Peer feedback on student's lab report assignments to reduce formative feedback required by teachers

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Introduction

Peer feedback is increasingly used as pedagogical tool in higher educations and involves an activity where the students give each other feedback e.g. on a written assignment before it is handed in to the instructor for final assessment. The activity provides an opportunity for the students to learn from each other, and both the process of giving and receiving feedback has been associated with increased learning, which includes achieving a greater understanding of the content and awareness of the criteria and rubrics for the assignment in hand (Nicol et al. 2014; Topping 2009). It has even been suggested that feedback from peers may be more understandable and helpful than teacher feedback, as it may be given in a more accessible language and in a study investigating the benefits of the use of peer feedback in improving academic writing skills, similar improvements were observed for students receiving feedback from peers as from teachers (Huisman et al. 2019; Topping 1998). Furthermore, a clear improvement in academic writing skills was observed for students receiving peer feedback compared to students receiving no external feedback at all (Huisman et al. 2019).

The benefit for students in receiving formative feedback in their learning process is well established (Hattie et al. 2007; Wisniewski et al. 2020). However, the power of feedback is also related to its form and content (Wisniewski et al. 2020). At higher educations, teachers commonly face the challenge of limited resources in providing formative feedback at sufficient level. As peer feedback has been shown to reduce the need of external feedback from teachers (Nicol et al. 2014;

Wisniewski et al. 2020; Topping 2009; Kobayashi 2018), it has consequently become an attractive element to implement when resources for sufficient teacher feedback are not achievable.

Aim and motivation

The purpose of this project was to test the potential benefits of implementing peer feedback on a lab report assignment to reduce the time for the teachers used for correcting the assignments, while maintaining or improving the learning outcome for the students.

The peer feedback activity was here implemented in the practical part of the microbiology subject at the course Biology (Pharmacy) (SFAB20027U, Danish title Farmaceutisk Biologi). This is a compulsory course at the second semester of the bachelor program in pharmacy and is attended by 180-220 students enrolled at the study annually. The microbiology part contains both a theoretical and a practical part, which are assessed independently. For the practical part the students are taught in teams of approx. 30 students (in total 7-8 teams) and it requires active attendance in a 4-day lab course and connecting 4-hour classes. Furthermore, the students need to work together in groups of 2-3 students on writing and delivering satisfying assignments/reports related to lab exercises within the set deadline. These are corrected by responsible teachers in the lab, and the students are given one second attempt to improve their report to a satisfying level based on feedback from the teachers.

The resources needed for correcting the lab report assignment at the course have until this year been extensive, both due to the numbers and sizes (up to 40 pages) of the assignments handed in and since most assignments have not been in an acceptable state after first submission, which then requires a second round of correction by a teacher before final decision. Thus, a major aim for improvement at the practical part of the course in the spring semester 2023, was to reduce the format of the report assignment and the workload connected to correcting these, while retaining or improving the learning outcome for the students.

Description of the intervention

Teachers at the Biology (Pharmacy) lab course spring 2022 experienced that one of the major workloads for the correction of the lab report assignment was to guide the students in following the common lab report structure and to include the required elements described in the rubrics of the assignment. Lack of experience in writing lab reports at this early educational level of second semester is likely to explain this. Thus, taking use of peer feedback, focusing on these structural elements before the students' hands in the assignment to be assessed by teachers seemed a logical approach. This was anticipated to reduce the need for the more general comments on the report structure in the teacher feedback. If successful, the teacher feedback could then instead only focus on the subject-related matters the students have for the assignment, as these also are less likely for peers to evaluate at this early educational stage.

Good organization of the peer feedback activity, including a solid introduction to the teaching benefits as well as monitoring and coaching throughout the activity, has been pointed out as important for success of peer feedback (Topping 2009; Müllen 2019; Hvass 2018). The peer feedback was therefore implemented as a teacher-guided activity as part of a two-hour class approx. one week after the four practical days in the laboratory were finalized. 45 minutes were devoted to this specific activity. This class was held individually for each of the 7 teams of approx. 30 students taught in the spring semester 2023.

