



Delft University of Technology

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### DOI

[10.21125/iceri.2018.1811](https://doi.org/10.21125/iceri.2018.1811)

### Publication date

2018

### Document Version

Final published version

### Published in

Proceedings of ICERI2018

### Citation (APA)

Gordijn, J., Broekhans, B., Dunn, K., & Ubacht, J. (2018). Increasing the effect of peer review. In *Proceedings of ICERI2018: 11th annual International Conference of Education, Research and Innovation International Association of Technology, Education and Development (IATED)*. <https://doi.org/10.21125/iceri.2018.1811>

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# INCREASING THE EFFECT OF PEER REVIEW

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## Abstract

Peer review is increasingly used in higher education, also at Delft University of Technology. Unfortunately, the potential of student-student feedback often appears to be undervalued, making it less effective. The quality of the reviews is not as good and they are less constructive than expected. Moreover, not all students take giving and or receiving feedback serious. Since 2005 the peer review process in the course Preparation Master Thesis has been continuously developing with the aim to increase the contribution of constructive feedback to the learning process.

In the course students learn the essential academic skills to write a research proposal. More than 1200 students have participated so far. Our objective is to support students in developing a suitable and feasible research design. For intermediary feedback on drafts and formative assessment, peer review (PR) is an essential element of this course. In the first years of the course the PR procedure was similar as well known in academic and other professional circles: students received collegial informal peer review of their ideas in class, and a more formal written peer review of the full draft of the deliverable. From 2012 the course was also offered fully online. Without class meetings, and far less student-teacher interaction the peer review procedure became more critical for the students' learning experience, since informal interaction was hardly arranged. Continuous evaluation led to adaptation of the peer review process in the course.

In this paper we reflect on the improvements that we have made over the years:

- to consider feedback seriously: rebut and asses the reviews
- to learn how to give constructive feedback: introduce a repeated review process, evaluating the reviews and assessing the rebuttal
- to structure feedback: using an assessment form, later a rubric
- to reduce peer pressure: using an anonymous review
- to improve trust, confidence and comfort: experiments with peer groups

Based on the most recent lessons learned we will discuss our latest project integrating the peer review process in a game-based learning environment. Based on the data and experience from the previous course runs we assume that game incentives will improve learning results as students are encouraged to engage in the interactive peer review process and further their professional behaviour giving constructive feedback. We aim to make this into an adaptable learning format for any programme that wishes to adopt a similar approach to increase the learning experience and effect of peer review.

Keywords: peer review, peer feedback, game-based learning, higher education.

## 1 INTRODUCTION – GET STUDENTS CLOSER TO THE PROMISE OF PEER REVIEW

Like all higher education institutions, the faculty of Technology, Policy and Management at Delft University of Technology aims to support students develop the academic skills needed to write their research proposal and to be prepared for research design and execution. Students learn about research methods and acquire research and academic writing skills in several courses in their master programme. However, doing predefined activities within the courses is quite different from independently developing a research design for the topic of their master thesis project. That is why we have been offering students the course *Master Thesis Preparation (MTP)* as a preparation for their final research project since 2005. In this course, as described by Ubacht, Broekhans and Enserink [1] in an earlier paper, the student acquires academic skills in order to develop a suitable and feasible master thesis project proposal on a topic of their choice.

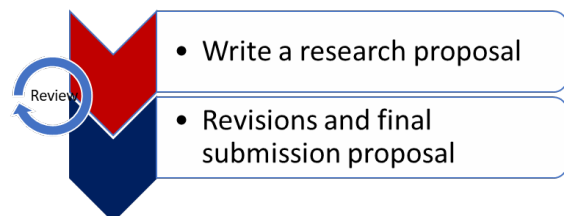


Figure 1: First course design

The first course design (fig. 1) mirrored the traditional review process, as common in academic journals and research funding procedures. Over the years the course has been continuously adapted and an elaborate peer review procedure has become an increasingly important element of the course and learning process. Learning materials stimulated and supported students to take reviewing seriously, review free from peer pressure, to feel comfortable and trust the reviewer, consider feedback seriously, to structure feedback, and to learn how to give and receive/deal with constructive feedback. However, students (about 200-250 per year) still perform very differently in the peer review procedure.

