Deep Learning through Peer Feedback in Higher Education; a Manual for Teachers

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1) Introduction & outline

The core task of universities is to enable deep learning in their students. Deep learning involves critical thinking, making new connections between different concepts and integrating what has been learned into what the student already knows (Biggs, 1999). Deep learning is often contrasted with "surface learning", the latter being characterized by memorization mainly aimed at passing a test and resulting in rather quickly forgetting what has been learned. Only when students are encouraged to adopt deep approaches to learning, high quality learning outcomes, such as analytical, conceptual & critical thinking skills can be achieved (Biggs, 1999; Ramsden 2003; Biggs & Tang 2011). Literature in higher education focuses on strategies to motivate and encourage students in this process of deep learning, often in small groups with intensive contact between students and teachers. Over the past decades the number of students in universities and in courses has increased which makes intensive contact with teachers more difficult. Therefore additional strategies are required to meet the goal of reaching reach deep learning. One of the strategies that became more relevant, also in relation to increasing student numbers in courses, is peer-feedback. The act of giving and receiving feedback between peers has a number of advantages: comments may be more accessible, you learn the criteria on which your own work will also be assessed, you will think more critically about the comments and suggestions you receive from peers in comparison with feedback received from teachers. Teacher feedback is often interpreted as the opinion of an expert and therefore accepted without much critical thinking.

The use of peer-feedback was recently shown to be an efficient strategy to stimulate deep learning in students in online courses (Van Popta et al. 2017; Filius et al 2018a, 2018b, 2019). These students were shown to think more critically, relate new ideas to everyday experience, relate ideas to each other and create new concepts.

In this manual, we will give you a method for implementing dialogic peer-feedback into your courses. This method has been piloted in 10 different courses within three different faculties. This has helped us to shape the method and provide you with the key sources to implement this into your course. From experience, we know that every course is different and all written assignments are different. It is therefore of upmost importance that you know which learning objectives you want to achieve with your assignment. Only when these goals are clear, you can start thinking about the process of implementing peer-feedback.
We will give you an infographic with all the steps of the method, plus extra tips on implementing all the steps. Then, we present the design of two short workshops with the following aims: 1) to prepare students to give feedback in an effective and constructive way, 2) to assume an attitude to receive feedback efficiently and tp pay special attention to the structure and clarity of argumentation in written assignments both when providing as well as in receiving peer-feedback. These workshops can be used in your course to help shape the written assignment in your course.

In order to implement dialogic peer-feedback, a number of online tools are available. A Table is presented from which a tool can be selected which appears to be most optimal for the type of product you want your students to provide peer-feedback on. All of them have advantages but also specific limitations. In this Table tools that are currently most often used, like Peergrade, Feedback Fruits, Pitch2Peer and Blackboard, are compared based on a set of criteria. At the University Utrecht, Educate-It is able to help you in

your choice and support you in using the tool. From what we heard many teachers expressed positive experiences over the past three years with the tool Peergrade when using writing assignments.

In addition, in the Appendix A-B, information is provided which can be used for students as well as for teachers. A factsheet on Peer-feedback and Deep learning can be used as a handout for students both to motivate them to provide feedback but also as a short guideline with some do's and don'ts on how to give feedback in an optimal way.
A factsheet for your fellow teachers may be helpful to provide them with some essential information on the benefits of peer-feedback.

In Appendix C, we provide you with a short review of the latest literature on Deep Learning and Peer-feedback. Here, you can find the academic sources that back up the provided method.

In Appendix D, we share a best practice from our project. We have experienced that students are best able to provide peer-feedback if they are analyzing the text of their peers using a predefined set of questions that will guide them to focus on the most important aspects of the paper. These questions have been formulated with the rubric and/or learning goals in mind that are used by teachers to assess the specific assignment. We include the set of guiding questions for different sets of writing assignments: 1) minireview for first years students, 2) a paper in a level 2 course, 3) the bachelor thesis to be written at the end of their undergraduate education. Also, a set of questions to provide peer-feedback on an interdisciplinary paper is added.
Moreover, some information is added that was used to evaluate the impact of peer-feedback on deep learning and its mechanisms: A questionnaire for students to be filled in during a course when the dialogic peer-feedback assignment was finished. The set of questions we used in Focus group meetings with students to get an (qualitative) impression of the extent to which peer-feedback stimulated their deep learning.
Finally, in Appendix E we give the summary of the PhD thesis by Renee Filius (Utrecht University) is provided, since these studies further stimulated the use of peer-feedback both in online and on campus courses. This thesis has been the inspiration for the project.

We hope you enjoy this teacher manual and all the other sources we have provided.

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Fred Wiegant & Rianne Poot
(project leaders)

2) Short explanation of Dialogic Peer-feedback

For this peer-feedback intervention we have designed an infographic that helps visualizing the steps. As you can see, there are three actors: the teacher, the student and the peer-groups. Now each of these actors have specific roles during the intervention.

The process of the intervention can be described in three different phases, although these phases contain small steps.

Phase 1: The feedback training + writing

Phase 2: Workshop peer-feedback + Providing peer-feedback*

Phase 3: Workshop receiving peer-feedback + discussing the peer-feedback + rewriting

* When necessary, phase 2 can be repeated several times.

Phase 1:

In this phase, teachers need to provide clarity on the learning objectives of the writing assessment. However, we have to acknowledge that every course is different. In our project we have seen Bachelor-1 courses that paid a lot of attention to explaining the assignment and Master courses where only a short outline of the assessment was given.

Do: Understand your audience. What do students need in order to feel competent to do the assignment and motivated to start working on it? Maybe you need to spend some of your lecture time explaining *why* peer-feedback is useful and what kind of things you expect as a teacher. Maybe your students have a lot of experience with peer-feedback and deep learning, so you can only provide your objectives and the fact sheet.

Don't: Overestimate what students know about written assignments. Every assignment is different and the more clarity you give on the final objective (via *feed forward)*. The more equipped they are to write a first draft.

Phase 2:

In this phase, teachers need to provide clarity on how to provide peer-feedback (in relation to deep learning). We have developed materials to help you with this: a short knowledge clip, a powerpoint presentation and a factsheet (see below for more explanation). These can help to shape student's understanding of why peer-feedback and deep learning is important.
Afterwards they can provide peer-feedback via an online platform.

Do: Give the information in multiple formats. Students tend to appreciate the fact that they can watch or read the (already given) information, just before or during peer-feedback.

Don't: Overestimate students' experience. Most students have had some experience with providing peer-feedback, but might not have taken the process into account. As a teacher, it is extremely powerful to explain students what it is they can gain, while providing peerfeedback.

Phase 3:

Receiving and responding to the feedback. This final step is crucial in order to reach the full benefit for the receiver. Only when required to react will the receiver think critically about whether or not the suggested improvements are really meaningful and worthwhile to implement. The receiver should also be able to ask for clarification to which the provider can then respond. This may encourage an academic dialogue.
To prepare this important step it can be useful to prepare students for reflection and reaction to the feedback received with some additional information. This is explained in short powerpoint presentation and knowledge clip (see below). Here we have illustrated with some clarifying examples on how to react to peer-feedback, ask for additional information and finally implement the peer-feedback to improve your assignment.

Do: Encourage to seek the dialogue. Research shows that dialogic feedback is a powerful tool for deep learning (For more information, see Appendix C).

Don't: Underestimate the difference between anonymous and non-anonymous peer-feedback. Depending on the tool that you have chosen, students might need to provide non-anonymous feedback. From our focus groups, we have heard that bachelor students in their first year(s) can feel anxious about that.

3). An overview and/or short description of Workshops

In order to cater to your needs we have provided important information for the students about the process in different formats. We strongly suggest using the powerpoints provided during your course. This way you will be able to better connect the assignment to the rest of the course. However, we have also developed a knowledge clip that you can share on you learning platform and that students can watch at home. Also, we have provided factsheets and links to useful Clips to facilitate the process of Dialogic Peer-feedback.

