sciences Journal, Vol. 6(1), 2009, pp 123-128.

[7] Raban, R., and Litchfield, A." Supporting peer assessment of individual contributions in groupwork", Australian Journal of Educational Technology, Vol. 23(1), 2007, pp 34-47.

Biographical Information

Ivan D'haese is an education development practitioner at the Service for Education Development at the University College Ghent, Belgium. His current work focuses on faculty development, learner-centered methodologies and ICT implementation in higher education. He is also regularly involved in educational programmes in the framework of development co-operation.

Johan D'heer is a Professor in Physics at the Faculty of Applied Engineering Sciences of the University College Ghent, Belgium. Apart from teaching the general physics courses to first and second year students, he organizes the design-implement experience for the first-year engineering students.. In 2008, he served as co-chair of the 4rd International CDIO Conference.

Corresponding author
Ivan D'haese
Hogeschool Gent
Cel Onderwijsontwikkeling
Kortrijksesteenweg 14
BE 9000 Gent, Belgium
ivan.dhaese@hogent.be