

Scaffolding the use of formative peer assessment and feedback in a project-oriented PhD course

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Background

Assessment and feedback are two of the pillars of higher education and have been extensively studied throughout the years. While feedback is more broadly defined as “information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one’s performance or understanding” (Hattie and Timperley, 2007, p. 81), Joughin gives the following definition of assessment – “to make judgments about students’ work, inferring from this what they have the capacity to do in the assessed domain, and thus what they know, value, or are capable of doing” (Joughin, 2009, p.16). Recently, more focus has come to the use of assessment and feedback not only by the teacher or educator, but also by peers, specifically referred to as peer assessment (Topping, 1998) and peer feedback (Liu & Carless, 2006). In this case, peers could be equal in different ways such as age, educational level, or expertise. Both peer assessment and feedback can be either formative or summative and the difference is “assessment *for learning* versus assessment *of learning*” as nicely put by Adachi *et al.* (Adachi *et al.*, 2018). They also consider peer feedback as a component of peer assessment, while Panadero *et al.* (2018) discuss them as two independent processes, which are different because of the absence (feedback) or presence (assessment) of a score or grade (Panadero *et al.*, 2018). Specifically, they use Shute’s definition of formative feedback – “information communicated to the learner that is intended to modify his or her thinking or behavior for the purpose of improving learning” (Shute, 2008, p.154). Still most research agrees that formative peer feedback and assessment are pow-

erful tools that can enhance students' learning and promote deep learning, enable the development and assessment of domain-specific knowledge as well as transferable skills such as teamwork, critical thinking, and even evaluative judgment (Adachi et al., 2018).

With this project, I set out to introduce and scaffold the use of peer assessment and feedback in the PhD course *Bioinformatics analysis of gene expression data*, organized and mainly taught by Stefan Seemann and co-taught by myself and a few other colleagues. Since the course is project-based, it already includes a lot of group work and teacher–student feedback. Thus, it seemed very fitting to integrate more formalized peer feedback and assessment in addition to the other teaching and learning activities. The overall goal would be that the students receive good-quality, constructive, formative feedback about their projects and final presentations, which will be helpful for their future project development. As Panadero *et al.* point out, it is important for the students what type of activity we choose, how we instruct them in it and what type of feedback they have to give (Panadero et al., 2018). To accommodate this, I planned and organized an activity on the last course day, when students give a final group presentation of their projects. With this activity, I had hoped to specifically activate students to ask more questions during these presentations and help them identify the potential and limitations of the projects and analyses of their fellow students. Due to time constraints, it was only possible to include a peer feedback and assessment session at the end of the course, but I also present a proposal of how to integrate them more fully into the course for its future editions.

Here, I describe the specific course setting, the design and execution of the formative peer feedback and assessment activity as well as my impressions and thoughts about it.

Methodology

The yearly PhD course *Bioinformatics analysis of gene expression data* is offered at the Faculty of Health and Medical Sciences and mainly targets first or second year PhD students from the UCPH graduate programs *Biostatistics and Bioinformatics*, *Veterinary Clinical Sciences*, and *Molecular Mechanisms of Disease*. This is a rather new course and its structure has evolved since the first edition in 2019. Currently (spring of 2022), it is an intensive 3-weeks course, online or in-person depending on the cur-

rent COVID-19 regulations, and the number of participants is limited to 15. The course is a combination of approximately 8 introductory lectures and 4 tutorials as well as a data analysis project which the participants define themselves, based on their own PhD project or relevant publicly available data. The project work is performed both during the course and outside the classroom in small groups of three to four students, which are predefined by the course responsible based on related data and/or scientific questions. The final assessment is based on an oral presentation of the project work, delivered by each group of students on the last course day, and a short report, submitted by each student individually shortly after the course. A course evaluation is performed on the last day. My role in this course is to give part of the lectures and tutorials as well as to provide supervision as a tutor during some of the project sessions.

The image shows a Padlet board titled "Peer feedback on group presentations" by Nedzhda Tsankova Doncheva. The board is organized into five columns: "Feedback for group 1", "Feedback for group 2", "Feedback for group 3", "Feedback for group 4", and "Feedback about the peer feedback". Each column contains four questions with corresponding "Add comment" buttons. The questions are:

- What did you like in particular about this presentation?
- Give at least one suggestion for improvement!
- Did you experience similar challenges with your quality control? If yes, how did you address them?
- Are there aspects of the presented methodology that you did not consider yet, but are relevant for your project?

 The "Feedback about the peer feedback" column contains three questions:

- How did you experience giving peer feedback here?
- Did you receive useful feedback?
- Would you have liked to have more written peer feedback during the course?

 The board also features a "+" sign at the bottom of each column and a "+" sign at the bottom right corner.