3a). Workshop/werkcollege 1: How to provide peer-feedback

This short workshop provides students a reason why they need to learn how to give peer-feedback, what we mean with deep learning and how they need to provide peer-feedback. Tips are given on providing feedback on structure, specific parts of the assignment and details. Plus, students get tips on using the right tone of voice in their peer-feedback.

Available materials:
1. Powerpoint with comments for the teacher,
2. a knowledge clip generally explaining the powerpoint
3. a factsheet on providing peerfeedback and deep learning.

Meanwhile, if you want to provide students with other sources, you could look at the sources below.

Videopitch Renée Filius about research on deep learning via peer-feedback
https://www.youtube.com/watch?v=2lLPzLOtFKQ&t=1s

Improving learning via peerfeedback – Uitgeverij Deviant
https://www.youtube.com/watch?v=K6lwCIiDz0A

Knowledge Clip Peerfeedback
https://www.youtube.com/watch?v=EgQIq7Fds4g

Interview Esther van Popta, on the benefits of online-peerfeedback.
https://lerenvantoetsen.nl/de-kracht-van-online-peer-feedback-interview-met-esther-van-popta/

3b). Workshop/werkcollege 2: How to receive peer-feedback and start an academic discussion about it

This short workshop provides students tools to receive peer-feedback. Receiving feedback is never easy, and students can become quite scared. However, we have provided students with tools to be calmer and take more distance.
We help them realise how important emotion management is, in order not to lose the focus: It is possible that the tone of the feedback is somewhat invalid, but the message behind the feedback is true.

Therefore, we give tools to critically analyse the given feedback and make a plan for communicating with your peer.
After the discussion students are asked to make a plan to start working on their final draft: what feedback do they need to do first, what are they going to do last and what feedback they won't use to improve their work.

Available materials:
1. Powerpoint with comments for the teacher,
2. a knowledge clip generally explaining the powerpoint

We have experienced that this type of exercise is quite difficult for first year students. Therefore we have provided you a Good Practice from our project, where students are helped with every step of the way, with very good results!

Good Practice: Analyse van de ontvangen peer-feedback:
Jullie hebben inmiddels feedback gegeven op twee verslagen en jullie ontvangen vanavond van twee medestudenten feedback. Ga altijd kritisch om met de feedback die je krijgt. Klopt de feedback volgens jou? Ben je het ermee eens? Is de feedback relevant? Ga je jouw miniscriptie aanpassen naar aanleiding van de peerfeedback? Bij het lezen van de feedback die je hebt ontvangen is het goed je weer te realiseren dat goede feedback aan de volgende eigenschappen moet voldoen:

- Constructief (uitleggen waarom je iets vindt, voorbeelden noemen, verbetertips)
- Specifiek/helder
- Kritisch
- Vriendelijke toon
- Subjectief ('ik' vorm)

Om deze opdracht goed te laten verlopen, moeten jullie de onderstaande stappen in Peergrade volgen.

1. Zodra de feedback open staat, lees je de feedback kritisch door en geef je hier commentaar op. Dit doe je eerst voor de feedback van persoon 1, dan persoon 2. Als je bij deze twee feedbackgevers commentaar hebt gegeven, wordt de feedback van beide personen pas tegelijk zichtbaar. Maak bij het geven van commentaar op de feedback gebruik van de volgende mogelijkheden:
   - Geef een "Like" als de feedback behulpzaam is.
   - Stel een vraag aan de feedbackgever als de feedback niet duidelijk is, dit doe je door een antwoord op een vraag te "flaggen".
   - Geef commentaar als je het niet eens bent met de feedback, ook door te "flaggen'.
   - Op het eind worden twee vragen gesteld over de feedback. **Het beantwoorden van deze vragen is verplicht!** Dit telt ook mee met het cijfer voor de feedback.
     - De eerste vraag is een multiplechoicevraag "How useful was the feedback?", beantwoordt deze vraag zo eerlijk mogelijk.
     - De tweede vraag is een open vraag "Additional comments". Jullie moeten hierbij een stukje tekst typen waarin jullie aangeven in welke mate er aan de onderstaande punten wordt voldaan met een toelichting erbij:
       - Constructief (uitleggen waarom je iets vindt, voorbeelden noemen, verbetertips)
       - Specifiek/helder
       - Kritisch
       - Vriendelijke toon
       - Subjectief ('ik' vorm)

2. Kijk of er vragen zijn gesteld over de feedback die jij hebt gegeven op een miniscriptie. Beantwoordt deze vragen zo goed mogelijk.

3. Vergelijk de peer-feedback die je hebt gekregen. Vul vervolgens het verbeterpuntenplan van je verslag in op de volgende pagina.

Verbeterplan Miniscriptie naar aanleiding van de peer-feedback

Naam student:

Benoem de twee punten waar de meeste feedback op is gegeven in jouw verslag:
1.
2.

Schrijf in elk kader welke punten je voor je eindversie wilt verbeteren:

Titel / Inleiding

Middendeel

Discussie/ Conclusie

Onderschrift figuren

Schrijfstijl

Overig

4. Lees hoe studenten jouw feedback hebben beoordeeld, welke drie punten vallen daarin het meest op:
1.
2.
3.

4). Tools to facilitate peer-feedback;

Wat in alle (peer)feedbacktool van Educate-it mogelijk is:

- Zowel individuele als groepsopdrachten inleveren en van feedback voorzien
- Niet-anoniem (peer) feedback geven
- (Peer) feedback geven met eigen rubrics of beoordelingscriteria
- Feedback geven door docent

Verschillen tussen de tools zijn in onderstaande tabel te vinden.

Geschikt voor:	**Blackboard Peer assessment**	**Pitch2peer**	**Peergrade**	**Feedbackfruits 2.0: Peer Review**
Korte schrijfopdrachten: essays, blogs etc. (max ca. 3000 woorden)	Ja, in BB zelf of als bijlage	ultrakort (blog)	ja	ja
Langere schrijfopdrachten: papers, scriptie etc. (ca. 3000- 10.000 woorden)	Ja, in BB zelf of als bijlage	nee	ja	ja
Video-opdrachten	Ja (embedded of als bijlage)	ja	ja	ja
Powerpoint presentaties	Ja (embedded linkje of als bijlage)	ja (als pdf)	ja (als pdf)	ja
Audio, embedded content	Ja (embedded of als bijlage)	ja	ja	ja
Anoniem pfb geven	Ja	Ja (afh. van opdr)	ja	ja
Inleverende student anoniem	Ja	ja	ja	nee
Feedback in de vorm van annotaties bij de tekst	Nee	nee	nee	ja
Cijfer beoordeling door peers	Ja	nee	ja	ja
Cijfer beoordeling door docent	Ja, docent stuurt cijfer naar Gradecenter en kan in het Gradecenter het cijfer aanpassen.	ja	ip niet (wel mogelijk met workaround)	nee
Student kan reageren op ontvangen feedback	Nee	nee	ja	ja
Directe koppeling met BB	Ja (het is BB)	ja	nee	ja
Gebruikersgemak	+/- Met nakijken is het lastig beoordelen. De embedded video wordt in een te klein vak	+	+	+

	weergegeven, je moet scrollen om de hele video te kunnen zien. Daarnaast is het vak om geschreven content te lezen ook niet prettig omdat je maar zo weinig kan zien. Door zaken als bijlage te laten inleveren omzeil je bovenstaande beperking.			
Hoeveelheid In te stellen variabelen: bv multiple pitch, categorieën, only submission, koppeling peers	+/-	+	++	-

Zie https://educate-it.uu.nl/toolwijzer/ voor aanvullende informatie over de tools.

Appendix

Appendix A). **Factsheet for Students** with background info on the relevance of peer-feedback and with some do's and don'ts in giving efficient feedback.

Appendix B). **Factsheet for teachers** with background info on the usefulness of peer-feedback and some tips on how to implement it.

Appendix C). **Overview on Deep Learning and Peerfeedback**

Appendix D). **Sets of questions** to guide students through the different texts they will provide feedback on during their undergraduate years (in Biology) – separate document-
C i). Year 1: Writing a minireview (1500 words) on an evolutionary topic (in Dutch)(Fred vult dit onderdeel nog aan)
C ii). Year 2: Writing a paper (in Dutch)
C iii). Year 3: Bachelor thesis (in English)
C iv). Peer-feedback on an interdisciplinary paper (in English)

Appendix E). **Summary of the PhD-thesis by Dr. Renee Filius** (2019)(in English)

Appendix C). Promoting deep learning through peer-feedback practices in higher education.

