PEER FEEDBACK IN CDIO COURSES IN ORGANISATION AND LEADERSHIP

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ABSTRACT

Peer feedback is increasingly being used as an important part of higher education, as it has a potential to contribute to development of professional skills such as giving and receiving feedback while having the benefit of not overstretching the teacher resources. In this paper we share our experiences of working with peer feedback in a course on organisation and leadership with approximately 170 students given during the first year of a CDIO-based engineering program. We present and discuss the course design and how peer feedback was organized as well as the experiences of both teachers and students of this course. We observe that working with peer feedback has helped our students in achieving several important outcomes, for example increased learning within the subject, documented development of own writing and assessment skills, and increased awareness of different perspectives on the same topic. However, we also identify problematic aspects of working with peer feedback, such as a large variation in the quality of provided feedback, perceived difficulties when students are asked to provide non-anonymous feedback to their peers, and students' doubts whether peers can provide as "correct" feedback as the teacher would have been able to give. We discuss the benefits and downsides of peer feedback within the framework of CDIO-based engineering education and conclude by recommending that feedback-related skills should be trained and developed throughout educational programs in a gradual and integrated way.

KEYWORDS

Peer feedback, Course design, Skills development, Active learning, Standards: 8, 11

INTRODUCTION

Feedback on one's performances is central to any learning experience and can certainly be considered a cornerstone of CDIO-based engineering education. Our students expect and crave feedback on their assignments, and it seems they never can get enough of it. At the same time, providing feedback is time-consuming and resource-intensive, so as teachers we are left with difficult decisions regarding how to work with feedback within limited means. One possibility of extending the amount of feedback provided to our students is working with peer feedback where students themselves provide feedback to each other. However, this needs to be implemented in a carefully designed way and peer feedback activities need to be treated as learning experiences in their own right.

In this paper we will share our experiences of working with peer feedback during a large-scale course with approximately 170 students during the first year of a CDIO-based engineering program. The main topics of this course are organisation, motivation, and

leadership and besides these subjects a vital aspect of this course is development of skills such as analysing, critical reasoning, and written presentation. We have recently re-designed this course with inspiration from the work of Kristina Edström and Jakob Kuttenkeuler and their course development (c.f. Edström et al., 2005). Our new design entailed exchanging a previous group writing assignment stretched in time over an entire semester for several short individual writing assignments, ongoing for two-three weeks each where peer feedback was used as a vital part of every assignment.

THEORETICAL BACKGROUND

Peer feedback is increasingly being used as an important part of higher education, as it has a potential to address training & development of professional skills such as giving and receiving feedback while having the benefit of not overstretching the teacher resources (van den Berg et al., 2006 b). Within the CDIO framework peer feedback can be considered as a vital part of "Active Learning" – standard eight, while also being highly relevant for "Learning Assessment" – standard eleven (CDIO, 2016).

Previous studies of peer feedback in higher education suggest that learning activities that include peer feedback foster preparedness for working life insofar as they require the student to formulate feedback independently and accurately as well as to handle incoming feedback in a constructive manner (van den Berg et al., 2006 a). Engaging in peer feedback also creates an arena for reflecting upon and discussing each other's work, which is positive for the students' development and confidence (Topping, 1998). Studies also suggest that peer feedback might be equally good as or even better than teacher assessment (Topping, 1998) – perhaps due to a higher degree of carefulness that can be applied when the students work with feedback on a smaller number of texts as opposed to a teacher's workload. This has been noted by van den Berg and others (2006 b) as they observe that peer feedback means receiving more feedback sooner than when provided by a teacher.

However, others note that peer feedback can also lead to problems with varying quality of comments and suggestions received, differences in assessment between peers and teachers, as well as fear of being plagiarised by one's peers (Pearce et al., 2009). Problems can also arise with regards to different interpretations of the assessment rubrics as suggested by Boase-Jelinek et al (2013) that observed that even detailed explanations of the rubrics were not enough to eliminate misunderstandings between the teachers' intentions and students' interpretations. Furthermore, students can be confused when peer feedback generates contradictory suggestions, and can experience that they are not getting any valuable feedback on their work, while simultaneously doubting their own capability with regards to providing feedback to others (Sweetland Center for Writing, 2016).