Figure 1. The peer feedback form in Padlet.

The actual activity was focused on peer feedback and assessment and consisted of two parts. The first part was asking all students to give a short feedback on each presentation in a Padlet I prepared beforehand. The second part was for students in one group to prepare and perform a short discussion with relevant questions after the presentation of another group. To scaffold this process, I prepared a Padlet with four questions for the students related to the group presentation and three questions on the peer feedback

activity (Figure 1). Since there were four groups, I made a different column for each group and a fifth one for the general feedback. To make it easier to distinguish the questions and keep track, I colored each question in a different color. For the answers, I used the comment field in Padlet since it has an option of keeping the answers anonymous. The questions were formulated in a way that would hopefully guide the students to give valuable feedback to their fellow students, self-assess their own project in the context of their peers' project, and help them come up with good questions during the following discussion.

The last course day started with me giving a very short introduction of the plan in three simple slides. I provided the students with a clear course of action that included a timetable, the order of presentations, the group pairings for the discussion, and the main goal of the discussion questions. The group presentations were scheduled for 20-25 minutes, followed by 2-3 minutes for peer feedback in the Padlet, 10 minutes of peer-driven discussion and 5-10 minutes of open discussion. I also included and presented the four Padlet questions and encouraged the students to give constructive, concrete and caring feedback to each other. Thereafter, I monitored and supported the activities together with the course responsible, with whom I had discussed the planned activity in detail beforehand.

There are several different ways to evaluate whether the performed peer feedback and assessment activity succeeded and one can collect both qualitative and quantitative data. In this project, my evaluation was based on the content and quality of the oral discussions after the presentations and of the written feedback from the students to their peers in the Padlet. I also included three questions in the Padlet and one question in the final course evaluation in order to hear directly from the students how they perceived the peer feedback and assessment and if it contributed to their learning outcome. Under different circumstances, I would have liked to interview a few students about their experience with it directly after the final day, but I did not manage. Thus, I plan to do so in next year's edition of the course.

Results

Overall, the peer feedback and assessment session was received well by the students and went smoothly. On the final course day, there were four groups that presented after each other, and each group was responsible for doing a small discussion after the presentation of another group. The peer-driven

discussions went very well, the students had prepared good questions and in most cases each student would pose at least one question to the other group. The course organizer and I had the impression that students have understood well what they have worked on during the course and are able to assess the progress and to constructively comment on the project design and analysis decisions of their fellow students.

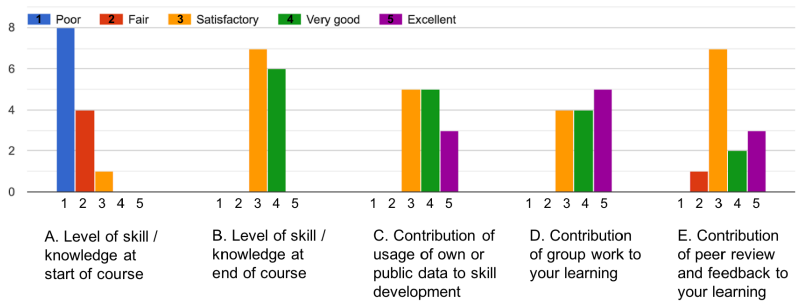


Figure 2. Excerpt from the course evaluation filled by 13 students.

As can be seen from the evaluation (Figure 2), the level of skill and knowledge of the students increased a lot between the beginning and the end of the course (A-B). Among other questions, we asked the students to evaluate the contribution of three specific aspects: usage of own or public data (C), group work (D) and peer review and feedback (E). In this project, we were most interested in the last part (E), where three students chose to evaluate it as *excellent*, two as *very good*, seven as *satisfactory*, and one as *fair*. Compared to the evaluation results for the contribution of group work and own/public data usage, we can still improve the way we facilitate the peer feedback and assessment and how much it contributes to the students' learning.

Between the presentation and the discussion, all students had a few minutes to comment on the questions in the Padlet and at the end of the day, I asked them to also comment on the peer feedback activity in general (the last column of the Padlet and Appendix A). As evident from the size and color of the question boxes in Figure 3, some of the questions related to the group presentations received more comments than others and in general not so many students used the Padlet actively. The first two questions were more directly related to the presentations and were apparently the easier

