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PEER REVIEW IN A PRODUCT DEVELOPMENT COURSE – IMPLEMENTATION AND RECEPTION

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ABSTRACT

The use of peer review as a teaching and learning activity has gained lot of ground during the last decade. Effective peer response is characterized by students' engagement and gives students the chance to practice both their ability to review by reading and commenting on other students' work and to receive and address feedback from others. There is also a driver that using peer reviews can separate formative and summative feedback and make the feedback loop quicker.

In this paper we describe the introduction and implementation of a particular peer review intervention involving peer review from many students in a project-based product development course taught in the second year at a five-year mechanical engineering programme at Chalmers University of Technology. To find out how the students' perceived the peer review activity, a student survey and in-depth interviews with students as well as interviews with supervisors were performed. Overall, the response from the students is positive and more so when a year passed compared to the ones who just completed the course. The few negative aspects are things to improve rather than discarding the method. The supervisors' response is likewise positive and highlights the additional skills developed by the students, such as critical thinking, resulting in a more effective learning environment.

The conclusion is that the peer review in this course benefits students as well as the supervisors. It gives quicker response form more participants. The grades in the course, which are based on a combination of a grade from the group project work and an individual grade based on their peer review, became fairer after implementing peer review.

KEYWORDS

Peer review, supervisors, Group work, Project Work, Assessment, CDIO Standards: 8, 11.

INTRODUCTION

The issue of feedback has been highly debated within higher education in the last decade. The debate emanates from various stakeholders withing higher education, for instance student complaints about the lack of feedback, instructor concerns about providing feedback to increasing numbers of students and general concerns about when and how feedback is given to students. The discussions have involved general perspectives on teaching and learning in higher education (e.g. Nicol et. al., 2014; Boud & Molloy, 2013; Carless, 2016) but also more specific aspects of feedback, such as written feedback for the purpose of language learning (Bitchener & Storch, 2016). Studies have also addressed the roles and activities of students and instructors in feedback processes. Cho et. al. (2006) were particularly interested in student roles and the potential of student evaluations by comparing evaluations of writing assignments made by instructors as well by randomly selected groups of students. The authors found that ratings of assignments made by at least four students or peers within a course were both as reliable and valid as instructor evaluations. It is important to note that the focus of the study was on evaluation rather than feedback and learning, but the study still indicates the potential of using multiple peers for feedback purposes.

The interest in student peer review has also grown as studies indicate that students learn not only from receiving feedback but also from giving feedback (Cho & Cho, 2011; Lundstrom & Baker, 2009). The activity of reading someone else's paper about a topic that one is involved with makes the reviewers reflect on their own writing and the content of their own paper. It has also been argued that the ability to give high quality feedback is an essential skill for students graduating from higher education (Nicol et. al., 2014). Research has however also shown that certain circumstances need to be fulfilled for student review process to be effective. First of all, students need to be introduced to and trained in giving feedback (Nicol, et. al., 2014, Lundstrom & Baker, 2009). Secondly, feedback needs to be followed by student activity and engagement (Boud & Molloy, 2013). Simply telling someone or being told by something that something needs to be revised is not enough. It needs to be followed up by revision, and ideally careful revision that does not only involve changing simple surface errors. In the words of Boud & Molloy (2013, p. 702), feedback is within such a perspective on feedback understood as "information used, rather than information transmitted".

Peer feedback comes with a number of challenges. The first, and principle one, is if the peers have enough competence to give effective and accurate feedback. In addition, there are challenges connected to how peer feedback should be organised, if it is fair, if the students wil take it seriously, and what the role of the tutor or instructor should be. This paper focuses on students' perception of the introduction of student peer reviewing in a project course in product development and how the reviewing affected the project.