(Lisann Brincker & Fred Wiegant)

1. Introduction

How students approach their learning has been shown to affect learning outcomes (Biggs & Moore, 1993; Biggs, 1999; Chin & Brown, 2000). Crucially, deeper engagement and subsequent understanding during learning rather than surface level memorizing correlate with academic success and student motivation (Dooley & Bamford, 2018). Numerous factors that may influence which learning approach a student utilizes at any given moment have been investigated in order to create educational environments that foster deep learning (Biggs & Tang, 2011). The popular practice of peer-feedback is one candidate which may aid students in achieving deeper learning during their studies. Here, we examine how peer-feedback may promote deep learning. We will first explore the dichotomy between surface and deep learning and the latter's apparent superiority with regards to learning outcomes before elaborating on factors that have been shown to promote deeper engagement during learning. With deep learning being the goal, we then investigate peer-feedback practices as the means to reach it. We discuss how peer-feedback may drive competencies that trigger and maintain deep learning, also touching upon the push to treat peer-feedback as a loop activity, also called dialogic peer-feedback. We end with a number of recommendations to set up effective peer-feedback practices in higher education.

2. Deep learning superior to surface learning

While a large number of cognitive theories about learning have come forward over the last decade, constructivism is still on the forefront of learning research and has had an enormous impact on educational theory and practise. Within this framework, the student is considered to be constructing their own learning environment, actively engaging with input from their surroundings. Learning is seen as being rooted in the interaction between the student and the material of interest, and, even more importantly, in the interactions among students and between students and teachers (Chapman et al., 2005). In this context, a distinction between surface and deep learning has been made that has moulded the field of pedagogy with regard to both, instruction and examination (Biggs & Moore, 1993).

In this dichotomy of learning approaches, *surface level learning* has a more negative connotation and is repeatedly shown to lead to poorer outcomes when it comes to understanding of concepts and retention thereof (Ramsden, 2003). It is related to a means-to-an-end attitude where the process of learning is considered a nuisance and only necessary to eventually pass an examination after which most of the supposedly acquired knowledge dissipates. Students engaging in surface level learning often expect to be given the important content by the teacher and have little motivation to explore the topic in more width or depth, making fruitful discussions with peers difficult to maintain (Platow et al., 2012). When observing and interviewing 8th grade students during confrontation with a number of science modules, Chin and Brown (2000) found that a clear distinction could be made between surface and deep learning. Students who employed the former, gave reformulations of the question and avoided referring to a possible central mechanism when asked to explain the relevant concepts.

Deep learning refers to a process in which the learner recognizes the dynamic and interrelated structure of the subject under study and actively engages with it. It involves critical thinking, making new connections between different concepts and is marked by constant active integration of new information with old ideas (Gordon & Debus, 2002). Knowledge here is born less out of a transfer from expert to novice but out of the explorative nature of the interaction between teacher, learner and material. In the study conducted by Chin and Brown (2000), deep level learners elaborated on explanations of possible cause-effect relations between elements of

scientific concepts and engaged in what they call "on-line theorizing". While students started explaining the mechanisms, they showed a lot more spontaneous utterances of insights and were more confident in pursuing these further. The primary motivation of somebody using a deep learning approach is not to learn in order to pass a test but to learn in an effort to increase the understanding of a subject and committing to put in the work it might take to do so. It often originates from a fundamental interest for the topic itself that is then amplified over the course of instruction (Ramsden, 2003). Even though receiving good grades is not the primary goal in this approach, engaging in deep learning has been positively related to academic performance as well as an increase and maintenance of student motivation (Azer et al., 2013; Platow et al., 2012). The latter is particularly intriguing as it suggests that facilitating and encouraging a deep-learning approach early on in a student's academic career may have a lasting effect on their determination to continue to engage in the discipline they have developed an interest for. Thus, it is desirable for the overall learning outcome that teachers encourage their students to get involved in deep rather than surface learning approaches.

3. Factors promoting deep learning

Whether a student chooses a surface or deep learning approach depends on internal and external factors. Some of these factors are particularly suited to inform the design of educational environments in which students are encouraged and facilitated to engage in deep learning. It has been shown that students' attitude towards the acquisition of knowledge improves when they learn in a participative context (Chapman et al., 2005). After allowing time for trust and a sense of community to develop, students are often more willing to expose their uncertainties with regard to a specific concept. The following discussion and collaboration in identifying and solving the issue amongst peers and the teacher leads to a discourse that drives deep learning. Does the student intend on clarifying their uncertainty and is this clarification successful, they are subsequently more likely to follow such a deep learning approach again (Gordon & Debus, 2002).

Not only the students' attitude but also that of the teacher can influence the level of learning that occurs in a classroom. Teachers that see learning as a dynamic, constructive and integrative process are more likely to encourage their students to use methods that are connected to a deeper processing of materials such as group work or critical analysis (Gordon & Debus, 2002). They are also more likely to ask high-level questions that challenge students (Offir et al., 2008). Such questions are questions of analysis, evaluation and synthesis and those that prompt the students to expand from a specific fact towards broader hypotheses and principles. This also applies to the nature of the tests a teacher may use. When students know that they will be assessed using e.g. multiple-choice exams, they are less likely to employ deep learning approaches during their preparation for said test. When they expect essay questions or other types of assessment that requires them to explain principles and concepts and apply them to novel circumstances, using a deep learning approach becomes more economical than trying to memorize all potential scenarios on a surface level (Marton & Saljo, 1976). Crucially, using formative assessment (including feedback) rather than just summative assessment promotes deep learning by providing information about the current state of knowledge and the desired state of knowledge of the student (Moore & Teather, 2013). Most importantly, it suggests directions for improvement which encourage the student to evaluate their current work and monitor their following progress in working towards their goal (Rushton, 2005).

4. Peer-feedback as a means to drive deep learning

One classroom activity that captures many of the above mentioned factors and thus might help students in utilizing a deep learning approach is peer-feedback (Dooley & Bamford, 2018; Moore & Teather, 2013; Filius, 2019). Peer-feedback has been defined as an arrangement in which individuals consider the amount, level, value, worth, quality, or success of the products or outcomes of learning of peers of similar status (Topping, 1998). In this regard, it should be distinguished from peer-tutoring which often occurs between students that are different in age and

skill and is a more unidirectional approach in which one individual teaches or helps another with a specific task (Reinholz, 2015). Ideally, peer-feedback results in a set of suggestions that the receiver can use to improve their work before it is being graded. This makes it different from peer-assessment which involves peers grading each other's performance on the basis of relevant criteria, often provided by the teacher. The goal during peer-feedback is establishing a collaborative dialogue between equals. Making grading part of the process, was shown to reduce the learning opportunities it provides (Liu & Carless, 2006). While the process of peer-*feedback* is regarded as neutral or positive by many students, peer-*assessment* for a summative purpose traditionally elicits more resistance because students do not feel comfortable with being directly in charge of a peer's grade. As many students still struggle with accepting others' feedback, accepting their grading is even more difficult. Additionally, while it has been suggested numerous times that grading by students is moderately correlated with the grades a teacher would give, 'friendship marking' still skews peer grading results in many cases (Liu & Carless, 2006).

Reinholz (2015) elaborated on the elements of peer-feedback in higher education, stating that it facilitates the development of three key academic competencies: (1) it provides grounds for critical thinking and *academic process reflection* in which students can reflect upon their own understandings of the content, the task and the aim of the task. (2) It allows for an *expansion and revision of conceptual knowledge* by giving students an opportunity to build on prior knowledge and integrate ideas they encounter in another's work. Additionally, they may practise to generate inferences and repair misunderstandings that occur in the process. Lastly, (3) students improve their *communication skills* during the process of collaboration in which they need to explain and back up their understandings of the task and the content. Actively engaging with their own and others' work, integrating new knowledge and starting a dialogue about the material are not only elements of peer-feedback but are also indicators of deep learning (Biggs & Tang, 2011). Considering these parallels, the following sections discuss how each of these competencies can be driven and practised through peer-feedback, thereby promoting deep learning in the classroom.