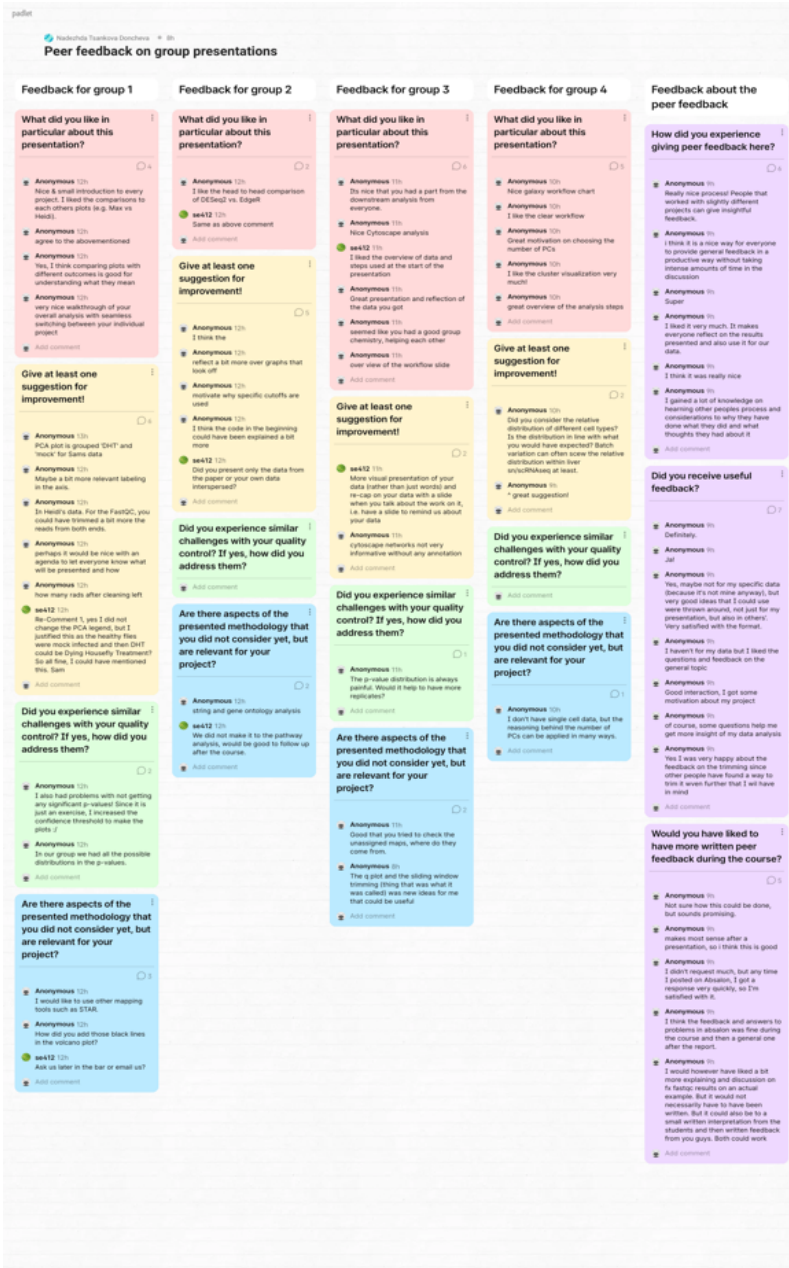


Figure 3. Final version of peer feedback Padlet.

ones to fill out. The other two questions referred to the students' own work and how it relates to their peers' projects. They required more in-depth consideration and thus clearly received fewer comments.

Overall, the comments were of good quality and constructive as judged both by me and the course supervisor and the students themselves. This can also be seen from the students' comments on the questions *How did you experience the peer feedback* and *Did you receive useful feedback*, which were all very positive. The five comments to the question about whether students would have liked more written feedback were more mixed, but in general they seemed to be open to the idea of trying it out even though I had not explained in the Padlet how this could be implemented during the course. One of the students actually suggested something similar to what we had in mind (see Discussion for more details). Two of the students commented more generally on the use of discussions in the Absalon platform as part of the peer feedback. Although we had not framed it as such officially, there were a few discussions between the students and teachers in Absalon during the course.

Discussion

This first step of integrating organized peer feedback was successful both based on my impressions from the day and the students' comments, but it also had several limitations. One of them was the short amount of time allocated for filling out the Padlet, which was partly due to the late introduction of this activity into the program and partly just because of the limited allocated time on the final day. It is likely that if the students would have had more time, more of them would have commented on more of the questions. It is also important to note that the whole course happened online, although we had planned for some days to be in person, specifically also the last course day. In my experience from the last two years, some aspects of teaching take more time online than they do in person.

With respect to the evaluation of how the peer feedback was received by the students, it would have been much better to perform a few interviews with them in the week following the final course day. As can be seen from the answers in the Padlet, the questions about the peer feedback session were not phrased clearly enough and led to comments related to the course as a whole. Nevertheless, I think the group-related Padlet questions were very useful to the students as a framework for their peer feedback and in-

spiration for their questions during the follow-up discussion. One can also argue that the Padlet rather provided the stage for formative peer assessment as defined by Panadero *et al.* (2018) since students commented on their peer's performance in terms of strengths and weaknesses, but without scoring it (Panadero *et al.*, 2018). In hindsight, when introducing the activity, I should have explained more clearly what students can gain from giving and receiving peer feedback, i.e., what the learning outcomes of this activity are as suggested by Adachi *et al.* (Adachi *et al.*, 2018).

