Educational Design Patterns for Student-Centered Assessments

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Assessments are an essential part of education. There are many well-known and proven practices for assessments, many of them also described as educational design patterns. However, most of them focus on organizational issues or on the teacher perspective. This paper describes six educational patterns which represent good practices and put the student central. They address issues of student-driven grading, getting an overview of student progress, and increasing student motivation.

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1. INTRODUCTION

Assessments are essential parts of education because they provide evidence about learning to both students and teachers. Assessments support learners by helping them understand their current progress and shortcomings and with determining the next steps in their learning process (formative assessment, often done several times during the trajectory). Assessments are also used for determining the final level of learning goal achievement, usually at the end of a learning trajectory (summative assessment). Designing relevant assessments which are aligned with the content and teaching methods is a challenging task for teachers and educational designers. However, well known good practices can offer help. These practices can be described as educational design patterns, solution heuristics to recurring problems in specific contexts.

Background: Assessment Design with Educational Patterns

Educational designers can apply patterns – or a pattern language – when designing scenarios to help them reach their educational goals. There are many educational patterns available, e.g. for general pedagogy [Bergin et al. 2012], technology-enhanced learning [Goodyear and Retalis 2010], MOOC Design [Warburton and Mor 2015] and many other educational aspects.

Specific patterns for assessment design can be found in Assessment-Driven Course Design [Bergin et al. 2015a; Bergin et al. 2015b; Warburton et al. 2016]. This pattern language formed the starting point for designing the assessment elements of a semester about software engineering at HAN University of Applied Sciences in the

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Netherlands. Besides applying effective practices for Assessment Design, there were additional challenges the semester designers wanted to address, including:

- instructor feedback seems unrelated to grading,
- students have low self-assessment skills,
- students show low ownership of learning, and
- big bang grading at the end which encourages procrastination and results in often unpredictable results.

To address these challenges, the teachers searched for existing patterns, pattern combinations, and other relevant known good practices. The concept of hybrid pedagogy served as an explicit guideline in order to widen the potential solution space [Köppe and Middelkoop 2020].

The result of the design process was the pattern language of Incremental Grading, which is summarized in the appendix and described in detail in [Köppe et al. 2019].

However, not all well-known practices that were applied during the design of Incremental Grading were already described as educational patterns, even though they are well known practices in education. This paper fills this gap by describing these practices as patterns. These patterns can be applied by educational designers to help them with making their assessment approach more student-centered.

2. NEW PATTERNS

In total there were 6 practices identified which haven't yet been described as educational patterns. Three of these new patterns focus on helping the students to become responsible for determining the quality of their work as well as how to handle this as the teacher. WORK SELF-ASSESSMENT is a formative assessment which the students perform using pre-defined criteria in order to determine the quality of their (partial) work products. Based on the WORK SELF-ASSESSMENT, the students can perform a STUDENT-DRIVEN GRADING, a student-driven formative assessment which includes a justification for the requested grade. Assessments are of most value when the results and feedback are communicated in a timely manner [Chappuis 2014] and GRADING QUEUE addresses this issue.

Two additional patterns focus on using assessment results for providing overview for both students and teachers (GRADING DASHBOARD) and for motivating students (REWARD SYSTEM).

Finally, when assessment shows that student work can be improved (even though it might be already of a sufficient quality level), then students should be encouraged to do so with GO FOR GOLD.

Please note that these patterns can be applied in combination and/or sequence as is done in Incremental Grading (see appendix A for a short summary). However, these patterns can also be applied independently of each other or in an adapted form even though they might be less valuable then.

The patterns are described using the most common elements of pattern descriptions: context (in what context does the solution solving the problem?), problem (what is the problem that can occur in this context?), forces (what influences the problem and makes it non-trivial to solve), solution (the essence of the practice which solves or weakens the problem and balances the forces), solution details (useful information for applying the solution), consequences (what do you get when solving the problem with this solution, both positive and negative), and finally known uses (examples of successful application of the pattern solution). All referenced patterns not described in this paper are summarized in the appendix.

Pattern: WORK SELF-ASSESSMENT

Context: Students work on larger products over a considerable period of time. Quality Criteria are defined (e.g. as RUBRICS) for various aspects of the work products.