Several authors have proposed specific methods of working with peer feedback that strive to address the potential problems that can arise. For example it is suggested that peer feedback should be organized in small groups of up to four students and that a combination of written feedback and a following face-to-face discussion leads to a more complete feedback (van den Berg et al., 2006 a). It has also been proposed that a structured review form can be useful for guiding towards specific aspects that the feedback should address (Pearce et al., 2009), preferably in the form of open-ended "how" and "why" questions (Sweetland Center for Writing, 2016).

The teacher's role in peer feedback learning activities

Organizing peer feedback activities means that the traditional role of the teacher shifts from lecturing and providing all the answers to facilitating students' own learning. Cooper (2002, p. 56) characterizes this as a "shift in focus from what is being taught to what is being learned". This should not be confused with a passive role of an observer, and initially often requires investing time and effort into making the transition (Finlay & Faulkner, 2005). In previous studies of peer feedback activities it has been observed that involved teachers sometimes experienced that their role was not clear enough and that teachers wished for more time and opportunity to provide students with support when giving feedback (van den Berg et al., 2006 a). The shift in focus implies concentrating on matters such as how to design the activities so that they are rewarding for students, how to explain what type of feedback the students should aim to provide, and how to create a safe atmosphere so that students are willing to share their own texts and their comments on texts written by others (van den Berg et al., 2006 b). It should also be noted that the surrounding academic leadership at the departmental level and collegial support impacts how active learning and activities such as peer feedback can be implemented and what outcomes can be achieved. The teachers' approach to teaching and learning in turn impacts how the students view their studies and their own roles (Ramsden et al., 2007).

Relation between teacher and students in peer feedback learning activities

The students' learning outcomes are dependent on their own conceptions of learning and their approach to learning as well as their perception of the learning environment (Trigwell et al., 1999). Additionally, it has been shown that the teachers' own approach to teaching is correlated to whether the students adopt a surface or a deep learning attitude towards learning in specific contexts where the teacher is involved. For example, an "information transmission" approach of a teacher is related to surface learning approach of students while a "student centred" approach is related to more engagement and deeper learning (Trigwell et al., 1999). Peer feedback activities can be considered as one possible way towards transforming the roles of teachers and students and how they are supposed to relate to each other (van den Berg et al., 2006 b).

METHOD

Experiences from working with peer feedback that are presented in the next section are derived from a course given at Linköping University during Spring 2016. The pedagogical development of the course has been supported by a small grant from the Institute of Technology at Linköping University. The teacher team consisted of the two writers of this paper and one more teacher. Teachers' experiences have been recorded in writing during the course and shared and reflected upon during meetings continuously throughout the course. The students' views have been collected through anonymous questionnaires four times during the course and have formed an important input into the teachers' discussions and continuous improvement of the course design. During several of the teacher meetings an external discussion partner from the university pedagogical center Didacticum has participated and provided valuable input.

Students' views on peer feedback that are presented below have been collected during the last activity of the course, after the last assignment was completed. 78 students participated

in this activity and all of them answered our open-ended questionnaire about the course design. The following questions were asked:

- What has been the most positive with the course design?
- What can be improved?

The questions were open-ended without any given keywords or alternatives to choose between. The responses were categorized by the course teachers. Of the 78 respondents 38 students spontaneously mentioned peer feedback in their answers. Half of the students who mentioned peer feedback were critical of the peer feedback "elements" in the course and the second half was positive or expressed both positive and negative attitudes.