Having seen the positive outcome of this rather short peer feedback and assessment session, the course responsible and I have agreed that we will continue working to integrate them more fully in the course and we have already discussed several changes for the next course in spring of 2023. For example, we have to allocate more time for the Padlet questions and we might want to revise them to be more accessible for all students and get more of them to comment. We can also consider if anonymity of the comments is really needed. Rotsaert *et al.* (2018) show that although students consider anonymity an important factor, they also find it beneficial to be in a rich and interactive, non-anonymous feedback environment (Rotsaert *et al.*, 2018).

More generally, we are discussing the option of integrating written peer feedback during the course. For example, this could go as follows: 1) at the end of the first and second week, each student writes a short, abstract-like description of what they did during the week, mentions one or two open issues, and submits it into Absalon's Peergrade (Peergrade, n.d.), where 2) it gets reviewed by one or two fellow students and one of the tutors, who provide (peer) feedback on it. I hope that writing such reports would improve the learning outcome and skill development of the students and also help them when writing the final report, which is required to pass the course. Furthermore, the students will have more practice in giving and receiving peer feedback, which has been shown to dramatically improve peer feedback (Panadero *et al.*, 2018). In addition, using an online system such as Peergrade enhances the peer feedback process by also allowing students to rate the feedback they receive and find out how their feedback was received. An important aspect to consider is how to best combine the weekly written peer feedback with group work and whether to have it within or across groups. To a certain extent, peer feedback already happens within each group, although it is not framed as such so far. So, it is up to us, the teachers on the course, to make a better use of the implicit peer feedback in the groups and scaffold it to make it more useful for the students them-

selves. Again, such peer feedback can also be seen as a formative peer assessment activity and we will be wise to consider the different categories of Gielen's inventory (Gielen et al., 2011) and Adachi's framework (Adachi et al., 2018) when designing, implementing, and communicating it to the students.

Conclusion and a personal note

Including a formative peer assessment and feedback activity for the first time in a project-based course with a lot of group work has definitely helped me further develop my teaching. Although there were some limitations, this first attempt was received well by the students, course responsible and myself as evaluated by the written feedback from the students and by us, the teachers, based on the content and quality of the students' questions and comments during the activity. Most importantly, we plan to introduce more formative peer feedback and assessment in this specific course.

Personally, I enjoyed preparing this activity and guiding the students through it. It was rewarding to see that they were enjoying it and that it improved their experience with the course as well as contributed to the development of their skills and general learning outcome. I also learned a lot from the interaction with my colleagues when designing the activity and from the feedback by my peers on this report. In the process of it, I was made aware of all the different factors that need to be considered for such an activity to be successful and I am looking forward to improving it further in the next editions of the course.

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A Feedback about the peer feedback

Q1: How did you experience giving peer feedback here?

- A1: Really nice process! People that worked with slightly different projects can give insightful feedback.
- A2: I think it is a nice way for everyone to provide general feedback in a productive way without taking intense amounts of time in the discussion
- A3: Super
- A4: I liked it very much. It makes everyone reflect on the results presented and also use it for our data.
- A5: I think it was really nice
- A6: I gained a lot of knowledge on hearing other peoples' process and considerations to why they have done what they did and what thoughts they had about it

Q2: Did you receive useful feedback?

- A1: Definitely.
- A2: Ja!
- A3: Yes, maybe not for my specific data (because it's not mine anyway), but very good ideas that I could use were thrown around, not just for my presentation, but also in others'. Very satisfied with the format.
- A4: I haven't for my data but I liked the questions and feedback on the general topic
- A5: Good interaction, I got some motivation about my project
- A6: of course, some questions help me get more insight of my data analysis
- A7: Yes I was very happy about the feedback on the trimming since other people have found a way to trim it even further that I will have in mind

Q3: Would you have liked to have more written peer feedback during the course?

- A1: Not sure how this could be done, but sounds promising.
- A2: Makes most sense after a presentation, so I think this is good
- A3: I didn't request much, but any time I posted on Absalon, I got a response very quickly, so I'm satisfied with it.
- A4: I think the feedback and answers to problems in Absalon was fine during the course and then a general one after the report.
- A5: I would however have liked a bit more explaining and discussion on fx fastqc results on an actual example. But it would not necessarily have to have been written. But it could also be to a small written interpretation from the students and then written feedback from you guys. Both could work