Integrated Construction and Manufacturing is a project course for students in their second year of study, where the students get to work with problems that companies hand out to them. The companies have the role of an external stakeholder and the students find themselves in a consultancy role. The course aims to give the students a deeper experience of modern ways of working as an engineer and develop skills in product development at the same time as they learn leadership. In the course, problem solving, and analytic knowledge are required by the students. These skills are developed from courses taken during the first two years of study, and include mechanics, strength theory, material science, machine elements and manufacturing technology and are to be applied in as realistic scenarios as possible, in order to prepare students for the future work life. The skills include abilities to work in groups and be able to share ideas and solutions without being defensive. The course has been a mandatory

course during the second year of the 5 years M.Sc. program (civilingenjör) within Mechanical Engineering at Chalmers University of Technology for over 15 years. Within a course that has been given for many years, there are always elements that are working well, but also challenges, discovered with course evaluation, that needs to be elaborated.

One of the challenges that has been discovered is that different supervisors give different feedback which, in some cases, can be unfair. Another challenge was that the individual assessments of each group member was based solely on one supervisor's observation. This made it difficult to know if a group member had knowledge in the course, especially since the students in groups often tended to cover up for each other if no major conflict was revealed. A third challenge was that the course is given in Swedish, and the students work is written in Swedish while some of the supervisors are international. This made it difficult for these supervisors to give feedback on the technical style, grammar and so on and therefore students had a harder time improve their writing.

To address these problems and to strengthen students' understanding of central concepts and processes in the course, peer review was introduced as a central component in the course. The rationale of the design is based very much on student activity and student engagement, and an attempt at using multiple rather than single reviews, following the work by Cho, et. al., (2006).

We use the term peer review rather than peer response, even though peer review is easily confused with peer review connected with academic publication processes. Peer response is in many ways a better term, but we use peer review as we approach on (Nicol, et. al., 2014, p. 103) definition of peer review: "Peer review is defined here as an arrangement whereby students evaluate and make judgements about the work of their peers and construct a written feedback commentary. In effect, students both produce feedback reviews on others' work and receive feedback reviews on their own work".

In this paper a detailed description of the integration of peer reviews and its contribution to addressing the challenges above is studied. Interviews and surveys are used to get students' impression of peer reviews, but also supervisor interviews to get their observations.

Aims of the study

The aim of this study is to evaluate if peer review improved any of the challenges and how it affected the students and supervisors. The following questions framed the study:

1) What are the students' general perception on peer review in the course Integrated Construction and Manufacturing?
2) Are the individual assessments of each group members knowledge more accurate when using peer review as an examining part?
3) How does the integration of peer review affect the students' writing processes?
4) How does the supervisor perceive the integration of peer reviews and its effect on student texts?

METHODOLOGY OF IMPLEMENTING PEER REVIEWS IN THE COURSE

Active learning, such as peer review, is a part of the CDIO (Conceive-Design-Implement-Operate) standards. “Teaching and learning based on active and experiential learning methods.” (Standard 8, CDIO). Design-implement courses is one kind of course where active learning is considered as an experiential learning method that gives the students a chance to simulate professional engineering practice. *´The CDIO approach to engineering education'* was a project at Chalmers during the beginning of the 21st century. Johan Malmqvist (project leader), Mikael Enelund and Stig Larsson research, Integration of Computational Mathematics Education in the Mechanical Engineering Curriculum (2011) has shown that CDIO-approach have been beneficial when designing and reforming the education in the MSc program in mechanical engineering at Chalmers.

Integrated Construction and Manufacturing is a 7,5 credits course, with approximately 160 students, during the second year of Mechanical Engineering at Chalmers University of Technology. The course runs during an entire semester parallel with other courses and the students are supposed to spend ten hours a week on this course. The students are divided into about 30 randomized groups of five group members, and have a supervisor who is responsible for about six groups in total. The groups with the same supervisor get the same problem. The case problems that are handed out from companies are different every year. For example, one problem could be to find a product to keep a patient warm during surgery or design an ergonomic knife handle. Each year there are new, unique problems for the students to solve and if a company finds the product satisfying, they might launch it.

Before 2020, while working in terms of engineering with the problem the students also documented their work in form of a number of written sub-assignments and one final report. Each sub-assignment was handed in to the supervisors who gave detailed feedback on the work and then the students had the opportunity to hand in a revised version for grading by the same supervisor. The feedback from the supervisors were not always detailed enough to be productive and helpful for the students.

