Deeper approach to learning with peer assessment

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INTRODUCTION

The focus of this paper is on peer assessment and the effect of assessment on learning. In addition, students' insights and experiences of peer assessment are explored. The authors' goal is to use assessment as a tool for guiding students' work to a desirable direction. Letting students get involved in assessment and defining the assessment criteria helps them take responsibility of their learning and build up confidence, commitment, and ownership. Could peer assessment encourage the students to reflect on questions such as am I doing the right thing or is this enough, and, as a result, activate them to analyze and enhance their performance?

The students' perspectives on assessment were collected with a survey and feedback from courses taught by the authors. For example, students were asked how they experience and value peer assessment, what is its effect on learning, what kind of support and instructions are needed, and do they feel competent assessing their peers. This paper introduces experiences from three courses at the schools of Engineering, Electrical Engineering, and Chemical Technology of Aalto University.

1 ASSESSMENT

1.1 Assessment methods

Various studies have explored different assessment methods. Struyven et al. [1] for example studied how multiple choice testing, peer assessment, case-based assessment and portfolio assessment affected student performance, and Fallows and Chandramohan [2] concentrated on the use of tutor, peer- and self-assessment. No simple rule can be drawn from the results. Assessment is an integral part of the learning process in higher education, but the selection of the suitable method is dependent on the discipline, course topics and teaching methods as well as intended learning outcomes. Despite the steadily growing emphasis on the student-centered learning, Taras [3] argues in her review that assessment in many UK universities has focused too much in grades. Assessment is strongly linked to grades also in Finnish higher education institutes.

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Another essential aspect is the time-dependency of the assessment. At Aalto University, teachers need to complete the grading within one month after the course ends. One academic year is split to five periods which means that students are fully involved with other topics in new courses when they receive grades from the previous courses. In the very minimum, assessment is a mark in the study record. To have an effect on learning and to guide students in their learning process, assessment should take place already during the course, when learning process is actively going on.

1.2 Assessment as a way to provide feedback to students

Several authors [e.g. 3, 4] have brought up the relevant question whether assessment is used for learning or is it assessment of learning. At same time, as teachers, we are familiar with the limited resources, which narrow down teacher's possibilities to give students the feedback they expect. Nicol [5] sees peer assessment as one way to enhance the quality of the feedback dialogue. Liu and Carless [6] argue for assessment which supports both learning and measurement. Peer feedback process develops skills such as critical reflection, listening to and acting on feedback. Students do not learn only from peer feedback but through reflecting on and justifying what they have done. Cartney [7] sees potential in peer assessment to act as a vehicle to enable students to make use of the feedback they receive. Tutors, however, need to have awareness of the emotional and cognitive aspects of group learning. According to van den Berg et al. [8] written and oral peer feedback are different in nature and therefore, if possible, both should be used to yield most complete feedback. Students don't usually use the possibility to receive feedback and discuss grading outside the class room [4], which also supports the idea of integrating the feedback dialogue to the peer assessment and other course activities.

1.3 Peer-assessment

The combination of teaching and assessment methods makes a difference. Peer assessment can be used for written and oral output and for group work. In the case of individual essays and presentations, the aim of peer assessment is usually to diversify and add the feedback, develop students' general skills and enhance learning. The same motivation may apply to the combination of peer assessment and group work [9], but group work often brings up the questions whose effort defines the grade. There are examples of using peer assessment to identify group members input to the project [10].

According to Stefani [11], students have a realistic view of their ability to assess their own and other students' work, and peer assessment by students can be considered reliable (compared to assessment performed by teachers). She concludes that if students are given both formative and summative assessment tasks from early on, they will learn to do them responsibly. Ballantyne et al. [12] argue that if first year students are properly instructed on peer assessment, they will adapt to it significantly faster than older students. On the other hand, mature students have more self-confidence. The study by McGarr & Clifford [13] seems to verify that such differences between students of different ages exist. Stefani [11] adds that the motivation of the students for peer assessment was high and seems to have resulted in higher quality of the assignments under assessment; students work harder knowing that their work will be assessed by peers and by themselves, too

It should be borne in mind that the concept and the criteria of peer assessment, even if well instructed, could mean different things to the students and to the teachers [14, 15], and must therefore be well understood.