Academic process reflection. Peer-feedback often occurs between writing the first draft for an assignment and submitting the final product which means that students have the chance to actually use the feedback they were given in order to improve. Additionally, research on the timing of feedback has shown that it is most effective if it is given within a short time frame after the assignment was submitted (Kulkarni et al., 2015; Prashanti & Ramnarayan, 2019). Reception of feedback and using of feedback is more tightly coupled in peer-feedback scenarios as compared to receiving feedback from the teacher alone. This promotes learning within one project rather than from one project to the next as it is often the case with teacher feedback (Nicol et al., 2013). Because of time constraints students may only receive feedback on a final product e.g. by being graded or scoring a certain number of points within a rubric. Even if a more detailed evaluation is provided, there is no chance for students to work on it further as the current project is by definition concluded. Teachers may expect students to take something away from the assessment of their performance on project 1 to perform better on project 2. However, as there is no close temporal coupling between the feedback and use thereof and the connection between project 1 and 2 might not be very clear to students, it is unlikely that they will take much of the feedback received into their work on project 1 into account when starting project 2. Thus, making rounds of peer-feedback a stable part of the curriculum provides the students with several opportunities to improve their work and monitor their progress from draft to final version within one project (Nicol et al., 2013). The context-independent skills they practise during that process can then be employed for the next project (Lynch et al., 2012). Interestingly, peer-feedback may encourage more deep learning in comparison with teacher feedback. As students tend to question feedback from peers more, in contrast to feedback from their instructor, they continue to think longer and deeper, which enables deep learning (Filius et al., 2018a, 2018b).

Engaging in peer-feedback seems to have a positive effect on academic self-regulation. Self-regulation of learning refers to students being able to identify their goals and manage their path towards reaching them by monitoring their motivation, cognition and behaviour in the context of an educational environment. Being asked to identify and evaluate the steps towards reaching

those goals in another's work can make them more transparent in their own work as well (Nicol & Macfarlane-Dick, 2006).

Interestingly, students do not only benefit from receiving feedback after they have completed the same task they are reviewing. Cho and MacArthur (2011) found that students that were asked to review peer papers and subsequently had to write a paper of their own on a related topic outperformed their peers who just read the papers without commenting on them. Specifically, those students that added comments including problem detections and solution suggestions wrote papers of a higher quality. This suggests that the process of reviewing a peer's work alone provides the student with competencies that can be used favourably in a related assignment.

Expansion and revision of conceptual knowledge. When being confronted with somebody else's performance on a task the student himself has also previously worked on, opportunities for a rich discourse about the topic arise. Within that discourse, several steps of critical thinking will be employed. Students need to analyse and evaluate what they have observed before identifying potential problems *and* offering constructive solutions. Being asked to critically review something makes students more aware of how others may critically review their products and enables them to take that step back when looking at their own work (Nicol et al., 2013). This skill then becomes context-independent and can be applied to (re)evaluating the structural elements of a paper or the interrelations between elements within a scientific concept. Recognizing that expansion and revision of conceptual knowledge is a dynamic and potentially infinite process encourages students to use a deep learning approach (Gordon & Debus, 2002).

This revision of knowledge can also occur on a very practical small scale. Chrispeels and colleagues (2019) conducted a study in which one group of students taught another group about the implications of the use of genetically modified organisms in the food industry. They found that opinions about this issue drastically shifted from pre- to post-teaching session. This indicates that peers can provide each other with convincing and valid information that is subsequently used to expand the knowledge of the receivers. Students in another study also benefited from peer-feedback and the collaborative process it triggered during an introductory biology course with subsequent 10 minute presentations (Tal & Tsauhu, 2017). Several indicators for deep learning during and after the small group sessions were shown to be of importance: Students reported to feel driven to look for information after the group discussions that would help in designing the presentations. Many students were then triggered to reorganize their knowledge in such a way that its explanation would fit within the time frame.

Lastly, the pedagogical relationship with a peer that holds no authority over the learner may prompt them to disclose questions and misconceptions more readily. This means that they can be rectified more efficiently than in any other context, aiding the student in discarding wrong information and developing a solid knowledge base (Topping, 2005).

Communication skills. For peer-feedback practices to be effective, it appears as though a dialogue between the parties is crucial (Filius et al., 2018a, 2018b; Schilling et al., 2018). With peer-feedback often being a group effort, students receive multiple comments on their work and are confronted with several different views, not only in the feedback they receive but also in the work of others they review (Topping, 1998). Deciding on whether or not they agree with the feedback and determining which elements they may want to incorporate can be facilitated through an ongoing discourse about the work that is subject to the feedback process and the feedback process itself (Schilling et al., 2018). Recently, there has been a push to see peer-feedback more as a loop activity in order to increase learning opportunities by having groups of students work out kinks in their projects collaboratively which promotes deep learning. This problem-solving team-work seems to be an evolutionarily rooted drive as peer groups have always provided grounds for teaching and learning experiences (Brincker et al., 2019). Using this affinity, continuous reciprocal peer-feedback could prove to be very effective and fits into the context of a social constructivist paradigm (Nicol et al., 2013). This may be especially fruitful in online education. While face-to-face

instruction enables teachers to encourage student to engage with one another "then and there", in an asynchronous virtual learning environment, participation and communication can be limited. Designing a system in which peer groups give, react to and discuss feedback online can then provide grounds for effective collaboration (Hacker & Niederhauser, 2000) and facilitate deep learning (Van Popta et al., 2017; Filius, 2019).

In their studies, Filius et al. (2018a, 2018b) focused on peer-feedback in online higher education (in SPOCs – Small Private Online Courses) as a teaching method and strategy to support deep learning. They were able to show that peer-feedback promotes three factors of deep learning: 1) critical thinking, 2) making new connections between different concepts and 3) integrating what is learned with what is already known. In addition, four mechanisms were identified that trigger a deep learning approach: 'feeling personally committed', 'understanding one's own learning process', 'probing back & forth', and 'asking and providing relevant feedback'. Interestingly, they reported that the quality of the interaction is more important than the quality of the feedback itself. Hence, Filius et al. (2018a) indicated that to fully exploit the peer-feedback, students should be actively engaged in feedback as a dialogue. The value of peer-feedback, in addition to the one who provides peer-feedback appears to result predominantly from the dialogue it triggers. Especially helpful to encourage fruitful peer-feedback appears to be: 1) instruction to how one provides peer-feedback aiming for deep learning; 2) by having to rate feedback, and therefore by repeatedly having to reflect on the subject matter. In a follow-up study, Filius et al. (2019) showed that, just like typed feedback, providing audio peer-feedback in online education leads to deep learning. Especially "feeling personally committed" was suggested as an important mechanism, as audio peer-feedback makes great demands on feeling personally committed and as a consequence, both feedback providers and feedback receivers learn deeply.

5. Setting up successful peer-feedback practices in higher education

In order for peer-feedback to be a useful educational activity that does indeed drive deep learning, certain circumstances need to be created that make it fruitful for both teachers and students. With it being a large part of many programs in universities around the world already, it is important to establish how it should best be approached and set up. First, we will investigate the impact of familiarity between peers on feedback quality. Even though peer-feedback explicitly does not entail grading, asking students to rate another's work can be an emotionally taxing task which can lead to inadequate and vague input in order to 'be nice' rather than state what should be changed. Related to this is also the mode in which peer-feedback is given. Nowadays, the process of giving feedback is often located online and not just in the online courses which are growing in popularity. Determining what can be done to ensure that high-quality dialogues about individual performances can occur in the virtual world is just as necessary as it is in an "Real Life" classroom setting. Lastly, we will discuss the influence of appropriate instruction and the type of language used when introducing and conducting the peer-feedback process.