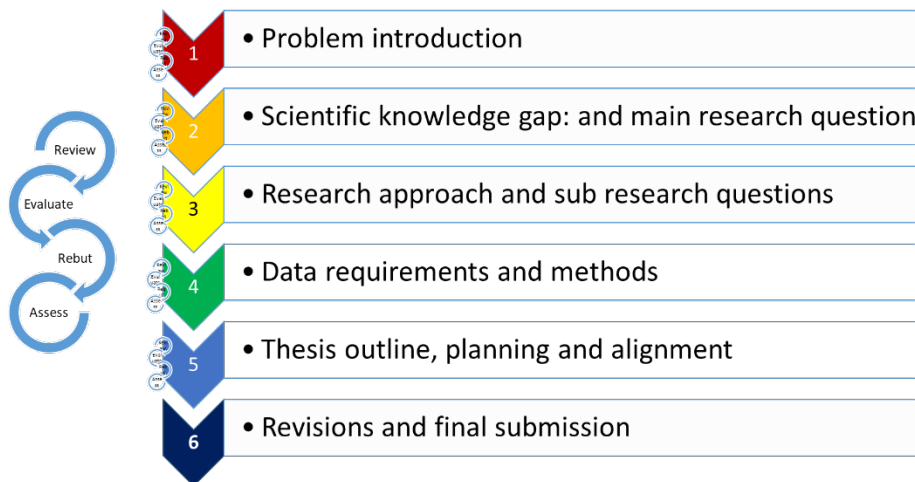


Figure 2: Current course design 2018

In this paper we reflect on the course design, informed by data collected from meetings and interviews with students and teachers in evaluation meetings and quantitative data from surveys (detail in section 3). We will discuss what constitutes effective peer review [2], such as active student participation, iteration and training, and enabling students to revise their work. In section 2 we present what improvements have been made over the years and why. During the academic year 2017-2018 we conducted student surveys and interviewed teachers on their experiences with the course. In section 3 we evaluate the most recent improvements made. We not only relate the most recent findings but also address “how” and “why” questions that will enable us to evaluate what has been done so far. Section 4 reports on the next improvement in our current project, integrating the peer review process in a game-based learning environment and on the design deliberations. We are now preparing a pilot to run the course in the game-based environment for November 2018. This project to improve the peer review process in the course even further by integrating it in a game-based environment was recently awarded by SURF, a government funded organization for education and research [3].

## 2 PEER REVIEW AS PART OF THE LEARNING PROCESS

In the course Preparation Master Thesis students are asked to write a draft research proposal that will kick-start their thesis project. The first course design expected students were already good reviewers. Over the years the PMT course evolved to its current set-up with a more elaborate peer review procedure. Experiences with and lessons learned from the peer review, and the increasing number of students in class and online in the course were the incentives to further attempt to gain greater peer review effectiveness. Students need sufficient and good quality feedback and support from their peers; teachers organize Q&A sessions and give summative feedback. The assumption is that adequate feedback will contribute to better research proposals, and thus to greater preparedness for the final research project of their master studies.

The next section describes the considerations that led to the changes in the peer review procedure. For each paragraph we discuss the issues that we encountered, relate these to literature, and explain the resulting design of the course.

### 2.1 Consider feedback seriously

The course PMT as taught until 2017 included learning activities to provide and receive peer feedback on the draft research proposal of two peers. However, we found that not all students spent

serious effort and time to review. To encourage professional behavior a peer review process was introduced.

In conversation with students and from course evaluations, we realized that students might not be fully aware why the peer review is valuable to improve their argument and results, during the course and in their future career. Therefore, students should become aware that learning to give constructive feedback is a learning objective in itself. We also found that students sometimes seemed to neglect the weaknesses addressed by the reviewers and submitted their final research proposal without adapting these. In discussion with students we noticed that many students do not accept that the reviewer is always right: if they do not understand an argument as intended, authors cannot neglect and blame the reviewer but should consider to improve the argument. Some students also tended to incorporate all comments, which often led to incoherency and inconsistency of their argument. Students should learn that it is not necessary to meet all comments, but they should try to explain, argue, discuss and rebut comments in a convincing manner. Our aim was that students take their time, deliver constructive feedback and consider feedback received.