2 METHODS

To capture students' perspectives on peer assessment, experiences from three courses at the schools of Engineering, Electrical Engineering, and Chemical Technology of Aalto University were collected. The courses are Experimental methods, Integrated Interior Wooden Surfaces, and Astronomical View of the World. The participants are mainly engineering students but there are some students from the schools of Arts and Business, as well.

2.1 Courses in this study

Basic information of the courses in this case study is presented in Table 1. The courses are described in more detail below. Academic year in Aalto University is divided into two semesters. Fall semester has two seven week periods and spring semester has three periods.

Table 1. Information of the courses in this case study.

Course name	ECTS	Duration	Number of students	Years in the curriculum
Experimental Methods	5	Spring semester	65	7
Integrated Interior Wooden Surfaces	4	Spring semester	20	7
Astronomical View of the World	3	Spring semester	70	2

Experimental methods

Experimental methods is a 5 credit course that introduces students to planning and execution of an experimental study. The course is a part of a methodology module that prepares students for their master's thesis. Learning outcomes include scientific writing and presentation of research results. The course is built around a research project which is supported by lectures. The project is done in groups of five students. Students are allowed to choose a research subject of their own interest as long as it includes experimental elements and is realizable. The course consists of four components that are assessed: project plan, two presentations and final report. The assessment is strongly based on peer review of the project plan and two presentations. The final report is assessed by the teacher. The weighting of these elements is decided together with the students at the beginning of the course.

There are multiple reasons for peer assessment on this course. Maybe the most important one is the possibility to give more feedback to students more often. One teacher does not have time to go deeply into dozen research projects. On the other hand students often wish to have some examples of the outcome they are expected to deliver. When studying each other's work students can see how other students have approached the same task that they are working on. They may notice deficiencies in other's work and also things that they have missed in their own. Before the peer assessment of project plans the project teams were given a project plan from previous year to evaluate. Their task was to analyse and discuss as a team what makes a good project plan, what would be their criteria for assessment and what would be their grade for that plan. Based on these reflections the teacher collected a guideline for the peer assessment. It was hoped that this together with the mutual agreement on the weighting of the different components in the assessment would give the students a sense of being involved in the assessment of the course. The template that was used for assessment contained both verbal feedback and numerical grade. Each project plan was assessed by three other teams to equalise the grading. More importantly each team had a possibility to read up on three other project plans and learn from others. After receiving the assessments the teams once more reflected the feedback, what they had learned and how they would refine their plans. They had also possibility to protest against the grading. The presentation assessments were done using an assessment form that contained questions about different areas of presentations, such as, contents, preparation and appearance. Also verbal feedback was provided. Each team returned assessment form for each other team's presentation. Students were also encouraged to ask questions from the presenters. The assessments were collected and transcribed by the teacher and delivered to students within a few days after the presentations.

Integrated Interior Wooden Surfaces

Integrated Interior Wooden Surfaces is a 4 credit course where students from different disciplines explore the material properties of wood and try to find new ways to utilise the functional properties of wood in varied wooden interior products. Studying together helps the students to understand other perspectives to problems related to wood construction than just their own. After the course student is able to plan and schedule a short project in a group and knows how to search information related to a research topic, make a project plan based on a given framework, analyse the results, and present the results of the project. To pass the course, students have to make a pre-assignment based on pre-selected journal articles, document the project work and present the results, and write a learning diary for every course week. All these elements were assessed and affected the final grade.

Peer assessment is used in the course to ensure that students receive feedback for their work not only from the teachers. Assessing peers also forces students to think what makes a good project. Students presented their project plans on third week of the course, which was followed by mid-term review and at the end by final presentations. Other groups gave comments and asked questions. There was no template for assessing the project plans, but purely oral assessment proved to be difficult and

therefore a template allowing anonymous comments was used in the mid-term review and final presentations. Teacher collected the anonymous comments for other groups' work and distributed them accordingly. Students' feedback included something positive of the group's project and something that group could develop in their project. Using the template did not decrease the discussion in the class room, quite the opposite. At the end of the course, after submitting all the documents, students were asked to assess their own contribution to their own project as well as their group members' contribution. The amount of time used and the quality of each member's input were included in the assessment. This has proved to work well during the years. Group members' rankings have been very well in line with each other.