RESULTS

The design of peer feedback activities and teachers' experiences

During the course students worked on five assignments, the first being a visualisation of own time planning with regards to the course activities in a Gantt chart and the other four being short texts (1-3 pages) on given topics. For each of the four writing assignments the students received feedback in three ways, see Figure 1. Firstly, each student received extensive written peer feedback from a few of their classmates; secondly, assignment texts were awarded points by the teachers (0 points for incomplete submission, 1 point for "good enough" text, 2 points for excellent text); and thirdly, the teachers provided group feedback where we pointed out common problems in the texts and displayed good examples.
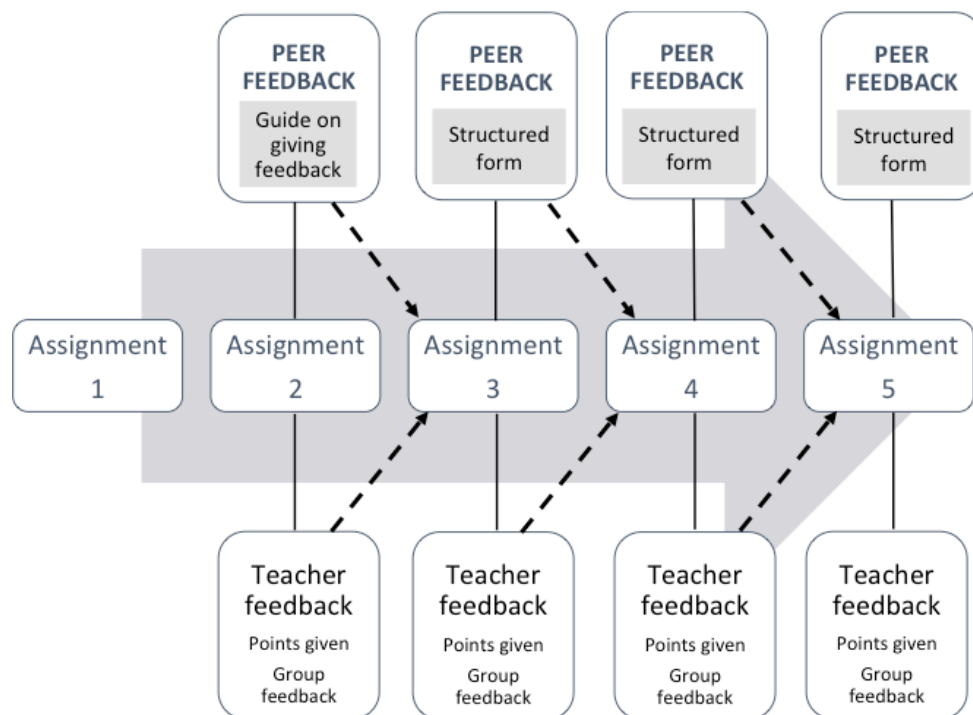

Figure 1. The structure of course assignments and feedback.

Peer feedback was given during four separate classroom sessions, lasting for 90 minutes each, one for each writing assignment. The participation in these sessions was voluntary and active participation added credits to the total for the course segment. In order to pass the segment a fixed amount of credits was required meaning that collecting a lot of credits in the beginning of the course lead to a quicker completion of this segment.

Each student was required to bring a printout of his or her text for the current assignment to the feedback session. The texts were collected by the teacher in the beginning of the session and distributed randomly to peers. Approximately 15-25 students participated in each single session (the 170 course participants were divided into several classes). Thereafter time was given to read and give written feedback. Each student was given at least two different texts and consequently received feedback from at least two peers. When giving feedback the identities of the reader and the writer were known to both. In the end of the session each student was given their own text and written peer feedback from all readers and time was allowed for reading and reflecting upon the received comments as well as documenting received feedback by taking a photo. Both the text and the feedback were then returned to the teacher in order to be graded (the text for the assignment could receive 0, 1 or 2 points and this grading was done solely by the teachers). Finally the students filled out a questionnaire in the end of each feedback session with questions concerning learning from writing as well as from giving and receiving feedback on the current assignment.

Since every text was supposed to be in its final version at the feedback session it was important that the peer feedback focused on aspects that could be applied to forthcoming assignments as well as future writing in general. In the beginning of the first feedback session a guide on giving feedback was distributed to the students, specifying among other things the questions that peers should address in their feedback, e.g. how easy it is to follow the reasoning in the text. We noticed that having this guide was not supportive enough and that most students did not address all the questions given in the guide. They focused instead on minor details that were instantly recognizable such as spelling errors. After the first session we discussed this during a teachers' meeting and consulted the literature. We decided to provide students during the following feedback sessions with structured forms with specified areas on which feedback was supposed to be given. This was much appreciated by the students and steered them towards providing more comprehensive and nuanced feedback. However, we still experienced problems related to differences in interpretation of feedback criteria/assessment rubrics and we found it challenging to explain all criteria that we encouraged the students to apply.