Interestingly, there seem to be two opposing views on the degree of familiarity and closeness between peers that is optimal for having them evaluate each other's work. Some argue that allowing time for building a strong sense of community is key to establishing a classroom in which good peer-feedback can be given. Chapman et al. (2005) found that students are more willing to expose their uncertainties and appreciate their peers' opinions if they have gotten to know each other and developed a certain level of trust that they are all working towards the same or at least a similar goal. Feedback arises out of interaction and if students do not feel comfortable participating in the activity, it is unlikely that fruitful discussions of each other's work will be held.

On the other hand, students within a classroom are less likely to rate each other as very good or very bad and often choose the comfortable middle between the two extremes even if this objectively does not reflect the true performance level (Liu & Carless, 2006). In this case anonymity may actually help when giving and receiving peer-feedback. Lin (2018) conducted an online peer-feedback study in which one group received and gave feedback with their names and profiles available and the other did the same completely anonymously. The anonymous group

reported more cognitive (constructive) feedback and a more positive attitude towards the system. The other group showed more affective (supportive, opposing) and reflective feedback but did not report to have learned as much as the first group. It seems as though a compromising solution may be that students are given time to develop a sense of community in which they trust each other but within this community, peer-feedback is conducted anonymously. However, some teachers may want to establish a system in which peer-feedback is part of the actual class hours where students would discuss their evaluations with one another. Then anonymity can no longer be granted, and other approaches may be necessary.

To reduce the impact that reciprocal rapport between familiar peers or even friends might have on the quality and honesty of their feedback, the language used during the process and on the forms that are often part of it may need to be adjusted. Nilson (2003) proposes that questions for peer-feedback forms should move away from judgement and opinion and towards identification of main elements and attention to the details of the content and its presentation (i.e. asking "At what point did you identify the thesis of the paper?" instead of "Is the thesis of the paper clear?"). Reformulating questions in such a way removes their emotional load, giving students the opportunity to be more accurate in their evaluation while also providing additional scaffolding for the task itself. Going back to the above-mentioned example it may be that when students are asked about the location of the thesis within their peer's paper, they become more aware that this is something they should pay attention to in their own work. Determining the clarity of a thesis is a much more subjective task and it is likely that students may struggle to find a justification for why their peer's thesis is or is not 'clear enough' and how that would translate into a rating. This is also supported by studies showing that quality of student feedback increases when it is identified as a less dualistic task (this was good, this was bad) but rather as commenting on the learning progress on different levels where structure and content are considered separately (Gan, 2011).

In order to give appropriate feedback, students need to be able to identify the current level of achievement in their peer's paper and determine how it relates to the desired level of achievement (Moore & Teather, 2013). The latter can often be deduced from feedback-forms, rubrics or explanations of the task in the classroom. However, teachers should be aware that they might have to make the criteria more explicit in order for students to have a template against which their own and their peer's work can be evaluated (Liu & Carless, 2006). It may be helpful to have the entire class work on a good and a bad example of what the current task can result in. Discussing the differences between the two approaches can aid students in grasping the often fairly context removed peer-feedback form questions in relation to their current objective. Teachers should schedule such instruction modules before peer-feedback is introduced as a class activity and explain why and what kind of feedback is useful, otherwise students may not recognize its value (Gan, 2011) and struggle to work out what can be done to close any existing gap between their current level of performance and the desired one (Moore & Teather, 2013). In this respect, Filius et al. (2018b) showed that instruction on providing peer-feedback, combined with assessment of the peer-feedback received, lead to peer-feedback dialogues, an improved quality of peer-feedback and a better quality of the end product.

Reducing the impact of emotions and clarifying the goal and instruction of the peer-feedback process can help to make it a more fruitful part of the curriculum in higher education. Depending on the circumstances, teachers may choose to keep the peer pairings anonymous or not, however, reformulating feedback forms and instructions to focus more on the specific content, structure and presentation of the work rather than asking students to judge how good or bad a certain element is should help in any case. Using these forms to provide students with some guidance and scaffolding for the task may already improve their own work by itself. The quality of the material that is then subject of the peer-feedback process may turn out to be higher to begin with and can potentially elicit a more in-depth dialogue when the students discuss each other's work, driving their deep learning competencies.

6. Conclusion

When aiming for deep learning in the classroom, peer-feedback activities appear to be a valid and effective means to reach this goal. Peer-feedback, especially when it is looped and includes moments of collaborative discourse about the product under review, stimulates deep learning in both the provider and the receiver of peer-feedback. After a sense of community is established, online or offline, peers are more open in sharing and rectifying their misconceptions and provide high quality feedback that significantly improves the work of the receiver. If set up correctly, peer-feedback is regarded as a motivating, fun and useful experience which prompts students to engage in it more frequently, thereby creating more deep learning opportunities for themselves and others.

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Student factsheet

Peer feedback & Deep learning

Over the last decade, peer feedback assignments have become more common in many universities. Research has shown that it improves your learning, your writing and your grades. This factsheet is designed to explain why peer feedback is beneficial and how to make sure you get the most out of it.

Benefits of peer feedback

✔ **Improve your own work**
A fresh set of eyes can tell you whether your main question is clear, your argumentation is logical, and your conclusion is sound. They might also catch spelling and grammar mistakes. In addition, peers often use a language that is more accessible and specific than that of your teacher.

✔ **Practice your critical thinking**
You don't agree with the feedback you received? Good! You shouldn't take everything others say for granted. You can ask your peer to clarify what they meant and discuss your differences. You may find that they can give you some good reasons to re-examine your work.

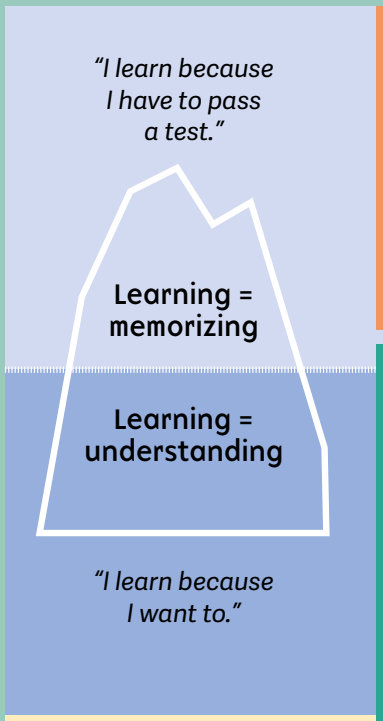
✔ **Reflect on your academic process**
Looking at your peer's approach to the same assignment gives you the chance to reflect on your own understanding and execution of it.

✔ **Expand and revise your knowledge**
You may come across some valuable insights and references in your peer's work that you had not considered before.

✔ **Use your communication skills**
Peer feedback creates a dialogue in which you might need to explain and back up your understanding of the assignment and the material you or your peer worked on.

✔ **Avoid procrastination**
If more feedback sessions are organized at several points between the first draft and the final version may help to keep you on track and finish your work on time.

Taken together, all these elements promote deep learning. You can find out what exactly that is and why it is important in the box on the right.



SURFACE LEARNING

- ✔ Focus on facts relevant to examination
- ✔ Reliance on teacher to provide important information
- ✔ Little motivation to explore topic beyond the bare minimum
- ✔ Majority of what was learned is forgotten as soon as it is no longer relevant (e.g. after test)

DEEP LEARNING

- ✔ Focus on underlying central mechanisms
- ✔ Knowledge gained through explorative interaction between teacher, learner and material
- ✔ Independent investigation of the topic that goes beyond what is necessary
- ✔ Concepts remain accessible long-term and can be modified if new information is encountered

Deep learning

In schools and universities around the globe, teachers aim to provoke deep learning processes in their students because it results in understanding rather than just memorizing. Unfortunately, it is difficult to simply make deep learning happen on command. Many promoting factors such as the nature of your test or your teacher's attitude are beyond your control. However, you can prompt yourself into a deep learning process by seeing the acquisition of knowledge as dynamic and interactive. Giving and discussing peer feedback stimulates critical thinking, helps to integrate new knowledge with what you already knew and facilitates making new connections. Research has shown that discussing a topic with others, rather than just reading about it silently, promotes deep learning. Peer feedback can be used to bring about such a discussion and deep learning process, improving your retention of the material and helping you to apply it to new situations.