The promises of using peer feedback in higher education are many [4]. It supports the learning process, its outcomes and learner autonomy. Peer feedback allows students to construct knowledge and understand the aim of the assignment through sharing and interaction. Various studies [5] show that the collaborative process of peer feedback is effective in improving writing skills. Moreover, giving and receiving peer feedback provides students with evaluative and generative skills.

In professional life peer review is an important element of academic research activities. On the one hand peer review is considered to maintain standards with experts in the field assuring the quality of the work of others. But also, peer review is considered to improve the quality of thought and published materials and both the reviewer and the author can learn from the experience [6]. That is why we think that going through the peer review process should mirror the task that a professional researcher undertakes. It followed that a first step towards improving the course was to emulate academic research aiming to develop professional and critical thinking skills. Students develop their argument and analytical and reflective capacity by first evaluating their assignment and then giving and receiving criticism and rebutting.

This is also in line with Bloom's taxonomy [7] which is often used in education to organize the cognitive processes by which learners encounter and work with knowledge. In this course it is not as much about acquiring knowledge, but using and connecting knowledge to be able to evaluate the resulting argument and create the research proposal. So, to encourage students to take it seriously, we explicitly defined peer review as a learning objective. We added resources relating to the standards of peer review; and stressed mutual dependencies and encouraged a critical but moderate attitude in the assignments. We extended the peer review process to explicitly train students to get to the higher levels of learning.

In the first years, the peer review procedure consisted of several steps: student submits the assignment; peers review; student rebuts. Then, peer assessment of both the review and the rebuttal was added to stimulate students to take it more seriously (figure 2). The intention was to force students to value the review and the rebuttal for their constructiveness. This procedure not only stimulates students to take reviewing seriously but also to support them to improve their reviewing skills.

## **2.2 Learn to give and receive feedback**

The original course design assumed that students who are nearly graduated would master peer reviewing and scientific arguing. We expected them to be experienced in both giving constructive feedback and dealing with critical comments. That is why the assignment consisted of only reviewing the full draft. This was considered to be sufficient to improve their argument and the draft research proposal. We had to reconsider our assumption and decided to introduce an extended peer review process in order to facilitate learning how to write constructive comments and deal with feedback.

Students also experienced downsides of the single peer review at the end of the original course. Firstly, it is rather time-consuming, especially when the deadline for the reviewer's own deliverable is nearing. Students could not really pay adequate attention to all elements and details of a full research proposal. Also, they felt that evaluating would be easier if they were able to discuss the feedback received. Third, revising their work in a single shot appeared to be difficult. We concluded that the peer review process should be further improved so students would learn to give and receive feedback.

To further facilitate learning to review, we opted for a three-way solution. First, the assignment to write a research proposal, was split into 5 smaller learning modules; one for each element of the research

proposal. This did not change the (order of) the learning materials and structure of the course; only the structure and size of the assignment needed to be redesigned. This assignment structure allowed the review process for each learning module to be repeated. In this way, students would give and receive feedback 5 times during the course, receiving the first feedback early so they could improve their work; and argument incrementally. Second, the peer review process was explained and organised step by step to further stimulate students to reconsider and improve their argument. Each submission would receive a review, that had to be rebutted: the student considers the comments received and explains to the reviewer how they will incorporate the feedback. And finally, we introduced two extra assessment steps in the peer review process to stimulate a reflective attitude and progress awareness (also see 2.1). After receiving the review, the reviewee has to evaluate the feedback they receive: its style and tone of voice, supportiveness and adequateness. Likewise, after reading the rebuttal, the reviewer assesses the comments.

All in all, the final assignment was now split up in 5 smaller assignments which are all to be peer reviewed during the course (figure 2). In this way the review process is iterated 5 times to create the so-called spacing effect which has been shown to boost retention [8]. We also provided additional educational resources to support students to become better reviewers as they go through the process. Students could rewrite their proposal in steps during the process before submitting a final version for assessment by the teacher. According to Nicol et al [9] this helps close the performance gap; students improve their work using what they have learned from the feedback activity. This would also encourage higher levels of motivation and self-esteem. The aim is that by scaffolding the course in this way students become more confident about their own and reviewer's expertise and skills.