In 2020, peer reviews became a part of the course and the students started to give each other feedback on their work, instead of the supervisors giving feedback, before handing in a revised version. Reviews were given on each sub-assignment. The peer review system for this course was designed so that each group member reads, and gives feedback, on one report from another random group, and their own report is reviewed by five other students in turn. In other words, the students are influenced by ten other reports and points of views in their group. The assigned report is randomized each time. The students had up to three hours for each peer review and were told to focus on the content. Things like grammar, word choice and spelling were encouraged to review as well, although it would not merit a higher assessment than focusing on content.

To make sure that the student took the peer reviewing process seriously, the peer reviews were each graded from 0 to 2 points and counted towards the final grade. The final grade is a combination of the grade from the group work and the individual grade from peer review, which is shown in Figure 1. If a group would get a high grade, but one student in that group received a lower grade on their peer reviews, that student’s final grade would be lower than the group grade. If a student would get a higher grade on their peer reviews than on their group grade, that student’s final grade would be higher than the group grade. This system is used to keep up the motivation for the peer reviews as well as to ensure the individual

assessment of each student. If the written reviews were not graded there is a chance that the student would not make an effort while writing it.

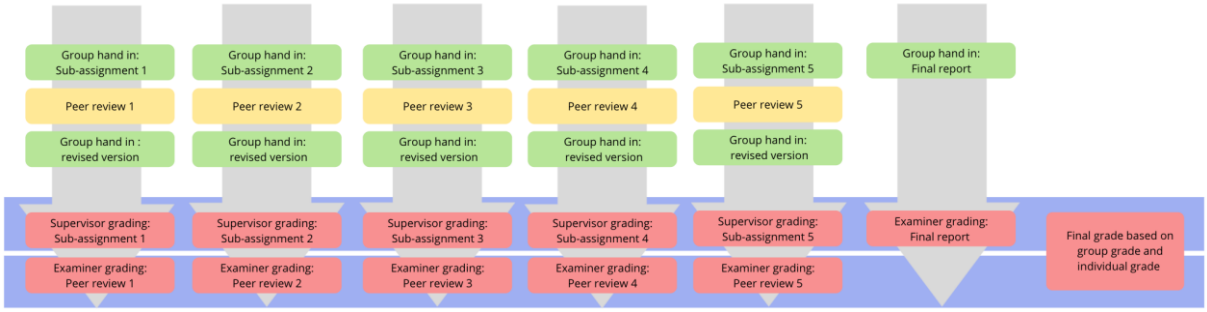

Figure 1: Grading structure in the course

METHOD FOR EVALUATION OF PEER REVIEWS

To do this analysis, student-survey and interviewing were used. The target of the analysis was the two classes from 2020 and 2021, who had taken the course during the time peer reviews has been implemented, and the supervisors who were involved during and after the transition. The analysis was decided to be executed after the course, to be able to use both student classes from 2020 and 2021, to have the opportunity for an evaluative study. It must however be recognized that the students in 2020 had the course a year ago and might not have been able to recollect the course accurately, on the other hand, some affection frustration from the course might have settled. Also, since they have completed their bachelor thesis project it might warrant a different perspective on peer reviews.

Method I: Student Survey

Firstly, it was necessary to get the overall student opinion of peer reviews, the course and to what extent the peer reviews contributed to the project or assignments. This was done with two questionnaires or surveys; each questionnaire was sent to the two groups. The first group was second year students who took the course in 2021 and the other third-year students who took the course in 2020. The survey was based around general questions such as advantages and disadvantages, and their thoughts on having peer reviews as a graded requirement. The survey was anonymous to make sure every student who answered it would feel fully comfortable expressing their opinion. The survey was sent out to 200 students and answered by 57 and was equal distributed between the two years. The questions asked in the survey can be found in Appendix A.

Method II: Student Interviews

The student interviews were done to get more in-depth responses and to be able to ask follow-up questions. It was agreed to keep the students anonymous. The selection process was based upon the student project groups to make sure there were not students from the same group since they would have received the same response. The number of students were narrowed down to seven from each class, 14 in total. The questions asked were the same for all with some follow up or clarification questions and can be found in Appendix B.