You might not deem all new information you encounter during your studies "worthy" of deep learning. However, keep in mind that many courses in university are built on one another and the assumption that you expand your knowledge of a subject and incorporate new information from higher levels continuously. Employing deep learning strategies early on can make understanding more complex concepts in higher levels easier.

Universiteit Utrecht

Student factsheet
Peer feedback
& Deep learning

IN SHORT

SMALL PICTURE

Peer feedback gives you the option to correct mistakes and improve your work before you submit it.

BIG PICTURE

Peer feedback trains critical thinking about your own and other's work, helps you improve your academic process and prepares you for dealing with constructive criticism.

Giving good peer feedback

Giving good feedback in general can be hard. However, using yourself as a guideline can give you some inspiration: What kind of feedback do you find most useful? Which comments helped you improve your work the most? Which ones did you struggle to incorporate? Answering these questions for yourself should already provide you with some basic ideas.
You may for instance prefer to receive feedback on the introduction and clarity of the main question, the structure of your paper, on argumentation and readability, rather than grammar and spelling.

This table elaborates on some of the do's and don'ts of peer feedback you should consider.

DO'S	EXAMPLE
Focus your feedback on the task, not the learner.	"You reach a conclusion without elaborating on step X and Y." instead of "You are always jumping to conclusions without explaining anything."
Elaborate on why you are giving this feedback.	"Your title gives good insight in what the text will be about!" instead of "Great title!"
Present elaborated feedback in manageable units.	"I would move this paragraph to the beginning to make the structure of the discussion clearer." instead of "Your discussion is missing structure, please rewrite."
Be specific and clear with feedback message, preferably linking your feedback to the criteria.	"One of our criteria is about spelling. I saw some mistakes in the introduction (example). Don't forget to spell check your text."
Promote a learning goal orientation via feedback.	"I think Hattie is using a different definition of efficient feedback." instead of "Please look at page 187 of Hattie's book for the right definition of feedback."
DON'TS	**EXAMPLE**
Do not present feedback that discourages the learner or threatens the learner's self-esteem.	"Did you actually understand the assignment?"
Avoid using unexplained praise.	Instead of "This looks great!", try to indicate what is good, such as: "The format you used really supports the flow of the text."
Avoid using progressive hints that always terminate with the correct answer.	"You used a wrong quote. It should be [correct answer]."
Minimize use of extensive error analyses and diagnosis.	Instead of changing words in the text or commenting on every sentence, try to summarize small but comparable mistakes with an overarching advise.

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Teacher factsheet

Peer feedback; info for teachers

In many classrooms around the world teachers aim to provoke deep learning in their students in an effort to ensure that they understand rather than just memorize a concept. In recent years, peer feedback has been considered as a potentially facilitating activity during this process. This fact-sheet places peer feedback in the context of deep learning and summarizes what is known about effectively introducing, explaining and structuring peer feedback activities in higher education.

What is peer feedback?

Peer feedback is defined as an arrangement in which individuals consider the amount, level, value, worth, quality, or success of the products or outcomes of learning of peers of similar status. They then share their insights in written or oral form but do not grade each other.

What does it offer?

It is an educational tool that is being utilized in many universities already, often to give students an opportunity to receive feedback in larger classes where the teacher may not be able to review everybody's work in detail before the final submission. Recently, peer feedback has gotten renewed attention in the quest for deep learning in higher education. It is beneficial for the development of key academic competencies of all participating students, providers and receivers of feedback alike, especially if they get involved in an academic discussion.

Academic process reflection
By analyzing a peer's work, students reflect upon their own understanding of the assignment and its content. Regular timely feedback at different stages of the process enables students to improve their product and monitor their progress continuously.

Expansion & revision of knowledge
Students may integrate ideas they encounter in another's work into their own conception of their subject. This provides an opportunity for academic discourse when the feedback is discussed, which stimulates critical thinking, helps to integrate new knowledge as well as to make new connections.

Communication skills
Students practice formulating their ideas concisely and explain or back up their understanding of the task and content when facing opposing views.

How does it promote deep learning?

Many of the driving forces behind deep learning can be ignited and maintained through peer feedback activities.

- ✔ **Participative environments** improve attitude towards learning, acquisition of knowledge and willingness to collaborate.
- ✔ **High-level questions** that ask students to analyze and evaluate a text demand employment of critical thinking.
- ✔ **Providing peer feedback** gives students an idea about their current and desired state of knowledge, while also providing direction for improvement, prompting them to evaluate their own work.
- ✔ **Receiving peer feedback** challenges critical thinking as students often do not accept advice easily from peers.
- ✔ **An academic dialogue** between provider and receiver of peer feedback further stimulates deep learning.

The above-mentioned items are somewhat automatically a part of most peer feedback activities. There are some additional factors, that play a role in deep learning, that may appear less directly linked to peer feedback. However, they do become more relevant over time in a long-term context.

- ✔ **Past success** of employing deep learning strategies increases the likelihood that students will use them again.
- ✔ **Student intention** may change from memorizing to wanting to understand the material as deep-learning strategies are successfully applied.

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Teacher factsheet
Peer feedback;
info for teachers

The Feedback loop

Recently, there has been a push to see peer feedback as a loop which increases learning opportunities for students. They not only provide peer feedback, but they also react to the feedback received either online or face-to-face, where they engage in an academic dialogue. This turns the process into a more collaborative effort which promotes deep learning.

Making peer feedback effective

In order for peer feedback to be a useful educational activity, certain circumstances need to be created that make it fruitful for both teachers and students. The table below lay out some ideas about introducing, explaining and structuring peer feedback that have been shown to improve its overall quality as well as students' willingness to engage in it. They are presented in pairs of problems, that may come up before, during or after the process, and possible solutions. Some of the solutions may seem like common sense, however, it is important to remember that giving and receiving feedback is difficult and students may need more explicit guidance than you would expect.

	PROBLEM	SOLUTION
BEFORE	Students do not know how to give (good) peer feedback.	Provide ample information (e.g. factsheet) about what peer feedback is and how to give feedback in an academic context. Whenever quality of feedback is low, it is often because students simply "do not know better".
	Students do not see why giving feedback is relevant.	At university, students may demand and have the right to know *why* they get certain assignments. Presenting scientific evidence about how this activity contributes to their academic development can increase their motivation.
	Students are hesitant to engage in peer feedback when there are big skill and/or effort discrepancies among their classmates.	It is important to point out that *giving* peer feedback is just as valuable for academic improvement as *receiving* peer feedback. There may well be quality differences in the feedback, however, these should then be explicitly discussed afterwards to ensure that both, higher and lower skill/effort students benefit. Additionally, pairs/groups should be regularly shuffled to avoid stagnation of the feedback process.
	PROBLEM	**SOLUTION**
DURING	Students are vague in their feedback.	Reformulating instructions and rubrics from vague into specific prompts can help students elaborate on their feedback. Questions such as "At what point did you identify the main research question of the paper?", or "What is the main question according to you?", are easier to answer than "Is the main question of the paper clear?".
	Students are too "nice" or too "mean".	Students should be asked explicitly to reflect on what kind of feedback *they themselves* find most helpful. They also need to know that feedback is not always critique but positive elements should also be pointed out.
	PROBLEM	**SOLUTION**
AFTER	Students do not discuss the feedback they gave and received.	It is vital to make time during class hours for students to discuss the feedback they gave and received as well as the peer feedback process as a whole. Once students are comfortable and confident about the process, these discussions may happen independently of class hours.
	Students do not incorporate the feedback they received.	If students receive feedback from different peers on different tasks it is likely that they start recognizing its value automatically. However, whether they want to incorporate the feedback remains their choice.
	Students do not agree with the feedback they received.	Students should be given a chance to discuss their disagreements about their own or others' work. Such a discourse results from and in critical thinking which is an important element of deep learning.

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Appendix D: Sets of questions for writing assignments used in Peergrade

In this Appendix two sets of questions are provided which were used to guide students in giving peerfeedback on written assignments of their fellow students.