Astronomical View of the World

Astronomical View of the World is an interdisciplinary course that was held for the first time in spring 2013. It is a so called Aalto course that is open to all students at the university regardless of their field of study, aimed mainly at Bachelor students. The course discusses the historical and modern scientific worldviews and how they have been shaped, and the effect astronomy has had on the human civilizations throughout history. The course is assessed based on learning diaries, homework, and student activity. In spring 2014, when the course was held for the second time, teachers wanted to experiment whether peer and/or self-assessment would be viable methods for the course. The main driver for this is the need to provide the students feedback on their learning diaries when the resources of the teachers are limited. Another target is to provide the students with examples and new perspectives: How do other students write their diaries, Could I learn something from them? In addition, student activity is enthusiastically promoted on this course, and involving students in assessment is yet another way of doing that.

The student population on the course is very heterogeneous not only in their knowledge level but also in their chosen study programmes. The topics they write the learning diaries about are often thought provoking, close to being personal. Because of these factors, it was decided to hold a separate peer assessment trial session with synthesized learning diaries (including bits and pieces of actual diaries written by several students so that no individual text could be recognized). Here the students (in groups) read, discussed, and graded five different learning diary entries based on the same assessment criteria that the teachers use. Afterwards the grades given for each diary by all groups were collected on the black board and discussed within the whole class. Last, the grades were compared to the grades given by teachers. In general, students' grades agreed fairly well with teachers' grades, even though there were some obvious caveats, too, particularly concerning the disparate conceptions of the assessment criteria (even though these had been covered well on earlier lectures and in learning diary feedback).

Before the peer assessment session the students had been asked to grade their own learning diary entry from previous week. After the session they were asked to check whether they still agreed with the grade they had given themselves. During this process many students noticed the mistakes they had done, and actually lowered their grade. None graded their work higher than before the session.

2.2 Student surveys

A number of surveys were done on each course in this study. The questions were mainly closed but there were also some open questions to allow students to describe their expectations and give feedback on the courses.

Experimental methods

To study the students' views on peer assessment two surveys were executed. The first survey (N=37) was done in the classroom at the first lecture. The second, online survey (N=42) was done right at the end of the course. The questions were mostly related to students' attitudes and emotions towards peer assessment. At the same time the target was to find out if the participation in the peer assessment and involvement in the development of the assessment criteria would affect them. Because the implementation and criteria for peer assessment were mostly discussed during the lectures there was also a question about the lecture participation activity. *Active students* (N=31) participated to 50% or more of the lessons and *less active students* (N=11) to 25% or less. 81% of the students had earlier experience on peer assessment.

Integrated Interior Wooden Surfaces

In the beginning of the course students answered to open questions in the Course start inquiry (N=16). Students were asked to describe their earlier experience of group work, what kind of assessment they find appropriate for group work, perceptions and experience of self-assessment, assessing peers as well as being assessed by peers. Also the need for support and instructions to help them assess their peers was asked. The last question was how different ways of assessment should affect their final grade: self-evaluation, peer-assessment and teacher assessment. Along with the general course feedback, after the final presentations, students (N=15) were asked to evaluate in 5 point Likert scale similar issues which were covered in the Course start inquiry.

Astronomical View of the World

After the peer assessment session at the lecture a web-based survey was conducted to find out the students' attitudes to self and peer assessment. Three groups of students were studied: all (N=61), those with no prior experience of self or peer assessment and not present at the peer assessment session at the lecture (N=11), and those with earlier experience and present at the peer assessment session at the lecture (N=19). The last two groups were used to look for differences between students who had no experience of peer assessment and those who did.

3 SURVEY RESULTS

The surveys were composed of mainly closed questions (5 point Likert Scale). Statistics for online surveys were obtained using statistical tools of the survey software (Webropol). The results are presented using the same descriptors that were used in the questionnaires. Depending on the question the scale from 1 to 5 equals to *difficult…easy*, *very awkward…all right*, *not reliable at all…very reliable*, *not at all…very well*, *not at all…a lot* or *strongly disagree…strongly agree*.