A high design quality of the peer assessment and clear feedback criteria has also been associated with more valid peer assessments than those which have poor experimental design (Falchikov et al. 2000; Kobayashi 2018). Thus, prior to the class, the exercise was setup in peer feedback in the University of Copenhagen's online teaching platform Absalon, which included detailed questions to guide the peer feedback, that focused on specific aspects of the report structure to follow and elements stated to be included in the rubrics of the assignment (see questions Appendix 1).

Following didactical recommendations, the peer-feedback activity was started out in the class with an introduction (10 minutes) to what peer feedback is and the motivation for this activity, e.g. by explaining the

pedagogical outcomes aimed for, including the benefits in providing feedback and receiving feedback in order to improve academic writing skills (Hvass 2018; Müllen 2019). The students were then asked to work in their groups to do a review on the lab report assignment from another group (30 min), that had been automatically distributed to them by the peer-feedback software. Teachers were available throughout the review session to assist in any problems the students encountered.

Following the class, the students were given a few days to revise their assignment based on the comments from peers before submitting it for correction by teachers. The success of the intervention was evaluated by comparing the frequency of the lab assignments that were positive at first attempt of this year compared to last year, in a course evaluation meeting with the other teachers at the lab course, and in an online survey questionary filled out by the students after finalizing the lab course.

Outcome of the intervention

In the spring semester of 2023, 183 students were enrolled in the lab course, whereof all submitted an assignment in the peer feedback portal, which also was implemented as a mandatory element for positive assessment at the course. In class, the students were observed by the teachers while doing the peer feedback, and most seemed very motivated towards the exercise. The statistics in the peer feedback portal revealed however that only 90.2 % (165 students) delivered feedback to peers, which may partly be explained by students prevented from attending their scheduled class or students teaming up in other groups when doing the class activity, why their participation was not detected. Due to this, a few students ended up not getting feedback from peers and the feedback was in these cases provided by the teachers.

The students were subsequently asked to revise their assignment and hand it in for teacher assessment. The aim was for the peer feedback activity to improve the students' performance before this step, at least in the context of structural elements of the report. To measure the success of the implemented intervention, the frequencies of accepted assignments in first teacher assessment was compared to the previous year (Figure 1).

In this year's assessment, 59% of the students delivered assignments that were accepted at first attempt. This was an increase in performance compared to last year (2022), where only 46% of the assignments were accepted at first attempt. This reduction in percentage of reports needing reassessment (from 54 % to 41 %), implies an improvement of the students' performance on the assignments, and a reduction in teacher time needed for giving feedback. However, these data cannot be used to directly demonstrate that this was due to the peer feedback activity, as there were also made other changes to the lab assignment compared to last year. Additional changes included reducing the assignment to cover only one full lab report (for one of the more advanced exercises - the assignment used in peer feedback) instead of full reports to all six exercises and instead supplement this report with a separate smaller scale report with focused questions about the other 5 lab exercises. 53% of the students got both of these lab assignments accepted at first attempts this year.
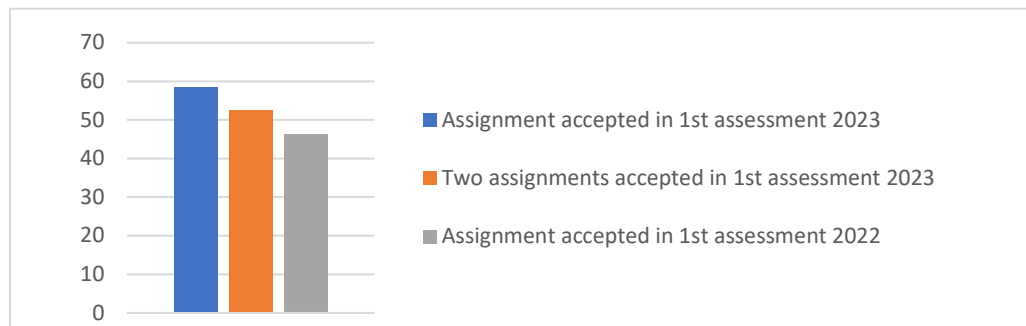
Fig. 1. The percentage of assignments assessed acceptable in first round of teacher assessment in 2022 and 2023. In 2022 only one larger assignment was given, while this year it was two smaller assignments.