C1). Peer feedback based on 7 statements (in Dutch)
C2). Bachelor thesis (in English), which represents the final assignment of the undergraduate programme

The first set with 7 statements can be used to get students focused on general characteristics of a paper on which they need to provide peer feedback.
The other set of questions is used to guide students in more detail through the Bachelor thesis (in this case the part which represents a literature review) of fellow students on which they need to provide peer feedback on.

C1). Peer feedback based on 7 statements (in Dutch)
Werkwijze: Voor iedere miniscriptie die je gaat beoordelen, gebruik je 7 stellingen. Per stelling geef je zowel een oordeel, als een toelichting. Ben je het er volledig mee eens dan geef je een 5. Ben je het er helemaal niet mee eens dan geef je een 0 of een 1. Ben je het er gedeeltelijk mee eens dan geef je een 2, 3 of 4. Van belang is dat je ook je oordeel toelicht in het tekstblok, waarbij je de auteur ook advies of compliment kan geven.

1. De titel is duidelijk, aantrekkelijk en dekt de lading.

2. Inleiding bevat de volgende 3 belangrijke onderdelen:
    a. Het onderwerp wordt geplaatst binnen een bredere context
    b. De relevantie van het onderwerp wordt uitgelegd
    c. Definities van belangrijke concepten worden gegeven

3. Aan het eind van de inleiding wordt de hoofdvraag duidelijk geformuleerd en worden deelvragen in een outline goed weergegeven

4. In de Conclusie wordt de hoofdvraag duidelijk beantwoord

5. De structuur van de miniscriptie is overzichtelijk ingedeeld in logisch elkaar opvolgende paragrafen die met inzichtelijke kopjes worden aangeduid

6. De illustraties zijn relevant en ondersteunen de tekst

7. De miniscriptie leest plezierig en het onderwerp wordt goed uitgelegd.

C2). Bachelor thesis (capstone)

S1. Abstract
Explanation: Read the review fist before starting the peer-feedback

Q1. Scale – Requires additional comment
Is the content of the Abstract clear?

- Couldn't find the Abstract
- Absolutely not clear
- Partly clear
- Clear
- Very clear

Q2. Text.
Is any information in the Abstract missing? (such as: main question, method, most important findings, conclusion). Please indicate, if necessary.

S2. Introduction: content and clarity
Explanation: The introduction describes the context and relevance of the topic. The goal or main question of the review should be clearly stated. An outline of what the reader can expect is provided at the end of the Introduction.

Q3. Text
What is according to you the main question of the review?

Q4. Scale. Requires additional comment
Is the content of the Introduction explained in a way that is easy understandable?

- Not at all
- Hardly
- Reasonably
- Yes

Q5. Yes/No. Requires additional comment
Is the structure of the review (short outline of paragraphs) indicated at the end of the introduction?

- No
- Yes

Q6. Text.
Is there any type of information still missing in the Introduction? Is here any aspect that should be further clarified? Please explain.

Q7. Text.

Is there any unnecessary information in the Introduction? If so, what type of information and why is it relevant?

S3. Main body: content and coherency

Explanation: Each section describes a relevant aspect of the topic and should have a sub-question, some results and possibly a partial conclusion and/or short summary. A section can be one or several paragraphs.

Q8. Yes/No. Requires additional comment

Are the titles (and subtitles) representative for the content of each section? Do they cover the content?

- No
- Yes

Q9. Scale.

Is the content of the various paragraphs described in an understandable way?

- Not at all
- Poorly, not every paragraph
- Reasonably
- Yes

Q10. Text

If not, describe for a specific paragraph(s) what is still unclear.

Q11. Scale. Requires additional comment

Is there (part of) a conclusion at the end of each section?

- No
- Yes, only occasionally
- Yes

Q12. Text.

Are the **connections** between the different sections and paragraphs clear and fluent? Give an example where it is unclear

Q13. Scale

Is the **sequence** of paragraphs logical?

- No
- Yes, some do
- Yes

Q14. Text.

Is the information provided (including the described experiments) relevant for the main question? Explain, if necessary.

Q15. Scale

Is there an over-reliance on one or two sources per section (each section may consist of one or more paragraphs)?

- No
- Yes, some do
- Yes

Q16. Text.
Is there any irrelevant information in the main body? If so, what type of information and why is it irrelevant?

Q17. Scale.
In-depth information is provided in the various sections.

- No, nowhere in the text
- Yes, in some sections
- Yes, in many parts

S4. Discussion and Conclusion

Explanation: The Discussion deals with possible conflicting data, ideas and/or arguments which were found in the literature in relation to the main question. You may like to discuss which arguments are most convincing (possibly using a table to provide a clear overview). The Conclusion answers the main question clearly and concisely.

Q18. Text.
What is the main conclusion of the review?

Q19. Yes/No. Requires additional comment
Is this conclusion a clear and concise answer to the main question?

- No
- Yes

Q20. Scale.
Is the conclusion supported by the described experiments and by the provided arguments?

- No, not at all
- Yes, partly
- Yes

Q21. Scale.
Is the content of the Discussion clear?

- No, not at all
- Hard to understand
- Reasonably clear
- Yes

Q22. Text.
Is there any information missing in the Discussion?

Q23. Scale.
Indicate the nature of the Discussion. Explain, If necessary.

- The Discussion is absent or is only a summary of what has been presented.
- The Discussion contains a concise summary as well as a discussion of arguments.
- An in-depth discussion of arguments related to the main question is combined with a clear vision of the author on the topic.

Q24. Yes/No. Requires additional comment
Are there any counter arguments or alternative explanations discussed for the conclusion?

- No
- Yes

Q25. Scale
Are there any suggestions given for follow-up research?

- No
- Partly, but doesn't seem very relevant or it is rather obvious.
- Partly, but not very logical in relation to the content or main question.
- Yes, interesting and logical suggestions are given.

Q26. Text.
Is there any unnecessary information in the Discussion? If so, please indicate.

S5. Illustrations, References and Bibliography
Explanation: Illustrations should support the main text. A legend explains what is seen in the figure, but should not contain a conclusion.

Q27. Text.
Are the illustrations/ figures relevant?(do they support the facts and arguments in the text?). Clarify, if necessary.

Q28. Scale.
Are the figures of good quality: is everything visible and readable?

- No.
- Only some
- Yes, most are
- Yes

Q29. Text.
Are the different parts of the illustrations explained in the legend? In case they are not, please indicate which part of the figure or illustration. Is a source indicated in the legend?

Q30. Scale

Are all the figures referred to in the main text?

- No
- Not all the figures
- Yes

Q31. Text
Are the references **in the text** correctly cited? If necessary, indicate what should be improved.

Q32. Text
Are the references **in the Bibliography** correctly presented (uniform style)? If necessary, indicate what should be improved.

S6. Writing style
Explanation: Indicate to what extent you agree with each of the following statements.

Q33. Scale.
The text is written in a fluent & coherent way and reads easily.

- Fully disagree
- Disagree
- Neutral
- Agree
- Fully agree

Q34. Scale.
The text is written in correct English (or correct Dutch).

- Fully disagree
- Disagree
- Neutral
- Agree
- Fully agree

Q35. Scale.
Difficult or unfamiliar scientific terms are explained well.

- Fully disagree
- Disagree
- Neutral
- Agree
- Fully agree

Q36. Scale.
The text is full of vague terms, jargon and unclear passages.

- Fully agree

- Agree
- Neutral
- Disagree
- Fully disagree

S7. Overall.
Explanation: -

Q37. Scale.
Is there a clear overall structure in this review? Do the various parts form a coherent whole?

- Unclear structure. There is no connection between the different alineas and paragraphs. Pieces of text seem to have found a random location and some are irrelevant for the main question.
- The structure is still a bit vague. The paper consists of parts that are relevant but remain somewhat fragmented, not always with a clear connection to the main question.
- The paper is rather structured. The different parts are quite well connected to each other. Once in a while there is a piece of text or (sub)topic that seems somewhat unrelated to the topic and/or main question.
- The Review is well structured. The different parts are well connected, also in relation to the main question.

Q38. Text.
Which compliment(s) would you like to give for this paper?

Q39. Text.
Describe two main aspects which should be improved in this paper.