Problem: Students are mainly relying on you, the teacher, to assess their work. They often have difficulties with determining the quality of it and as a consequence have trouble with identifying where they stand and what the

next steps are.

Forces:

➔ Students (and people in general) are more comfortable when they understand the criteria for evaluation and whether their work meets that criteria. However, they don't learn as much when they continue to ask others for this type of feedback.

➔ It's important to be able to assess one's work – to evaluate when it meets criteria and when it does not. However, we rarely give students the opportunity to learn this skill because typical grading methods see the instructor as the only person who can assess. Even if there are well-stated criteria, students do not automatically use these for determining the quality of their work.

Solution: Therefore, encourage the students to assess the current quality levels of their own work using the same assessment criteria that are used for determining the grade for the work.

Start by offering some support. Provide, if available, examples of work results with various levels of quality and let the students assess these and discuss the results using criteria such as rubrics. As creating rubrics can be time consuming, you can also start with defining the boundary between sufficient and insufficient. This way the students get familiar with the criteria and how to interpret and use them. If no such examples are available, then start with self assessments when students have the first parts of their work ready.

You may also wish to dedicate a portion of a class period to checking in to see how it is going, e.g. by asking students to explain the results of their self assessments and then addressing any questions.The frequency and duration of this exercise can be dependent on how well the self assessments are done by the students.

Emphasize that it is absolutely okay if the result of the periodic self-assessment shows that the work products (or parts of it) are still of low quality because this insight helps them with learning and improving their work.

The positive effects can be enhanced by asking the students to also provide an explicit justification for their assessment results. This way they are encouraged to think deeper about the quality and provide reasoning instead of just picking a quality level they think fits best. This also can form the basis for STUDENT-DRIVEN GRADING.

A nice addition to this solution might be to have the students initially develop the assessment criteria themselves which will increase the ownership and therefore the motivation of the students. It might be necessary that you supervise this process to ensure that the criteria indeed measure the quality of the desired learning outcomes.

Positive Consequences:

+ When students are given clear criteria to rate and to understand how well they are doing so far, they have the opportunity to become more comfortable with learning how to assess their own work.
+ Students understand how their work will be assessed because they are using the same assessment criteria (which is also the basis for a TRANSPARENT ASSESSMENT).
+ When having to assess their own work regularly, their self-assessment skills are likely to improve. Students play a more active role when they are encouraged to take more responsibility for their own learning progress.

Negative Consequences/Challenges:

- By definition, rubric tables do not contain significant details. This can be challenging for students who want to know exactly what they need to do in order to reach a specific quality level. Help students with interpreting the rubrics on specific examples, such as the work of previous students, and use their questions as a starting point for discussions on how to determine quality.
- Giving students criteria in advance may not prepare them for life beyond their university courses, where they won't often have such criteria. In addition, providing the criteria in advance could predispose them to look for

only those things even though any complex work product may have many other things that are relevant for judging quality. However, it can also be argued that exposure to such criteria helps students understand the importance of defining clear expectations when they are in the role of evaluating others in the workplace.

- When performing self-assessments on their work products, students do not get feedback from a teacher on the results. This increases the chance of over- or under-estimation of the quality. Teachers should regularly check the results of these self-assessments, as also suggested in CONSIDERATE LECTURER.

Known uses:
Jan Chappuis included self-assessment as one of the seven strategies of assessment for learning and provides many examples of self-assessment applications [Chappuis 2014].

Andrade & Valtcheva provide guidelines and many examples for self-assessments, such as for narrative writing were students had to circle the quality level in the rubric with one color and circle the elements in the story which relate to this quality level with the same color, hereby linking both the work product and the rubric elements [Andrade and Valtcheva 2009].

In the course on software engineering at HAN University, all assessment criteria were published in the form of rubrics and made available to the students via the learning management system. The students were encouraged to regularly assess their own work. When the result of this assessment was satisfying, the students could use it for STUDENT-DRIVEN GRADING, handing in a grading request.

In two project-driven courses at the University of North Carolina Asheville, students are given the rubrics that will be used to evaluate their work. They are encouraged to use each rubric as a form of checklist to help with continuous improvement while working on their assignments and as a final re-check just before they submit something for grading.