Although not being an objective measure of the success of the implemented intervention, the dialog at the evaluation meeting with the teachers assisting in assessing assignments, suggested a decreased need to comment on the report structure and elements to be included in the assignment compared to last year. Thus, although a large percentage of the students still needed a second round of teacher feedback, the amount

of work appeared to be reduced and the teachers they could focus more on the subject-related matters as was the aim for the peer feedback.

The students' own experience of the use of peer-feedback was evaluated in an anonymous online questionnaire after the lab course was finalized, where 51 students out of the 183 participated (28%). It could be argued that a greater number of students may have completed the questionnaire if it was given directly after class, but at this stage the students would not have experienced the potential benefit of the activity on the final assessment of their assignment, which was important. Among the 51 participants, there were students from all the 7 teams taught separately, however, not all participants had answered all questions (for each, a mean of 11 respondents (22%) had not answered).

The main finding from the survey questionnaire was that the students who had answered were generally positive about their experience with the implemented peer feedback activity, and, when excluding the 22% not answering, 65% considered the peer feedback activity as helpful in the context of increasing their understanding of the report structure and how to write the report. Furthermore, 59 % answered that the activity was beneficial in order to increase their understanding of how to discuss and reflect about the experimental data. 58% also believed this activity contributed to a more rapid approvement of their report (see further the results of the questionnaire in Appendix 2). It should be noted that the low percentage of students answering the questionnaire meant that it is difficult to assess the opinion of all the participants. It is thus uncertain whether the answers provided were representative of the 183 students taking the course this year.

One consideration for further changes at the course, has been to ask the students to do the peer feedback already before the class, and thereby freeing time to other teacher guided activities in class. Thus, in the questionnaire, some questions were also directed towards the students experience of the time devoted for the peer feedback activity. Based on the responses here, the time used for it was evaluated as sufficient, and the students appeared to be positive about including the activity as a teacher guided activity in classes for the future.

Discussion and conclusion

When teaching at higher education level, it is important to recall the benefit of feedback on student learning, and that it depends on its form and content (Wisniewski et al. 2020). In this study, peer feedback was incorporated as an additional formative feedback form, aiming for the students to become more aware of the rubrics and the structural requirement for an written assignment. Thus, by giving and receiving feedback to peers on these elements, the aim was to improve the students' performance on this part of the assignment before it was being handed in for teacher assessment.

It has been argued that students needs both repeated explanation of the benefit of peer feedback and also training in doing peer feedback to benefit the most from this activity (Müllen 2019; Topping 2009). As the course Biology (Pharmacy) is part of the second semester, most students had previously not been subjected to peer feedback, and executing training in this repeatedly was not feasible as part of the course schedule. However, the purpose of implementing the activity was strived to be clearly communicated in class, and by being subjected to peer feedback as part of this course, the students will likely also gain from the activity in the future (when subjected to peer feedback again at courses later in the education).

The quality of the feedback provided by the students to peers was not analyzed in this study, and the importance of this aspect to benefit from the peer feedback, has been argued in literature (Müllen 2019), as studies has shown that by simply being actively engaged in producing feedback to others, the students learn to self-assess and improve their performance (Nicol et al. 2014; Reinholz 2016; Li et al. 2010). However, as little experience in peer feedback was expected for the students at this course, the design and feedback criteria were thoroughly considered, as these influence the peer assessments (Falchikov et al. 2000; Kobayashi 2018). Thus, the aim was to design clear questions to the rubrics, and content expected for the students to give feedback on, to improve the quality of feedback given by peers (Appendix 1). Furthermore, it was not expected for the students to comment on subject-related matters within the assignments, as this was considered as too advanced at this

educational level and with a possibility to cause misleading feedback by peers.