We expected this adaptation of the course to spread the workload, facilitate intermediate improvements of the storyline/argument, increase variety of perspectives (the number of reviewers is now increased from 2-10), support students to improve their reviewing skills, satisfy reviewers through valuing their effort, stimulate students to argue (instead of please reviewers or neglect comments) and to gradually improve towards the final assignment. The peer assessment adds to their grade to encourage and to make their learning curve explicit.

### **2.3 Structure feedback**

After several years, we started using a review form for students to fill in and reply to the author. Students had to hand in the completed forms with their final submission and account for how they had dealt with the feedback.

However, this was still not as effective as we had wished. Submissions were sometimes sloppy and the reviews appeared to cover a wide variety of topics. Both as a reviewer and reviewee students mentioned that the level of detail and topics of feedback were various among them. Also, some students felt that comments were not always clear enough to improve their work. Students felt they missed indicators and a frame of reference on what is considered relevant. Students did not always consider their peers to be able to give the same feedback as their teacher.

We felt that students do not seem aware of the fact that they have prior knowledge from other courses to actively use. Moreover, they expect the topics and criteria of their feedback to differ from teacher feedback. We realized that if we want students to give structured feedback on all topics considered relevant, according to shared indicators, the instructions for what the review should be like could be more extensive.

This relates to one of the principles of good feedback practice identified by Nicol et al [9]. This principle notes the importance to clarify what determines good performance. This can be done using a rubric for example, which is what we did: the review form was replaced by a detailed rubric for students to fill in. Elements of the rubric compare to the – existing – rubrics to assess literature review and the master thesis research project. Similar criteria and values are used with an emphasis on arguing, and professional standards of proper referencing, language proficiency and academic writing. This would activate students' prior knowledge and expert judgement and point out and guarantee that students use the same criteria as the teachers. Using the rubric should thereby increase both structured comments and the reliability of the peer feedback.

### **2.4 Reduce peer pressure**

In the previous years we had noticed that students did not always appear motivated to provide critical feedback. In evaluations students would mention that they were hesitant to criticize friends, and

prejudiced about (the feedback of) high/low ranking class mates. In response, we tried both anonymous and known reviewers. On the one hand students did seem to have less confidence in each other's reviewing skills and being anonymous did not make up for that. They did not know whose feedback they received and were unclear of the level of expertise of the reviewer. And since they did not know each other, they felt a lack of responsibility towards the author they were reviewing. On the other hand, students sometimes wanted to remain anonymous as they felt they could not be as truthful if their peers knew who they were. Being classmates, friends even, they could not really be critical and their behaviour would be too moderate to be really supportive.

Literature confirms that social factors may have both positive and negative effects in the peer review process [4]. Social pressure can cause stress or unwillingness to share and students might not want to provide critical feedback. Also, trust, both in the peer and in oneself, is needed for the peer review to have educational value. When students consider their peers as experts they will accept each other's feedback sooner and apply it to their own work. This means they need to perceive their peers as reliable and trustworthy reviewers. However, students may be biased due to existing peer relations and this will have an effect on the quality and usefulness of the feedback. Studies have shown [10] that at first students are not always confident in their own ability or their peers' ability to conduct assessment in a fair and responsible way, although there is a positive shift over time in their attitudes as well as their confidence. However, students do find it hard to criticise their friends, which may lead to overmarking. Anonymous peer reviewing could make it easier to provide objective and more critical feedback.

We decided to use the anonymous peer review in large peer groups which allowed to automatically assign 2 peers per submission. With the proposal being divided into 5 parts this meant that for each assignment 2 new peers reviewed: leading to 10 peer reviewers in total.

## **2.5 Trust, confidence and comfort**

In evaluations of previous runs students mentioned that they had less trust in the judgement of their peers; they did not consider their peers experts and pleaded for teacher feedback. On the other hand, teachers consider students near-experts in the second year of their MSc studies. Moreover, students lacked confidence and did not consider themselves nor their peers capable. As mentioned earlier, they were annoyed that they made a lot of effort, and did not get much in return. Apparently, they did not experience the reviews they received to be an exchange for the reviews delivered. We also noticed that they did not experience the feeling of being part of a community, looked after by a teacher.