Pattern: STUDENT-DRIVEN GRADING

Context: Students work on larger products over a longer period of time. Quality criteria are defined (e.g. as RUBRIC) for various aspects of the work products. Students might already regularly apply WORK SELF-ASSESSMENTS.

Problem: Even with regular feedback, students are often unsure about the quality of their work with respect to the associated grades and whether they have a chance to earn their desired grade.

Forces:

➔ Not knowing where one stands makes it hard to focus on the right things in the right way. And even though students have an idea (based on a WORK SELF-ASSESSMENT), there is still some uncertainty about the grade they will finally earn. However, students (and people in general) are more comfortable when they understand if they are heading in the right direction.

➔ You often hear questions such as ”Is this good enough?" or ”What else should I do to pass this assignment?". You may be hesitant to answer such questions in order to encourage the students to focus on quality and not grades. However, the current system in higher education is mostly based on grading and getting sufficient grades is essential for student success. Still, you do not want to simply provide them with grades, as this puts the students into a passive and reacting role.

Solution: Therefore, give students the responsibility for determining the grade for (partial) work products, based on the results of their WORK SELF-ASSESSMENT. Let them make a grading request that requires them to identify and provide evidence for the quality and the corresponding grades they expect to earn. When their assessment is

accurate, they will earn the grade.

One way of implementing the solution is requiring the students to submit grading requests with the following information:

- for whom the grades are requested,
- for which assignment,
- for which criteria and/or rubrics the grades are requested,
- what the concrete requested grades are (per rubric/criterium),
- a justification for the requested grade/s, and
- the actual evidence (such as research reports, essays, documentation, source code, diagrams etc.).

Allow students to make grading requests for final grades or partially-finished work for partial grades. This works especially well with cumulative grading where students collect their grades or points during the execution of an educational unit such as a course or a semester. If grading requests are handled by the teachers in a timely manner (e.g. when applying GRADING QUEUE), they also shorten the feedback cycles, hereby supporting the students more effectively and making the assessment more formative.

You may wish to encourage students to request grades early and often before the final deadline, which will allow them to create moments of value themselves as also suggested in CONTINUOUS ACTIVITY. This forces them to regularly perform a thorough assessment of their work and in consequence improves learning. It furthermore likely leads to a higher ownership of the learning process.

STUDENT-DRIVEN GRADING is an extension of the concept of self-grading–it adds multiple increments to the process and makes the students responsible for deciding on the moment of self-grading instead of doing it once at a fixed point– and a follow-up on WORK SELF-ASSESSMENT. It combines the formative aspects of the latter one with the summative aspects of also defining a grade for current status of the work product (parts). The responsibility for determining the grade moves from teacher only to mainly student. The role of the teacher changes, instead of determining the grade themself they have to assess if (a) the requested grade, (b) the justification for it according to the quality level in the rubric, and (c) the work product do match. If that is the case, then the student gets the requested grades. It is important to note that these grades are not the final ones and still can be improved until the final deadline. If all of these 3 aspects do not match, then feedback should be given with the reason, including the justification that the student did not prove that the quality level has been achieved or the quality of the work product does not match the description in the rubric. This feedback can be used for either improving the work product, improving the justification (with a focus on quality), or requesting a more realistic grade.

Self-grading is an approach which has been shown to have potential advantages over teacher grading: logistical (time efficient, quicker and more detailed feedback for students), pedagogical (deepens students' understanding), meta-cognitive (awareness of own strengths, progress, and gaps), and affective (sense of shared ownership for the learning process) [Crowell 2015]. It furthermore appears to result in increased learning [Sadler and Good 2006].

Positive Consequences:

+ Students become more self aware of when their product has reached a point with certain quality (as described in e.g. a RUBRIC).
+ Students may be motivated to start working on an assignment earlier because they will get feedback for part of their work. This is not possible with a fixed deadline where the assessments take place after the deadline.
+ When students request grades early and often, this increases the amount of feedback they will get, as feedback is part of the teacher's assessment of the grading request.