Method III: Supervisor Interviews

Because peer review was introduced recently it was interesting to investigate how this affected the students' text from a supervisor's perspective since they work closely with the students with weekly follow-ups. To receive this perspective, interviews were conducted with five supervisors; two supervisors who had been working with the program for over two years and therefore been in the course during the implementation of peer reviews, and three supervisors who started this or last year were interviewed. The focus was to see if the students improved by having peer reviews compared to getting feedback from the supervisors. The questions that all interviews were based on can be found in Appendix C.

RESULTS

Result I: Student survey

The survey showed that the overall impression (Figure 2a) of peer review was good and got an average mark of 3.81 out of 5. In Figure 2b, it can be seen that generally, students were happier about receiving peer review (4,0 out of 5), than giving response to other (3,3 out of 5).

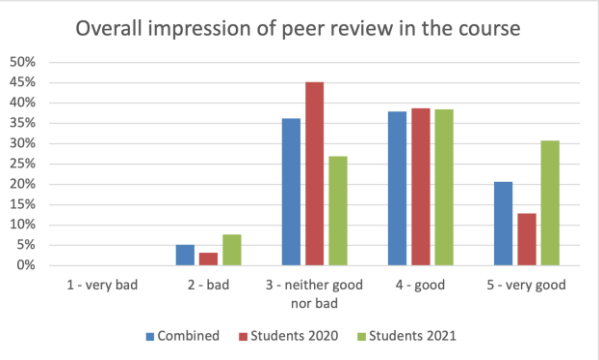

Figure 2a. Overall impression of peer review

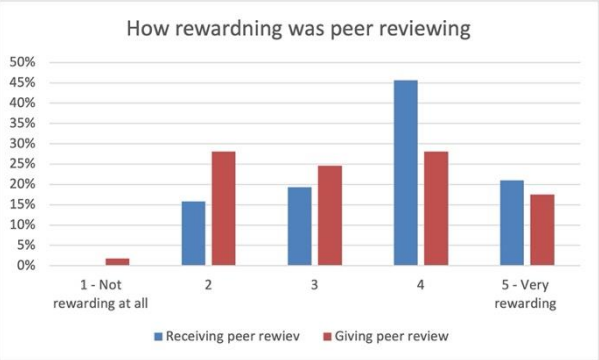

Figure 2b. How rewarding was peer reviewing

Figure 2. Data from survey

From the survey it could be seen that a lot of students said that they found it inspiring to read other groups work to get inspiration and insight of how you could solve the same type of assignment in different ways. One student wrote *"You got to take part in several projects with different approaches. This contributed to a greater understanding of the different steps within each submission. That is, you could pick up certain steps / sub-steps that you might have missed in your own project."*. They also saw it as a practice for upcoming courses. The downside of writing peer review, the students thought, was that it was time consuming and took the focus away from the rest of the work.

Most students where positive about receiving feedback on their own text in form of peer review. They wrote that it was nice to have someone reading your text and find errors before handing it in to the supervisor. Also, that it is easy to just choose one path and then following it and by getting others' opinions you will see the bigger picture and developing their work. Even if it was mostly positive comments, some students wrote that receiving peer review did not help at all and that the feedback from other students could be wrong.

The average opinion about that the opportunity to use peer review as a way to show how much the students understand in the course was neither good nor bad. Most of the students did not feel like they could show if they had knowledge about the course or not by giving peer review and they neither felt that peer review affected their learning.

Result II: Student Interview

The student interviews showed that all students that were interviewed considered peer reviews to be a positive experience but with some frustrating elements. They said "*It is good to be able to influence your own grade so that everything is not based on the group work".* Most of the students said that it was a good opportunity to compare others' texts and get inspiration and ideas. While reviewing someone's report they could find things they had missed in their own report. "I found it *really positive, it is required in order to develop your own text and writing, and for those you give the feedback, it is always good to get a second opinion*". However, they also expressed things as "*When the only feedback you get is from students, there can be unclarities, if there is something most students have not understood the group miss it*" and the overall though was that they found it frustrating when peer reviews were not useful, for example when the review only had comments on grammar, or the information was wrong.