Uijl et al [11] refer to social cognitive theory to show that social interaction between both learners and teachers and learners among themselves is key to educational success. It is important for learners to be accepted by their peers. Being part of a trusted community can significantly affect student learning and stimulate the learner's motivation to complete the course.

In short, we realized that in our course students' confidence, comfort and trust in themselves and each other needed to be boosted to achieve higher quality peer review. To do so, we experimented (not all at once) with:

- Small and simple quizzes about style of comments, tone of voice, typical and shared study characteristics to confirm students' professionalism.
- Weekly announcements to show and report on teacher attention and moderation, and to initiate online community building. We offered feedback notes on feedback and (online) consultancy conferences. Evaluation and analytics showed that both teacher activities were noticed by students, but hardly led to student reply or participation.
- Extra announcements and feedback supported informal student-teacher and student-student interaction. Students were invited to teleconferences and to ask articulated questions about the assignments (we were not open for general questions to review their work). Both happened incidentally; and staff moderation capacity did not reach its limits. Besides, students reported informal contact outside the (virtual) class room via social media or f2f contact.
- Large peer groups of 15-40 students that shared expertise based on the core of the MSc program.
- Small peer groups of 5-8 students fascinated and with knowledge about similar research topics, such as energy transition or infrastructures. From student feedback we learned that such topic groups increase trust in expert judgement, but also tend to focus on content details and less on argumentation.

In this way the focus was on professionalism to support confidence and trust, on online teacher presence to activate community feel and comfort, and on an expert community with peer groups to increase trust

in expert judgement. In previous years students reported that peer pressure did increase when smaller peer groups were formed.

Overall, our assumption is that if the course peer review procedure is improved, the peer reviews, student's professional attitude and behaviour and eventually the deliverable, i.e. students' research proposals will improve. In the next section, the peer review procedure is evaluated to take lessons for the next improvements in the course.

### 3 EVALUATE PEER REVIEW ATTITUDE

In the previous section we discussed the issues that led to adaptations in the course to increase the effect of peer review. In this section these changes are evaluated to consider remaining issues.

In the first semester 2017-2018 the course ran 4 times<sup>1</sup>, with 6 teachers and approximately 215 students in total. We gathered qualitative data during evaluation meetings (3 mid-term meetings and 1 afterwards with students, and 3 with teachers), providing an insight into the experience of students and teachers and their needs for further development. Additionally, surveys directly after the courses finished provided quantitative data: 2 regular student evaluations about the course in general (Evasys, 29 respondents in total), and 4 extra student surveys about the peer review process in particular (42 respondents in total). Although the response rate is low and probably not representative and the deviation is relatively high, the data indicate some issues. Overall, respondents appear to be moderately positive about the course as a whole. Students appreciated the structure of the course, materials, assignments and peer review: *"The structure of the course, based on the paragraphs of the ultimate research proposal, is quite good"* (Evasys SEN). Although the Evasys survey did not exclusively ask opinions about peer review, the results indicate experience and attitude.

Below we discuss the use of the peer review process in the course environment. Each section describes how students and teachers evaluated the current process. We briefly reflect on their experiences and consider what issues need to be further improved.

#### 3.1 Rebut and assess reviews

The elaborate peer review process in 4 balanced steps (review, evaluate, rebut, assess) aimed to support students to take advantage of reviewing and to improve students' reviewing skills (see 2.1). We argued that if students not only spend time and effort submitting and reviewing, but also evaluating the reviews they receive and rebutting their peers' feedback and finally assessing the rebuttals, they would learn to use and value peer reviewing; and their reviewing and argumentation skills would develop.

*Table 1. Average agreement to statements relating to: "The aim of the redesign was for you to both learn and improve giving feedback."*

<b>Learning to give feedback</b>	<b>Mean (Likert Scale 0-5; N=42)</b>
It was useful to read other students' submissions	4.02
It was helpful to read how others reviewed my work	4.00
Reviewing was helpful to reflect on my own work	4.05
Reviewing and rebutting improved my argument	3.57
Evaluating and assessing improved my constructive feedback to others	3.52

<sup>1</sup> In the MSc programmes Engineering Policy Analysis (EPA), Complex Engineering and Management (SEN, ran 2 times), and for students on exchange.