+ When students are requesting grades at periodic times, your workload is distributed. The cycles of feedback and improvement will likely increase the quality of the students' final products, creating less tedious grading for the teacher at the end of the semester.
+ Self-grading may also reduce student-teacher conflict [Edwards 2007], as it is a TRANSPARENT ASSESSMENT and students are actively involved in the grading process which leads to fewer discussions on the grading results.

Negative Consequences/Challenges:

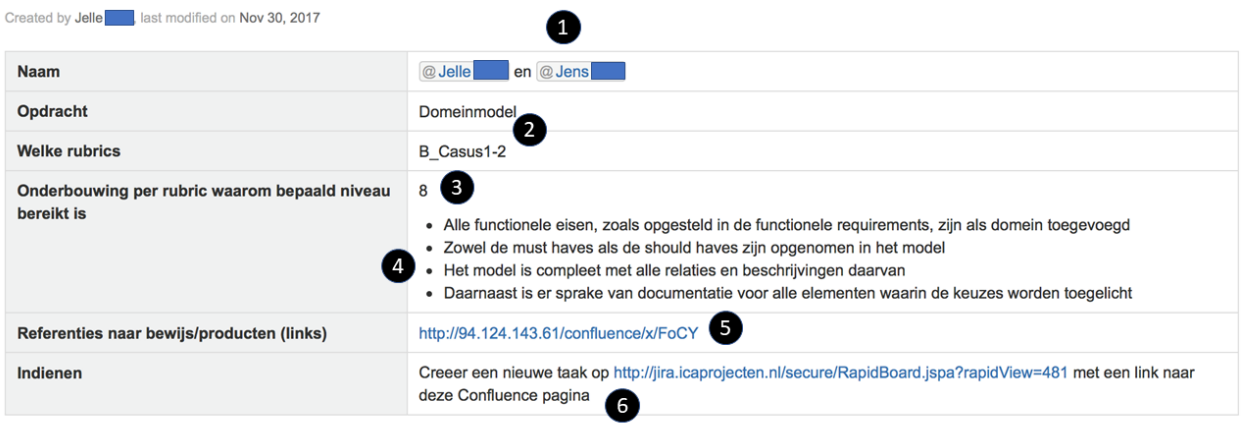
- This might require a change in the mindset for both you and the students. In the beginning, it might be difficult for some students to do this determination based on the criteria, as they are used to submitting their work and getting the grade and (hopefully) some feedback on the quality. When using the criteria themselves, questions might arise on how to interpret them or how to translate them into concrete elements of work. Use this as an excellent starting point for discussions about quality! As a teacher you have to accept that you are not the only one responsible for grading. Assessing the work changes into assessing the justification of the requested grade.
- You may be afraid of grade inflation (students grading themselves too high). However, research shows that most students feel that they grade themselves harder when self-grading [Crowell 2015]. And because they are only requesting the grades, instead of just giving grades themselves, you as teacher have the final say.
- Students might see this as doing the work of the teacher and become REBEL STUDENTS. Accept it and explain to them that they will learn more when doing WORK SELF-ASSESSMENT often and early. The worst that can happen is that students stick to their old habits and submit only one version when the final deadline has arrived, with all the negative consequences of this approach.
- It requires additional effort to teach students how to use the ASSESSMENT CRITERIA LIST or RUBRICS. It might help to include some exercises in using the criteria on some examples of varying quality as also suggested in WORK SELF-ASSESSMENT.
- It requires some extra effort from the students to provide the justification. This might be experienced as overhead by them, but is actually an important element for improving their self-assessment and meta-cognitive skills.
- If your response to STUDENT-DRIVEN GRADING takes too long, then chances increase that students won't see much value in this approach and stop grading their own work. This can be addressed by applying GRADING QUEUE.

Known Uses:

Self-grading in general has successfully been applied in a variety of domains such as Social Statistics [Edwards 2007], Public Health [Crowell 2015], History of Creativity [Strong et al. 2004], or General Science [Sadler and Good 2006].

Grading for most elements of the semester on Software Engineering at HAN University of Applied Sciences was student-driven. Students had to hand in a grading request, using a template to ensure that all required elements are present (see Figure 1).