Based on the positive evaluation of the students' performance on the assignment, and the teachers and students experience of the implemented peer feedback activity, it appears that the intervention was successful. Thus, the evaluation indicated that the students may have learned from the intervention whilst the teachers could use less time to focus on the structural elements of the report when correcting the assignments. It should be noted that there exist no exact estimates for the time teachers used in correcting assignment either in spring 2022 or 2023 and it is thus still uncertain if the teachers actually used less time for this. However, based on feedback from the other teachers and my personal experience, implementing peer feedback at the course, appeared to reduce teacher time used for the lab assignment corrections. It has previously been argued that peer-feedback does not necessarily save teacher time, and especially not when provided supplementary to teacher feedback, as executed in this project (Topping 2009). The time to prepare, organize and conduct the peer feedback activity in this project was certainly time consuming this year, as it was the first time this was prepared for the course. However, as Biology (Pharmacy) is a course with many participants yearly it is anticipated that the course will in the longer-term benefit from the time used in implementing the intervention, as only a few adjustments will be required yearly to maintain the activity as part of the course.

References

Falchikov, Nancy, and Judy Goldfinch. 2000. 'Student Peer Assessment in Higher Education: A Meta-Analysis Comparing Peer and Teacher Marks', *Review of Educational Research*, 70: 287-322.

Hattie, John, and Helen Timperley. 2007. 'The Power of Feedback', *Review of Educational Research*, 77: 81-112.

Huisman, Bart, Nadira Saab, Paul van den Broek, and Jan van Driel. 2019. 'The impact of formative peer feedback on higher education students' academic writing: a Meta-Analysis', *Assessment & Evaluation in Higher Education*, 44: 863-80.

Hvass, Helle; Heger, Stine. 2018. 'Brugbar peer feedback: Instruktion og træning, før de studerende selv skal give og modtage. ', *Dansk Universitetspædagogisk Tidsskrift*, 13(25): 59–70.

Kobayashi, Sofie. 2018. 'Peer feedback among international PhD students', *Dansk Universitetspædagogisk Tidsskrift*, 13: 91-106.

Li, Lan, Xiongyi Liu, and Allen L. Steckelberg. 2010. 'Assessor or assessee: How student learning improves by giving and receiving peer feedback', *British Journal of Educational Technology*, 41: 525-36.

Müllen, Rikke von. 2019. 'DUT Guide: Peer-Feedback ', *Dansk Universitetspædagogisk Tidsskrift*, 14: 188-96.

Nicol, David, Avril Thomson, and Caroline Breslin. 2014. 'Rethinking feedback practices in higher education: a peer review perspective', *Assessment & Evaluation in Higher Education*, 39: 102-22.

Reinholz, Daniel. 2016. 'The assessment cycle: a model for learning through peer assessment', *Assessment & Evaluation in Higher Education*, 41: 301-15.

Topping, Keith. 1998. 'Peer Assessment Between Students in Colleges and Universities', *Review of Educational Research*, 68: 249-76.

Topping, Keith J. 2009. 'Peer Assessment', *Theory Into Practice*, 48: 20-27.

Wisniewski, Benedikt, Klaus Zierer, and John Hattie. 2020. 'The Power of Feedback Revisited: A Meta-Analysis of Educational Feedback Research', *Frontiers in Psychology*, 10.

Appendix

Appendix 1.

Q1 · Text · Requires additional comment

Organization-

Is the report organized into following sections:

1. Front page
2. Intro exercise
3. Materials and Methods
4. Results
5. Discussion

Response

> Write your response here

Q2 · Yes / No

Frontpage -

Does the frontpage include full names and (studienummer), groupnumber and Team (HOLD)

Response

> No

> Yes

Q3 · Text

Introduction –

Does the introduction include
- A brief introduction to the exercise where the aim is explained.
- Some theoretical background.
- Why this experiment has been performed.