Both Evasys and survey results indicate that students felt that it was valuable to have the extended peer review process in the course to reflect on their own work and to develop their final assignment. The survey results show that a majority considered it useful to read other students' submissions. Many thought it helpful to read how others reviewed their work and replied that reviewing was helpful to reflect on their own work. The added value for their own arguments is less recognized. Based on opinions about peer assessment, there seems room to further improve the learning experience of peer reviewing.

From the comments and the interviews with students and teachers it became clear that students experienced the process as still rather time-consuming; with a large number of deadlines; and peer dependency keeping from individual progress. All in all, most students found that the intermediate feedback helped them improve the steps that followed. We need to reconsider:

- reducing the number of deadlines. In the second semester we already set the same deadline for time consuming assignments (review/rebut) and quick ones (evaluate/asses), which was appreciated by students. It also may reduce the experienced time consumption, and mutual dependency.
- deleting the rebuttal and assessment steps as suggested by some. However, we intend to keep the balance between evaluating the peer's review and also explaining how the feedback is used. And also the assessment symmetry since reviewees assess reviews and reviewers assess rebuttals. Instead we want to steer towards students' recognition of the added value of explicit rebuttal to their argument, and insight in their 'review' learning curve.
- increasing return on effort. This can be done for example by sending an automated message after submission of the review and rebuttal thanking them for doing so and reminding them that it is the professional way to reply to feedback.

### 3.2 Repeat the review cycle

The peer review process consisted of 4 cycles, carried out for each of the 5 elements of the final assignment, the research proposal. Spacing the peer review steps in this way are all part of the scaffolding to support the students in gradually becoming both better arguers and better reviewers.

In the student survey a slight majority (mean 3.07) reported an improvement of their peers' reviewing techniques. Some mentioned that the quality of the reviews was inconsistent. Teachers observed that students assessed each other more extreme in the first cycles, but that the peer assessment was converging over time. Teachers checked extremes and noticed individual improvement. In the latter cycles fewer students delivered poor reviews and or rebuttals, even after contact with a teacher.

By evaluating and assessing their peers, students could gain or lose points that could lead to a teacher appointment to discuss specific questions. Teachers noticed that only few students did so. However, in the special surveys, students mentioned they missed the teacher feedback. "*The only feedback one can receive is from other students who have a rush due to strict time limits*". Also, some students and teachers mentioned that the alignment between the review criteria (radio buttons) and comments (text box) was often incoherent. Some students commented that they were not always sure on whether to review/rebut the content or the reasoning. With regard to this feedback:

- Students could be facilitated with a better learning experience and progress overview to monitor development of reviewing skills.
- We consider adding rewards for example for quick responses, improved skills, word count.
- We consider introducing the option to have 1 of the 5 reviews for each student done by a teacher. The question than raised is how to distribute these.
- We agreed that the rubric itself should provide a clear indication of what to pay attention to when reviewing. However, rubrics are to some extent subject to interpretation. Both students and teachers mentioned after first use, that the assessment criteria were vague. Therefore, the rubric needs to be revised again. Besides that, the instructions for the rubric, provided in the course, should be revised accordingly.

### 3.3 Use of a rubric

The rubric serves to increase both structured comments and the reliability of the peer feedback. The rubric we developed focusses on scientific arguing and academic writing rather than specific content. It intends to increase the reliability of the peer feedback and to provide structure for students' comments.



Students mentioned in the survey comments and in meetings that they would like to have examples of good and bad submissions and reviews. Literature also [9] suggests providing examples in order to elucidate what good performance is like. After having a closer look at the rubric-based submitted review forms it was observed that many statements were jotted down. That may clarify why students would like to discuss with reviewers instead of rebut only. Teachers suggested to stimulate more argued feedback, although rubrics can be quite complex and difficult to articulate [10]. We are considering:

- adding examples and or small exercises to show good performance. For example, a quiz could help to actively reflect on the constructive quality of feedback and structure of arguments.
- minimizing the word count in the text box, and changing the order in the feedback form to comments first, and scoring in the end to ensure more in-depth feedback.
- making it possible to discuss informally instead of the more formal rebuttal, as it might be difficult to comment on arguing in a relatively small review assignment.
- some didactic changes in the rubric to reaffirm the use of doing the reviews and rebuttal. For example, adding a reflection statement to make a note to oneself of what can be learned from reviewing a peer that can be used for one's own work and to remind the student to use what they wrote in the rebuttal for revising their draft. These ideas were developed during the evaluation sessions with the teachers.