Figure 2 shows another implementation. For a video assignment in the course "Communicating Science with the Public" at Utrecht University, students had to carefully identify and describe elements such as target audience, aim etc. The first rubrics were covering these aspects and had to be applied for determining the quality of their descriptions. The students were asked to add the grading request on the bottom of their document (1) using a template (2) which contains a table where the grade and the justification had to be filled in and also a complete overview of the rubrics (3).

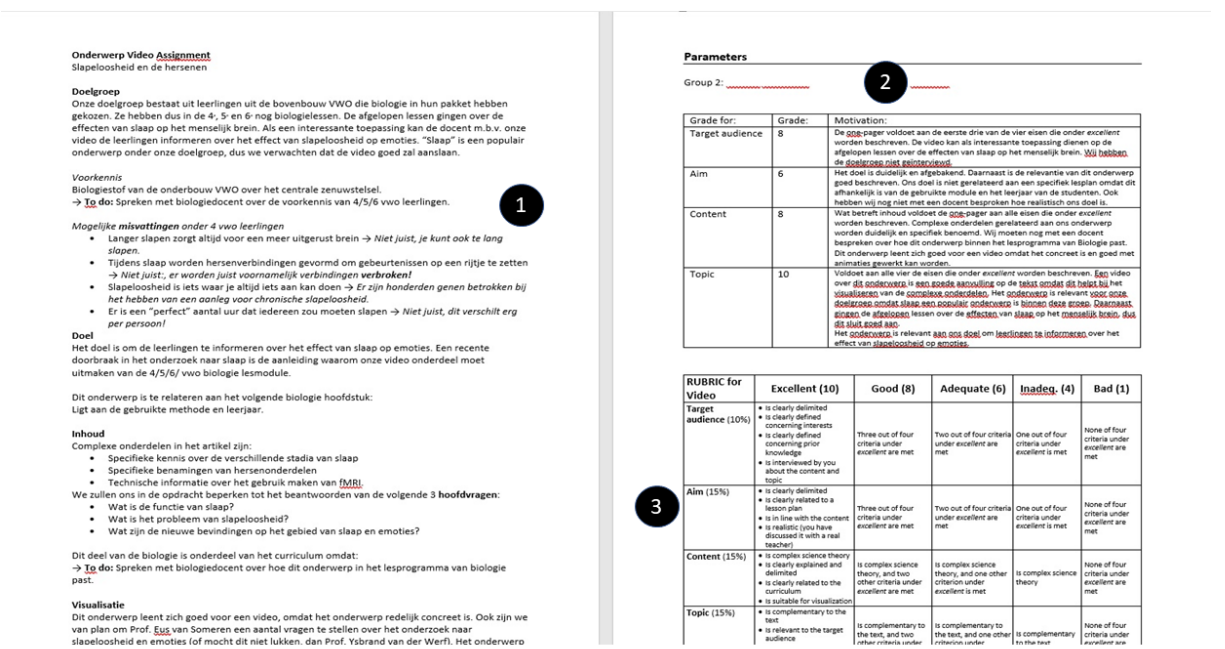


Created by Jelle [redacted] last modified on Nov 30, 2017

Naam	@Jelle [redacted] en @Jens [redacted]
Opdracht	Domeinmodel
Welke rubrics	B_Casus1-2
Onderbouwing per rubric waarom bepaald niveau bereikt is	8 • Alle functionele eisen, zoals opgesteld in de functionele requirements, zijn als domein toegevoegd • Zowel de must haves als de should haves zijn opgenomen in het model • Het model is compleet met alle relaties en beschrijvingen daarvan • Daarnaast is er sprake van documentatie voor alle elementen waarin de keuzes worden toegelicht
Referenties naar bewijs/producten (links)	http://94.124.143.61/confluence/x/FoCY
Indienen	Creeer een nieuwe taak op http://jira.icaprojecten.nl/secure/RapidBoard.jspa?rapidView=481 met een link naar deze Confluence pagina

1 2 3 4 5 6

Fig. 1. Grading Request template (in Dutch), elements are (1) for whom, (2) which rubric/s, (3) which grade/s requested, (4) justification for the grade/s, (5) a link to work/evidence, and (6) how to submit the request (adapted from [Köppe et al. 2019]).