Response

> Write your response here

Q4 · Text

Materials & methods -

Does the materials & methods section explain in short and sum up what have been done in the exercise? Text should however not be copied from the script, rather referred to (page 14, day 2) --> add information. If anything was done different from the script/procedures, this should be described. If a chemical or something were done in a different order, make a note. If data was acquired from another group, specify which group (ref.).

Response

> Write your response here

Q5 · Text

Results –

- Is the results from the experiment stated? (in full sentences).
- Is statement of observations and relevant pictures of results (photos e.g. of plates) included?
- Pictures of the LB plates with blue and white colonies and gel electrophoresis should be included

Response

Write your response here

Q6 · Text

Results –

Is there included answer to the EXERCISE QUESTION A)?

- Answer should be in full sentences.
- It should including a drawing of bands expected to be seen at the agarose gel for each of the four samples (band placed based on expected size).
- Each sample should be commented on individually (size and number of bands).

Response

Write your response here

Q7 · Text

Results –

Is there included answer to the EXERCISE QUESTION B)?

- Answer should be in full sentences.
- It should including a picture of own results on the agarose gel where individual sample is marked.
- It should include a comment on each sample and band observed individually.
- Data on own gel should be discussed compered to how you expected the gel to look like.

Response

Write your response here

Q8 · Text

Results –

Is there included answer to the EXERCISE QUESTION C)?

- Answer should be in full sentences.
- Has the transformation efficiency been calculated (defined as the number of Amp transformants pr. cell)?
- All steps in the calculations are included
- Are there commented on discrepancies in the number of blue and white transformants?

Response

Write your response here

Q9 · Yes / No

Results –

Is there included answer to the EXERCISE QUESTION D)?

- Answer should be in full sentences.

Response

No

Yes

Q10 · Text

Discussion –

Does the discussion

- Summarise the key finding and explains the results
- Discuss if the results was as expected or differed from expected.
- If different, suggestion for explanation is included.
- Errors that occurred during the experiment should also be discussed and analyzed.

Response

Write your response here

Q11 · Yes / No

Grammar and Spelling –

There are a noticeable amount of spelling and grammar mistakes that interfere with understanding.

Response

No

Yes

Q12 · Text

Mention something that your classmate did well 👍

Response

Write your response here

Appendix 2.

Synes du at peer feedback aktiviteten i klassetime K5 var god i forhold til at øge din
forståelse omkring opsætning og skrivning af rapporten til øvelse M4 (assignment 1)?

Ja	26 respondents	51 %
Nej	9 respondents	18 %
Ved ikke	5 respondents	10 %
No Answer	11 respondents	22 %

Synes du at peer feedback aktiviteten i klassetime K5 var god i forhold til at optimere
din forståelse omkring hvorledes diskutere og reflektere over forsøgsdata i øvelse M4?

Ja	23 respondents	45 %
Nej	9 respondents	18 %
Ved ikke	7 respondents	14 %
No Answer	12 respondents	24 %

Tror du at peer-feedback aktiviteten bidrog til at I fik jeres rapport hurtigere godkendt
/manglede færre elementer for at blive godkendt?

Ja	23 respondents	45 %
Nej	14 respondents	27 %
Ved ikke	3 respondents	6 %
No Answer	11 respondents	22 %

Blev jeres gruppe færdig med peer feedback opgaven i klassetime K5?

Ja	34 respondents	67 %
Nej	5 respondents	10 %
No Answer	12 respondents	24 %

Synes du der var afsat nok tid i klassetimen til peer feedback aktiviteten ?

Ja	30 respondents	59 %
Nej	4 respondents	8 %
Ved ikke	6 respondents	12 %
No Answer	11 respondents	22 %

Synes du at der var afsat for meget tid til peer feedback aktiviteten i forhold til
læringsudbytte af aktiviteten?

Ja	7 respondents	14 %
Nej	21 respondents	41 %
Ved ikke	12 respondents	24 %
No Answer	11 respondents	22 %