3.1 Students' approach to peer assessment

In the end of the Experimental methods course, 40.5% of the students thought that peer assessment suits very well for the course and 50.0% that it suits well. 76.2% of the students said that they had *good* or *very good* possibilities to influence on the assessment in the course. There was a clear difference in the answers between the students who only participated to 25% or less of the lessons compared to those who participated to 50% or more of the lessons. 54.6% of those who didn't participate said that they had *good* or *very good* possibilities to influence the assessment while 83.9% of those who participated most of the lessons said the same. Students' attitudes towards peer assessment didn't change notably during the course. On the question about how difficult peer assessment is their answers were equally distributed between *somewhat difficult*, *neither difficult nor easy* and *somewhat easy*. In general students felt that assessing their peers is *somewhat all right*. Those students who participated most of the lessons felt clearly (51.6%) that assessment is *somewhat all right* compared to other group (18.2%). Receiving peer assessment was mostly considered to be *somewhat all right* (50.0%) or *all right* (31.0%).

According to the Course start inquiry in the course Integrated Interior Wooden Surfaces, most students had experienced peer assessment in the earlier courses. At the end of the course 20% agreed strongly that assessment suits the course and 40% agreed. None disagreed strongly. Being assessed by the peers is not a problem: 73% chose 5 (=it is all right) or 4. Responses to how students felt assessing their peers were similar, 60% chose 5 (=it is all right) or 4. Peer assessment was considered slightly more difficult than easy.

In the course Astronomical View of the World, students with no prior experience and not present at the peer assessment session were quite conservative in their opinions about how difficult peer assessment is; all their answers were in the categories *somewhat difficult* and *neither difficult nor easy*. Those students that had earlier experience and were present at the session found peer assessment easier compared to the earlier group with categories *somewhat easy* and *easy* comprising approximately 22% of the responses. In general, students did not feel assessing their peers *very awkward*. Most students felt it is either *somewhat awkward* or *somewhat all right*. Again, students with earlier experience and present at the session were most positive about it with 26% *all right*. When asked how they feel about being assessed by their peers, their answers were very similar to these in all three student groups. Approximately half of all students agree that peer assessment suits the course.

3.2 Reliability of peer assessment

Most students (85.7%) in the Experimental methods course consider peer assessment reliable *to some extent* or *to a moderate extent*. 41.9% of the students who participated to most of the lessons considered peer assessment reliable *to a moderate extent* while only 27.3% of the less active students thought the same. 54.5% of the students who participated to 25% or less of the lessons think that other students are *very little* capable of assessing other students' learning and skills while 67.7% of more active students think that other students are capable *to some extent* to assess them. In general students feel that they are capable *to some extent* of assessing other students.

In the Integrated Interior Wooden Surfaces course, 40% of the students considered peer assessment very reliable or reliable. 26% considered it not at all or not reliable. Students consider their peers more capable to assess others' work than themselves. 47% chose the option very well or well for their peers, but only 13% for themselves.

Most students (87%) in the course Astronomical View of the World regard peer review reliable *to some extent* or *to a moderate extent*. None of the students with earlier experience and present at the session think it is *very reliable*. Interestingly, 9% of the students with no prior experience and not present at the session think it is *very reliable*. Most students and groups think other students are capable of assessing other students' learning and skills *to some extent* or *to a moderate extent*. Their opinion on how well they feel themselves capable of assessing other students' learning and skills, or their own learning and skills, are rather similar.

3.3 Who should decide the grade?

At the beginning of the Experimental Methods course the weighting of the components in the course were decided to be 20% for the project plan, 15% and 20 % for the two presentations and 45% for the final report. In the first survey when asked how the teacher's assessment and peer assessment should be weighted the average was 75/25 ratio between teacher and peer assessment. In the final survey the average was 50/50 ratio. This could indicate that students' confidence in peer assessment had improved during the course.

At the beginning of the course Integrated Interior Wooden Surfaces, students weighed teacher's assessment, but the percentage share varied from 10% to 90%. Nobody suggested grading based only on teacher's view. At the end, when asked what kind of weight peer assessment should have on the course grade, the clear majority (73%) thought that teachers' influence should be 75% and peers' 25%.

A clear majority of students in the course Astronomical View of the World prefer a system where teachers' assessment makes up 75% and peer assessment 25%. 5% of the students with earlier experience and present at the peer assessment session would prefer peer assessment as the only assessment method. This is the only group to choose this option at all.