Appendix E: Summary PhD of thesis by Renée Filius

"Peer feedback to promote deep learning in online education; Unraveling the process"

Universities aim for deep learning. Deep learning involves critical thinking, integrating what the student learns with what he or she already knows, and making new connections between different concepts. It is a learning approach that can be visualized as a continuum, with "surface learning" on the opposite side, which concerns memorization, mainly aimed at passing a test.

Two trends may threaten the achievement of deep learning: the massification of student numbers and the increase in online education by universities. Taking these trends into account, this dissertation examines the extent to which instructors can promote deep learning in online higher education. The main research question is as follows: How can instructors promote learning in online higher education? In answering this question, we use the "CIMO logic" as a frame of reference; we look at the context, intervention, mechanisms, and result. This offers the opportunity to describe exactly in which context which intervention, triggered by which mechanisms, leads to which result.

As interaction is regarded as a precondition for achieving deep learning, Chapter 1 examines the amount of interaction in online education and, specifically, in "Small Private Online Courses" (SPOCs). To this end, we analyzed the various interactions between students and between students and instructors within four courses. We distinguish among "social," "functional/technical," and "content specific." We then conclude that there is a great deal of interaction in online education, almost half of which consists of social interaction.
The types of interaction we found are comparable to the categorization used by Ké and Xie (2009). They distinguish among social, knowledge, and regulation. Students usually start the conversation; only 10% of the conversations are initiated by the instructor. Based on the large amount of interaction, we conclude that online higher education can be a suitable environment for students to learn deeply.

In Chapter 2, we looked for the challenges instructors face when trying to promote deep learning in online education. We interviewed 11 instructors with experience teaching in SPOCs, with a wide spread in terms of geographical location, age, and experience. Based on these interviews, we identified five challenges: 1) alignment in learning activities, 2) insight into students' needs, 3) adaptivity in teaching strategy, 4) social cohesion, and 5) creating dialogue. These results indicate that SPOCs have distinctive challenges compared to other forms of online education. If the results are viewed from the perspective of the

"Community of Inquiry" of Garrison and Kanuka (2004), it can be seen that instructors in SPOCs pay sufficient attention to cognitive presence when aiming for deep learning, but they could place more emphasis on social and, especially, teaching presence. Instructors can take these results into account when developing and teaching within SPOCs. Consequently, it shows the need for training in how to design and teach SPOCs.

In order to meet the challenges mentioned above, in Chapter 3 we identify a wide range of scalable feedback interventions, including mechanisms that trigger a deep learning

approach. Scalable feedback interventions are described in three categories: feedback management, peer feedback types, and automatic feedback. The mechanisms identified were "feeling personally committed," "asking and receiving relevant feedback," "understanding one's own learning process," and "probing back and forth." The results show a deepening of the "online learning interaction model" of Ké and Xie (2009), which focuses on deep learning. Their three categories can be expanded with the mechanisms found in this study, which will further enrich the model. Moreover, the results of this study show that the quality of the interaction is more important than the quality of the feedback itself. We indicate that in order to make full use of feedback, students must be actively involved in feedback as a dialogue. Therefore, our last two studies, in chapters 4 and 5, focus on the implementation of dialogic peer feedback.

Chapter 4 describes the use of asynchronous online typed peer feedback. We focused on deep learning by improving the feedback dialogue as a scalable intervention. Students provided peer feedback in the form of a dialogue, both individually and in a group. They were instructed to provide feedback aiming for deep learning. They were also asked to rate each other's feedback.
The data from questionnaires, completed by 41 students of a course of the master epidemiology, were used to measure for each feedback assignment to what extent deep learning was experienced. The feedback from students who scored extremely high or low on the questionnaire was analyzed to find out which features lead to deep learning. In addition, students were interviewed to retrieve information about the underlying mechanisms.
Our results support the view that instruction on providing peer feedback aiming for deep learning, combined with assessment of the peer feedback received, leads to peer feedback dialogues, which, in turn, promote deep learning in SPOCs. The value of peer feedback appears to derive primarily from the dialogue that is initiated, rather than from the feedback itself. The value of peer feedback appears to predominantly result from the dialogue it triggers, rather than the feedback itself. Especially helpful for students is the constant attention to how one provides peer feedback: by instruction, by having to rate feedback, and therefore by repeatedly having to reflect. This study then shows the added value of feedback from peers compared to that of instructors. Because students question feedback from peers more than feedback from their instructor, they continue to think longer and deeper, which promotes deep learning. It also appears that when the peer feedback refers to a theoretical source, such as a scientific article, this results in surface learning. Results suggest that the student does not quickly question the theoretical source and therefore does not think long or hard about it, which results in surface learning.

Chapter 5 discusses asynchronous online audio peer feedback. Students made an assignment that they presented via an audio recording. Then they gave oral feedback on the presentation of at least one randomized peer, who responded to it. Afterwards, 108 students filled in questionnaires, and 14 students were interviewed. This was used to measure the extent to which deep learning was experienced and why. All participating students followed an online course, of which 68% participated in a massive online course (MOOC) and 32% in a SPOC.
Results show that, just like typed feedback in online education, providing audio peer feedback in online education leads to deep learning. Van Popta et al. (2017) showed that providing online typed peer feedback leads to deep learning. We add to this finding that this also applies to audio peer feedback and that the extent to which this happens is

comparable to receiving peer feedback. The following student mechanisms were triggered: "feeling personally committed," "probing back and forth," and "understanding one's own learning process." Particularly important for both providing and receiving feedback is feeling personally committed. The results also show that the student mechanisms were a stronger predictor of deep learning when providing feedback than when receiving feedback. We suggest that audio peer feedback makes great demands on feeling personally committed and, as a consequence, both feedback providers and feedback receivers learn deeply.

In Chapter 6, the main research question — How can instructors promote deep learning in online higher education? — is answered on the basis of the conclusions of the chapters. Each individual chapter presented an empirical study that contributed to the answer. A summary of the conclusions of these studies is described below.

Interaction is important for promoting deep learning. In this dissertation, we show how, despite the fact that interaction in online education is often asynchronous and written, deep learning can be achieved. Subsequently, various recommendations for follow-up research are given, based on the CIMO logic. For example, deep learning could be measured differently. Moreover, other ways could be sought to trigger the mechanisms, and more specifically "feeling personally committed." Subsequent research can then be conducted into the scalability of the interventions and into the right balance between small-scale and large-scale learning methods. Research into the possibility of having a virtual assistant with artificial intelligence to carry out some of the tasks of the instructor can also be interesting. Furthermore, this research primarily focuses on the role of the instructor, but future research may also focus on the role of the student.

The landscape of higher education has evolved so rapidly and profoundly over the last 15 years, with the emergence of mass and online education, that the education strategy needs to be reconsidered. Students are increasing in number, but also in types and needs, as more students will combine their studies with other responsibilities, such as work or family life. Thus, as the differences between students widen, the current distinction between students in initial education and in pre- and post-initial education may become smaller. Universities are faced with the task of serving this large number of diverse students with often less funding per student.

This dissertation shows that online education enables universities to continue to focus on deep learning. This is important, as this is their core task and distinguishes them from many other education providers. Online education also contributes to more flexibility in learning pace, preference, location, and time, as well as to more modular education. That is why universities need to invest in their online education strategy and implementation. The following consequences for the future of higher education are therefore described: a)
reallocate the tasks of the instructor; b) shift from delivery to design; c) pursue diversity in student groups and through multidisciplinary education; d) utilize and expand lessons learned in MOOCs on scalability and lessons learned in SPOCs on social cohesion; e) monitor and join the developments on the deployment of artificial intelligence assistants; and f) keep supporting and professionalizing instructors and e-moderators. We advise universities to encourage instructors to develop their own education and to conduct continuous research into it. In this way, we want to help not only instructors, but also (future) academics to be inspired and reach their full potential. Ultimately, we want to enable them to contribute to solving all kinds of social issues that require deep learning and, therefore, deeper understanding.

Link to thesis
https://www.media-and-education.nl/publicaties/didactiek/proefschrift-peer-feedback-promote-deep-learning-online-education-unraveling