We also experienced that most students were positive towards peer feedback in the beginning during the first assignments but became more negative towards the end of the course. Moreover, we experienced that many students found it problematic to give accurate feedback without being anonymous – they told us that they tended to hold back on their criticism when it was known who gave feedback to whom. As future leaders and engineers it is important to be able to deliver feedback in a professional and open manner so we decided we would not make peer feedback anonymous, and instead explained the significance of providing feedback as a professional skill.

Students' views on the peer feedback activities

As mentioned above, approximately half of the students who spontaneously mentioned peer feedback in the final questionnaire were critical and half of the students were positive or

expressed a mix of both positive and negative attitudes towards peer feedback within the course. Among the positive responses we noted that several students perceived that working with peer feedback increased their learning. For example they reported that they learned how to give feedback and became better at it throughout the course and they also appreciated the practice. See table 1 where students' positive comments about peer feedback from our questionnaire are summarized.

Table 1. Positive attitudes towards peer feedback in course design questionnaire

Giving feedback to others	Receiving feedback on own text
Development • Educational, learned how to give feedback • Being able to practice giving feedback was good • Rewarding to provide feedback to others • Became better at giving feedback **Benchmarking** • Insight into someone else's thoughts • Seeing several ways to write the same assignment • Reading about how others interpret concepts/theories • Broader perspective when you read others' texts • Get several perspectives • Fun to read others' texts	• Positive to get comments continually • Useful to receive feedback • Feedback has stimulated development • Receiving feedback has been fun • Several opportunities to get feedback and learn • Improved my general way of working

Several students also appreciated the benchmarking aspect of reading other students' texts. They got insight into other students' ideas; they saw several different ways to write and how others comprehended concepts and theories. They also got a broader perspective on the topics covered by the assignments through reading other students' texts. Peer feedback, criticism and comments were perceived by several respondents as fruitful, useful and stimulating and inspired the students to improve their way of working. The quotation below illustrates this:

> *"Above all, the peer feedback sessions have been very rewarding. Both to read others and reflect on what could have been done better, but also to get feedback directly on own texts from people who are in the same position as you. This gives you a direct and good understanding of what you, by yourself, think is a good text."*

Half of the students that spontaneously mentioned peer feedback in their answers did not discuss the opportunities described above at all, instead they only reported on the downsides of peer feedback. They suggested that they would rather receive more feedback from teachers, that the peers could be too inexperienced to give feedback, and they were critical to the feedback system and the overall way of working, see table 2.

Table 2. Negative attitudes towards peer feedback in course design questionnaire

Other students' feedback perceived as not useful	Prefer more feedback from the teacher	Way of working
• Many peers are not good at giving feedback • Maybe the feedback I receive is wrong • Since my peers have the same knowledge the feedback I get from them is useless • I get nothing from the feedback provided by peers • Difficult to know what I should improve in my writing • The feedback I received was not always "correct" • I don't know if I can trust peer feedback since the subject is new for us	• More clear feedback from the teachers • Would like to know from the teacher what is missing for the excellent level • Teacher feedback is needed in order to learn from own mistakes • More comments on my text from teachers • The teacher should tell me what I have done well and what was less good. I have no idea what I could have done differently in order to write a better text • I would like to receive feedback along with the grade on the assignment • A grade is not enough assessment from the teacher • The person giving the text the grade should provide feedback • Teacher feedback is interesting when a text can get different grades • Even short individual feedback from teachers would have been rewarding	• I need to know how important each part of the text should be, would like more introduction to the disposition of the texts at the beginning of the course • Would like to be able to take home a corrected version of my text • I didn't take the course design seriously since I perceived the setup as unserious • Possibility to receive extra credits for the final exam would give me more motivation • When I read others' texts I don't know if the text is good or bad and may draw the wrong conclusions. I would rather first read the teacher's feedback and then give my own

According to the negative student comments, the students perceived that they did not get the "correct" peer feedback, and they could not trust the feedback they received, therefore they felt that they did not know what to improve in their texts, especially when aiming for higher points. The following two quotations illustrate this further:

"I would have appreciated some comments from the professor so that I would know if I was close to fail or to excellent level. The other students possess same knowledge and the feedback thus becomes quite useless."