Onderwerp Video Assignment
Slapeloosheid en de hersenen

Doelgroep
Onze doelgroep bestaat uit leerlingen uit de bovenbouw VWO die biologie in hun pakket hebben gekozen. Ze hebben dus in de 4-, 5- en 6- nog biologielessen. De afgelopen lessen gingen over de effecten van slaap op het menselijk brein. Als een interessante toepassing kan de docent m.b.v. onze video de leerlingen informeren over het effect van slapeloosheid op emoties. "Slaap" is een populair onderwerp onder onze doelgroep, dus we verwachten dat de video goed zal aanslaan.

Voorkennis
Biologiestof van de onderbouw VWO over het centrale zenuwstelsel.
→ **To do:** Spreken met biologiedocent over de voorkennis van 4/5/6 vwo leerlingen.

*Mogelijke **misvattingen** onder 4 vwo leerlingen*
- Langer slapen zorgt altijd voor een meer uitgerust brein → *Niet juist, je kunt ook te lang slapen.*
- Tijdens slaap worden hersenverbindingen gevormd om gebeurtenissen op een rijtje te zetten → *Niet juist:, er worden juist voornamelijk verbindingen **verbroken!***
- Slapeloosheid is iets waar je altijd iets aan kan doen → *Er zijn honderden genen betrokken bij het hebben van een aanleg voor chronische slapeloosheid.*
- Er is een "perfect" aantal uur dat iedereen zou moeten slapen → *Niet juist, dit verschilt erg per persoon!*

Doel
Het doel is om de leerlingen te informeren over het effect van slaap op emoties. Een recente doorbraak in het onderzoek naar slaap is de aanleiding waarom onze video onderdeel moet uitmaken van de 4/5/6/ vwo biologie lesmodule.

Dit onderwerp is te relateren aan het volgende biologie hoofdstuk:
Ligt aan de gebruikte methode en leerjaar.

Inhoud
Complexe onderdelen in het artikel zijn:
- Specifieke kennis over de verschillende stadia van slaap
- Specifieke benamingen van hersenonderdelen
- Technische informatie over het gebruik maken van fMRI.

We zullen ons in de opdracht beperken tot het beantwoorden van de volgende 3 **hoofdvragen**:
- Wat is de functie van slaap?
- Wat is het probleem van slapeloosheid?
- Wat zijn de nieuwe bevindingen op het gebied van slaap en emoties?

Dit deel van de biologie is onderdeel van het curriculum omdat:
→ **To do:** Spreken met biologiedocent over hoe dit onderwerp in het lesprogramma van biologie past.

Visualisatie
Dit onderwerp leent zich goed voor een video, omdat het onderwerp redelijk concreet is. Ook zijn we van plan om Prof. Eus van Someren een aantal vragen te stellen over het onderzoek naar slapeloosheid en emoties (of mocht dit niet lukken, dan Prof. Ysbrand van der Werf). Het onderwerp

1

Parameters

Group 2: [redacted]

2

Grade for:	Grade:	Motivation:
Target audience	8	De one-pager voldoet aan de eerste drie van de vier eisen die onder *excellent* worden beschreven. De video kan als interessante toepassing dienen op de afgelopen lessen over de effecten van slaap op het menselijk brein. Wij hebben de doelgroep niet geïnterviewd.
Aim	6	Het doel is duidelijk en afgebakend. Daarnaast is de relevantie van dit onderwerp goed beschreven. Ons doel is niet gerelateerd aan een specifiek lesplan omdat dit afhankelijk is van de gebruikte module en het leerjaar van de studenten. Ook hebben wij nog niet met een docent besproken hoe realistisch ons doel is.
Content	8	Wat betreft inhoud voldoet de one-pager aan alle eisen die onder *excellent* worden beschreven. Complexe onderdelen gerelateerd aan ons onderwerp worden duidelijk en specifiek benoemd. Wij moeten nog met een docent bespreken over hoe dit onderwerp binnen het lesprogramma van Biologie past. Dit onderwerp leent zich goed voor een video omdat het concreet is en goed met animaties gewerkt kan worden.
Topic	10	Voldoet aan alle vier de eisen die onder *excellent* worden beschreven. Een video over dit onderwerp is een goede aanvulling op de tekst omdat dit helpt bij het visualiseren van de complexe onderdelen. Het onderwerp is relevant voor onze doelgroep omdat slaap een populair onderwerp is binnen deze groep. Daarnaast spreken de afgelopen lessen over de effecten van slaap op het menselijk brein, dus dit sluit goed aan. Het onderwerp is relevant aan ons doel om leerlingen te informeren over het effect van slapeloosheid op emoties.