Towards the end the students felt that their written peer review became succinct, and that they felt more comfortable and knew what to check for. Since they received peer reviews from a different person each time, the student did not feel that they could say if the quality on the received peer review changed over time.

The students from 2021 felt that peer reviews gave a fair image of what they have learnt in the course and that it was good that the grade had an individual part. However, they felt that it was hard to know what to write in the peer review since the grading criteria was not known and the grade was the focus. Students from 2020 also found the grading criteria hard to understand but said that their focus more that they learned to be constructive and got to double check their knowledge. If the student had misunderstood some theory in the course, students found that peer review could help them to be aware of this.

All student from both years said that they learned how to give and receive feedback and evaluate texts. A lot of students also anticipated to use peer reviews in the future. Students 2020 say for "*maybe smaller things*" while others have already recognised the benefits "*well we have done some more peer reviews in later days and it was good to know how to do it*".

Result III: Supervisor Interview

Overall, the general thoughts on peer review were that it was good that the student learned more and that it provides a different perspective than only supervisors' comments would give. They also said that it is good to have a first round of filtering and help each other. On the other hand, they said that sometimes students give each other the wrong information and if a group had missed something crucial it could be frustrating since they did not have all the information. So even if the thoughts were mostly positive, they mentioned that they could not guarantee that the students get proper feedback.

The supervisors who had been in the course both before the implementation of peer review, and after, thought that the quality of the students' reports had gone down since the time when the supervisor gave feedback, but that was expected since the supervisor comments are often

more correct. They felt that the students should have an opportunity to change things after the supervisor's response to increase the learning and quality of the project process.

DISCUSSION

The following questions were framed to evaluate if the implementation of peer review improved any of the challenges mentioned in the introduction and how it affected the students and supervisors:

1) What are the students' general perception on peer review in the course Integrated Construction and Manufacturing?
2) Are the individual assessments of each group members knowledge more accurate when using peer review as an examining part?
3) How does the integration of peer review affect the students' writing process?
4) How does the supervisor perceive the integration of peer reviews and its effect on student texts?

Earlier research, done by for example Cho & Cho (2011) and Nicol, et. al. (2014), has shown that the students learn from critically reading other students' and giving feedback. In the study done in this paper, many students are supportive of the benefits of peer review, but there are also who find it less useful as they are uncertain about whether the feedback they get is accurate or not. The positive comments primarily concerned the giving of feedback while more the critical comments were about the reception of feedback. The survey data showed a similar trend with more students ranking the reception of feedback higher than giving feedback. The reason behind this trend could be that the students want to hand in as good assignments as possible and therefore feel like the received feedback affects their assignment more directly. Another reason could be that the students are not used to writing peer reviews and that it is a greater chance to dislike something they do not feel comfortable with, compared to receiving feedback, which they are more used to. The findings are in line with previous research and highlight the need for training students to do and use peer response (Nicol, et. al., 2014, Lundstrom & Baker, 2009). It may for instance be beneficial to talk to students about what happens with the feedback given to show the value of the given feedback. It also important to for students to realise the importance of actively using the feedback and to show that feedback is not only about passively receiving feedback (Börjeson & Carlsson, 2021).

To conclude, if peer review is a more accurate way of showing knowledge in the course it is important to evaluate the method compared to how it has been. Earlier, when the individual assessments of each group member was based on how the supervisor thought they performed, it was easy for a student to hide the fact that they did not have any knowledge by hiding behind their group members. Now, when there is an individual written part, this is something they cannot do that anymore. Even though the students found it hard to understand the grading criteria, they thought that it gave an accurate picture of their knowledge. When students write a peer review, they need to have knowledge of the subject for them to be able to give appropriate feedback. Therefore, it can be assumed that using peer review as a way of individual assessment is a way of making students more engaged in and aware of that assessment.

Even though all supervisors agreed that integration of peer reviews was good for the students' learning process and that it gave the student several new perspectives than what comments from themselves would do, they thought that the quality of the students' texts had gone down.