"If I had received feedback from the teacher I would have improved myself from good enough level to the excellent level."

CONCLUSIONS AND DISCUSSION

Overall we have experienced that this course design has helped our students in achieving several important outcomes, namely increased learning within the subject, documented development of own writing and assessment skills, and getting to know different perspectives on every assignment through reading several texts written by peers. Furthermore, students

have gained insight into how difficult and time-consuming it can be to give feedback to others. Through the course design the students have also started to develop a familiarity with sharing their work and their opinions of others' work among peers – something that will be essential in their further education and later on in their professional development.

Some of the challenges we discovered during the course presented here included difficulties with giving peer feedback when supported only by guidelines and questions provided by us. This was addressed through development of "feedback forms" that gave more structure to the peer feedback. The inspiration for this came through reading up on previous studies on peer feedback and the positive outcome has encouraged us to try out other ideas provided in the literature in the future, e.g. combining written and oral feedback during a feedback session.

The large variation in quality of feedback provided by peers was experienced as problematic, both by the students themselves and by us teachers. However, we noticed that students that were given the peer feedback task as "homework" instead of performing it in the classroom in most cases managed to produce feedback of higher quality. This implies that more time and possibility to work in a more comfortable setting can lead to improvements in the overall quality of peer feedback. Literature also suggests working with calibration exercises in order to address feedback quality issues, e.g. reading and giving feedback on the same text initially and comparing and discussing the results with the students as a way of clarifying how feedback can be provided. This could also prove supportive for critical evaluation of own texts. As seen in Table 2 some students expressed that it was difficult for them to know what was good and what could be improved within their own texts which signals problems with self-assessment. Nonetheless, some degree of variation is a normal part of working with feedback and should be expected; this could be better explained to the students during the course along with a discussion on subjective and objective aspects of feedback.

We were surprised by the strong preference for anonymous feedback from several students. Their argument was that anonymity allowed for more honest feedback. We are convinced that non-anonymous feedback is preferable from a learning and skill development standpoint. However, the students' requests for anonymity could be interpreted as a symptom of not feeling safe enough within their class, a problem that is indicated in the literature and that could be addressed in other ways by us teachers. Another aspect that surprised us was that feedback provided by the teachers through awarded points for each text, along with group feedback that identified common problems in students' texts and displayed good examples, was by many perceived as not enough. The system with 0 points (signifying fail); 1 point (signifying good enough); and 2 points (signifying excellent) for each text was by our students perceived more as a source of frustration than of valuable feedback. During the next edition of this course (given in Spring 2017) we have opted for limiting the grade scale to only the grades pass or fail on each text and we will be working with development of our communication regarding how our feedback relates to the individual students.

Working with peer feedback and active learning definitely strikes at the core of the various roles of teachers and students in higher education as discussed in the theoretical background. The attitudes of students presented in Table 1 and 2 can be related to how the students perceive their own and their teachers' roles in the learning process. Some of our students seem to view the teacher as the "oracle" that should be the one providing all the answers. Since the teacher is the one awarding points only the feedback from the teacher is perceived as potentially useful by these students. Other students instead perceive peer feedback as useful and appreciate being given the opportunity to reflect upon the work of

others and to express their opinions to their peers without being supervised or corrected by the teachers. Attitudes and expectations with regard to teachers' and students' roles can certainly be influenced during one course but they are also shaped by all the other educational experiences an individual goes through. Therefore the context of the educational program should be considered and to the highest degree possible aligned around common goals with regard to the approach to learning, as well as development of knowledge and of professional skills.

In conclusion we propose that both giving feedback and receiving/making use of feedback are vital skills that increase capability for learning and are required in virtually any future professional role. Development of these skills needs to be supported, as many students consider peer feedback to be difficult and many lack the confidence in both their own and their peers' abilities to give feedback. We recommend that feedback-related skills should be trained and developed within CDIO-based education in a gradual and integrated way.

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