### 3.4 Anonymous reviews

To make sure that reviewers were able to provide constructive peer feedback without experiencing peer pressure we decided to use randomized anonymous peer review in large peer groups. It was allowed for students to use their name in the submission if they wanted to discuss their work.

Each submission received at least 2 reviews from peers from the same programme. This ensured sufficient quality and feedback, knowledgeable reviewers, and multiple perspectives and variation in the reviews. Nevertheless, some students said they would have liked to have been assigned to peers addressing similar topics. We are still exploring the adequate balance between content and skills. Both students and teachers mentioned that meaningful interaction about their assignment, outside the online learning environment, was quite limited. Teachers and students said to be open to discussion. However, it turned out that in real life few students wanted to reveal themselves as a result of the anonymous peer review process.

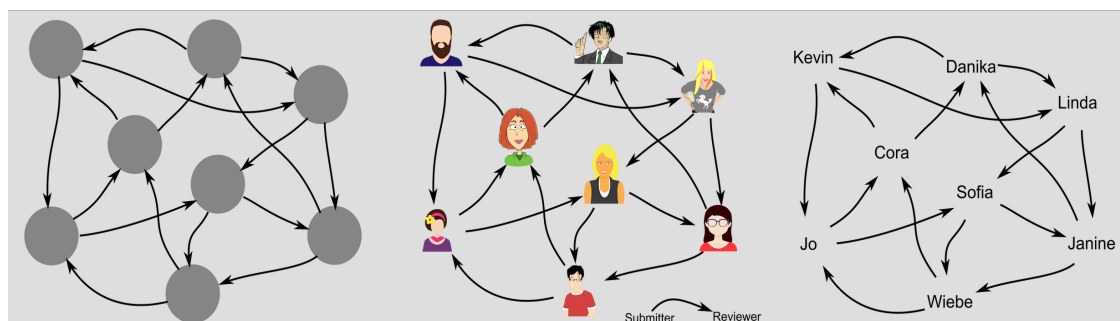


Figure 3: Example of community of avatars (middle) as compared to anonymous (left) or non-anonymous (right)

So, in the course – in various formats over the years – it appeared impossible to overcome the performing disadvantages of anonymity or distinctiveness. Can anonymity issues be avoided if students get to know each other in another way? As shown in a study using roleplay [13] learners would not feel peer pressure if they adopt a role. This strategy relieved the interpersonal burden often linked to critiquing peers' work. Likewise, if our students were to meet and review as avatars in a game setting (fig 3), they may not experience peer pressure and be able to deliver honest reviews. They could also interact and discuss their work informally.

### 3.5 Peer community experiments with peer groups

Section 2.5 discussed peer group experiments to stimulate professionalism and support confidence and trust. We aimed to incentivize community feeling by both teacher presence and peer selection to increase trust in expert judgement. It should be considered that multiple teachers were involved in the course, all with their own style and preferences, to do so.

The runs in the first semester 2017-2018 selected peers from the same Master programme. The Evasys surveys show that students felt they were part of the community. In meetings and interviews it was confirmed that a community contributes to a comfortable study climate, helps to trust expertise, give and take, dependency and moderate behaviour. Both students and teachers expect that informal contact enables discussion and taking feedback seriously, but it is hindered by anonymity.