These perceptions are not based on actual comparisons, and it is therefore not certain that quality has gone down. In order to qualify such claims and perhaps also consider how to address problems of quality, comparisons between texts should be made. It is also possible that the process should be improved to increase quality of the final paper, for instance by letting students revise the text also after they have received feedback from supervisors. In addition, the quality of the text is only one indicator of student learning, and in order to assess the quality of peer work in the course, further analyses on the influence on content learning as well as text quality need to be made.

There are always challenges when implementing changes in a course. The current study points to advantages and disadvantages of the design implement and gives indications of parts of the course and the intervention that can be developed further.

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REFERENCES

Bitchener, J., & Storch, N. (2016). Written corrective feedback for L2 development. Multilingual Matters.

Börjeson, F. & Carlsson, C. J. 2021. Talking about Writing – Designing and Establishing Writing Feedback and Tutorials to Promote Student Engagement and Learning. Journal of Academic Writing, 10(1), 128-135. https://doi.org/10.18552/joaw.v10i1.604

Boud, D., & Molloy, E. (2013). Rethinking models of feedback for learning: the challenge of design. Assessment & Evaluation in Higher Education, 38(6), 698–712. https://doi.org/10.1080/02602938.2012.691462

Carless, D. (2016). Feedback as Dialogue. In M. Peters (Ed.), Encyclopedia of Educational Philosophy and Theory (pp. 1–6). Springer. https://doi.org/10.1007/978-981-287-532-7_389-1

Cho, Y. H., and K. Cho. (2011). Peer Reviewers Learn from Giving Comments. Instructional Science 39:629-643. https://doi.org/10.1007/s11251-010-9146-1

Cho, K., Schunn, C. D., & Charney, D. (2006). Commenting on writing: Typology and perceived helpfulness of comments from novice peer reviewers and subject matter experts. Written Communication, 23(3). https://doi.org/10.1177/0741088306289261

D. R. Brodeur, The CDIO Standards v 2.0, http://www.cdio.org 2010

Enelund, M., Larsson S., & Malmqvist J. (2010). INTEGRATION OF A COMPUTATIONAL MATHEMATICS EDUCATION IN THE MECHANICAL ENGINEERING CURRICULUM.

Lundstrom, K., & Baker, W. (2009). To give is better than to receive: The benefits of peer review to the reviewer's own writing. Journal of Second Language Writing. Volume 18, Issue 1. https://doi.org/10.1016/j.jslw.2008.06.002

Nicol, D., Thomson, A., & Breslin, C. (2014) Rethinking feedback practices in higher education: a peer review perspective, Assessment & Evaluation in Higher Education, 39:1, 102-122, https://doi.org/10.1080/02602938.2013.795518

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Appendix

A. Student survey questions

1. What was your overall impression of peer review in the course?
   1) very bad
   2) bad
   3) neither good nor bad
   4) good
   5) very good

2. How much time did you spent on average at each peer review?

3. How rewarding did you find receiving peer reviewing? 1 (Not rewarding at all) – 5 (Very rewarding)

4. How rewarding did you find giving peer reviewing? 1 (Not rewarding at all) – 5 (Very rewarding)

5. What is the benefits with receiving peer review?

6. What is the benefits with giving peer review?

7. What is the disadvantages with receiving peer review?

8. What is the disadvantages with giving peer review?

9. Do you feel that peer reviews gave a fair picture of what you learnt in the course?

B. Student interview questions

1. How rewarding was it to give (do) peer reviews?

2. Did you notice any differences doing peer reviews between the start vs the end of the course? How come?

3. How rewarding was it to receive peer reviews?

4. Did you notice any differences receiving peer reviews between the start vs the end of the course? How come?

5. Do you feel peer reviews gave a fair image of what you learnt in the course up to that point?

6. How do you feel peer reviews affected your understanding of the course?

7. What do you think are the learning aspects on having this exercise?

8. Did you learn anything from peer reviews?

C. Supervisor interview questions

1. How did the quality of the students work change over time?
2. Did you notice any changes in the need for clarity as a supervisor?
3. What did/do you think of the transition to peer-reviews from the previous method?
4. How has your view of the course changed?
5. Do you feel like the transition to peer reviews improved or haltered the learning?