3.4 Did peer assessment have an effect on students' learning?

Most students in the Experimental Methods course think that peer assessment affects their learning *to some extent* (33.3%) or *to a moderate extent* (54.8%). No one thinks that it doesn't affect learning at all. There is no difference in answers between the active and less active groups.

The effect of peer assessment on learning was not clear in the course Integrated Interior Wooden Surfaces: 13% percent chose 1 (not all) and 20% 2 in 5 point Likert scale. None chose 5.

Most students in the course Astronomical View of the World think peer assessment affects their learning *to some extent or to a moderate extent*. None thinks it does not affect at all. None of the students with no prior experience and not present at the session think peer assessment affects their learning *a lot*. In contrast, 21% of the students with earlier experience and present at the session say it affects their learning *a lot*. This indicates that the roles of explaining why peer assessment is done, motivating the students to participate and possibly even concretely showing how it is done are very important.

3.5 What students need?

Students acknowledge that for being able to assess their peers, they need clear instructions and assessment criteria to work on. In the survey conducted on the case study courses, students also

frequently mention discussions within the whole class and the teachers, or assessment performed in groups. To be able to assess their peers fairly, they would also like to see examples of good and bad assignments, and a way of making sure everyone understands the criteria in the same way.

4 DISCUSSION AND CONCLUSIONS

The clear majority of the students found peer assessment suitable for the case study courses. They also had confidence on their own and their peers' assessment capabilities. Only one student out of total 118 respondents stated that peer assessment is not reliable at all and 13% that it is very little reliable. This means that most students trust their peers' assessment. Two of the case study courses included group work and also the study by Weaver and Esposto [9] suggest that peer assessment should be used to assess group work. Having prior experience in peer assessment seems to make a difference, in good and in bad. Students with experience are quite positive about peer assessment but on the other hand they also see its limitations.

Peer assessment provides timely feedback to students during the course. If feedback is solely the teacher's responsibility, and particularly if it is strongly linked to grading which usually takes place after the course has finished, it will not reach the student on time.

Students' views regarding the influence of teacher's assessment on the grade changed during the courses Experimental Methods and Integrated Interior Wooden Surfaces. Experimental Methods students weighed teacher's assessment more in the beginning of the course whereas students' views in the course Integrated Interior Wooden surfaces changed to opposite direction and majority suggested that teacher's assessment should make 75% of the final grade. Students in the Astronomical View of the World course ended up with the same 75%/25% ratio between teacher and peers as well as Fallows & Chandramohan [2] in their study.

Surveys did not show clear evidence concerning the effect of peer assessment on students' learning. The question might have been difficult to comprehend, because learning process and outcome are often intangible. Better way to explore this topic might be to describe the possible learning outcomes and then ask students to evaluate peer assessment's effect on these. Students in the case study courses suggested that examples of good and bad assignments would help them to assess their peers and the use of examples has also been reported [16] to support the peer assessment process.

During the peer assessment session on the Astronomical View of the World course, no negative comments about subjecting learning diaries to peer assessment were submitted. One of the largest worries of the teachers on this course has been concerned with the possibly personal content of the diaries and how the students feel about letting others read them, but it seems that for the students this is not a major issue. However, it is certainly possible that peer assessment might change the content of the learning diaries in this regard, and a further study is planned on this topic. In view of the present study, the teachers now feel confident in delivering at least some of the feedback on the learning diaries of the 2015 course through peer assessment, and it will also be taken into account in the final grades, possibly with a 25% share as the students prefer. How to do this in practice remains to be decided.

Disciplinary differences need consideration when teachers think of applying various peer assessment research results in engineering courses. McGarr and Clifford [13] for example reported that teacher students perceived peer assessment more valuable for their professional skills than physiotherapy students. This might lead to a question, whether engineering students could be engaged better in the peer assessment process, if the need to give feedback in the working life would be linked to the course objectives.

Analysis of the results and familiarizing with the research concerning the use of peer assessment has provided several ideas to be implemented later. The attitudes towards the peer assessment among the students vary. Specific instruction in peer assessment and involvement of the students in the assessment process including the forming of assessment criteria are the issues which we will address in our courses in the future.

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