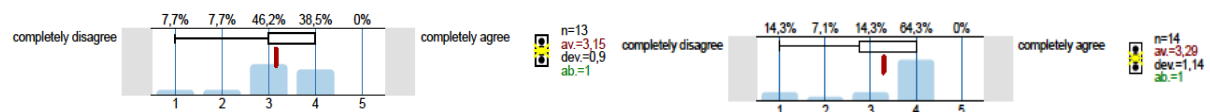


Figure 4: In reply to “I felt part of the academic and social community of this course” SEN (right), EPA (left)

However, in the special surveys it was mentioned more than once that there was “little to no direct interaction with our peers because of how the peer review system is set up. This course made me feel quite isolated from the academic community”. Two contradicting signals. Again, we felt limited to stimulate engaging community and encourage informal interaction in class (although we are ignorant about student interaction outside class). A course community could be a setting for students to do their formal peer reviews and have an informal – but relevant - chat.

#### 4 PEER REVIEW IN A GAMEBASED LEARNING ENVIRONMENT

Based on the experience and insights from previous course runs and the evaluations of the peer review in last year’s course, we concluded that it is increasingly successful to support serious work, quality of peer review, learning to give and receive feedback. However, the peer review procedure needs fine-tuning by reducing the number of deadlines for students, combining time-consuming tasks with relatively small ones; demonstrating student progress; simplifying the teacher overview to follow individual learning curves and facilitating tailored support. Students need learn-to-argue support: more interaction may reflect debate to improve arguing. Also, a community is paramount as more interaction builds relationships, which increase trust, confidence and comfort in the learning environment. The current set-up of the course facilitates constructive feedback from a technical point of view. However, in particular the anonymity of the reviewer hinders motivation, trust, collegial interaction, critical and constructive feedback and debate. Notwithstanding the improvements, anonymous peer review in its current form is sub-optimal, and leaves issues relating to peer pressure and comfort, confidence and trust unsolved.

Comfort, confidence and trust are typically encouraged in a community, but this conflicts with anonymity of those involved. In literature and discussion about gamification in education [12, 13, 14], we searched for a solution. We learned that various game mechanisms may encourage interaction, incentivise debate playfully, support comfort, demonstrate progress and increase confidence. As noted by Hamari [14] there are not many well-established theoretical frameworks yet as it is early days for gamification. We feel that maybe most important an avatar can be part of a community anonymously in a course like ours. That is why we will explore gamification to find whether it is a way to enhance students’ learning experience.

Our next project is to embed the course design and peer review process in an interactive, realistic game-based learning environment (GBL) to limit the undesired effects of anonymous peer review and to further community, interaction and professional debate. This GBL should reduce the complexity that multiple tools and platforms raised for students and staff in the current course. More important, the GBL may be a safe and comfortable learning environment with a community of students. Safe because students can meet as avatars. This anonymous but familiar actor can give and receive formal and informal feedback from both students and teachers.

We will pilot the use of avatars in the GBL to reduce peer pressure, create community feeling, improve reviewing skills and support collegial and professional behaviour, because:

*Avatars are anonymous:* In the peer review procedure, avatars may criticise each other (formal feedback) without social pressure and or personal (future) implication outside the (virtual) class room. As it happens avatars do not have past or future relationships, only the current exist. Research [12] confirms that peer pressure may decrease.

*But part of the community:* Avatars can know each other and interact. In the GBL avatars can also meet informally, in a campus-like situation like the library or coffee corner. This will encourage informal interaction and debate between students and with teachers. Moreover, in an online GBL, interaction does not necessarily happen at the same moment in the same place, which allows flexibility which is in

favor of students studying abroad. We expect an online community will increase informal interaction, discussion and as a result raise the quality of arguments.

*Adequate support increases:* The course becomes more flexible, scalable and the possibility that students get feedback and support from their peers at the very moment they need it, will increase.

*Adequate behaviour can be recognised and develop:* gaming mechanisms like challenging exercises, collaboration, competition, direct feedback, awards and leaderboards can stimulate student activity. Interaction like critical debate, inspiration, arguments, constructive feedback, rebuttal, peer assessment, equal relations will raise team spirit (collegiality) and professionalism.

It may be expected that learning to review as an avatar in the GBL community will provide a safe and comfortable course setting. Students will become aware and learn to value and deal with the quality of their own and their peers' reviews. More serious and good quality feedback should help them to gradually improve their argument and deliverable, and inspire to provide similar feedback. The pilot is meant to evaluate whether such GBL conditions will indeed manage to support all learning objectives, and encourage students to take advantage of that.

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