RUBRIC for Video	Excellent (10)	Good (8)	Adequate (6)	Inadeq. (4)	Bad (1)
Target audience (10%)	• is clearly delimited • is clearly defined concerning interests • is clearly defined concerning prior knowledge • is interviewed by you about the content and topic	Three out of four criteria under *excellent* are met	Two out of four criteria under *excellent* are met	One out of four criteria under *excellent* is met	None of four criteria under *excellent* are met
Aim (15%)	• is clearly delimited • is clearly related to a lesson plan • is in line with the content • is realistic (you have discussed it with a real teacher)	Three out of four criteria under *excellent* are met	Two out of four criteria under *excellent* are met	One out of four criteria under *excellent* is met	None of four criteria under *excellent* are met
Content (15%)	• is complex science theory • is clearly explained and delimited • is clearly related to the curriculum • is suitable for visualization	Is complex science theory, and two other criteria under *excellent* are met	Is complex science theory, and one other criterion under *excellent* is met	Is complex science theory	None of four criteria under *excellent* are met
Topic (15%)	• is complementary to the text • is relevant to the target audience	Is complementary to the text, and two other criteria under	Is complementary to the text, and one other criterion under	Is complementary to the text	None of four criteria under *excellent* are

3

Fig. 2. Grading Request example including work product (1), justification (2), and rubric (3).

Pattern: GRADING QUEUE

Aka GRADING REQUEST KANBAN

Context: You apply STUDENT-DRIVEN GRADING and have students request grades based on their WORK SELF-ASSESSMENTS.

Problem: Students will see grading requests as worthless and stop handing them in when they have to wait too long to get feedback on them. The positive effects of Incremental Grading and the student's trust in you as their teacher will diminish.

Forces:

- ➔ Feedback is most valuable when it is given in close proximity to the work done. This enables the students to relate the feedback to their most current work and therefore use the feedback for improvement.
- ➔ However, keeping track of which grading requests still need to be assessed and which ones were already handled might become difficult if there are larger student groups and a high amount of different assessment criteria. It might be even more difficult when multiple assessors are involved.
- ➔ On the other hand, not knowing how long it will take to get feedback can be frustrating and discouraging for students.

Solution: Therefore, provide an easily accessible overview of all open grading requests, sorted by waiting time. If possible, make this overview visible to the students. Handle the grading requests in a structured, timely, and transparent manner.

Try to handle the oldest grading requests first in order to minimize the average waiting time for the students (first in, first out). This requires that there is a structure where it can be easily identified when a grading request was handed in, ideally in the form of a queue. A kind of inbox with a timestamp can help here, but using e.g. the mail inbox does not provide transparency – students are not able to see how many open grading requests there are at the moment (and hence how long they likely have to wait before their request is handled). Combining the inbox with an open online document (e.g. with Google Docs) where students can also add the information in their grading request can help with providing more transparency.

In some cases it might be that some grading requests need more time for handling than others. In that case it might seem to be more efficient to handle a couple of smaller grading requests first before the more difficult ones even though they have been handed in later. This should only be done when the requests taking more time will be handled shortly after, otherwise the positive effects of close to synchronous feedback will diminish.

Another way of handling the requests can be to use a Kanban board[1]. When students add new requests in the todo-column (similar to tasks on a Scrum backlog), these are sorted automatically by date and time of submission. You should check the board regularly and assess the requests, taking the oldest ones first in order to minimize the waiting time for the students. Before assessing a request, you should move it to the in-progress column. If more than one teacher (or teaching assistant) assesses the grading requests, then in-progress columns should be added per teacher to make it transparent who is handling the student's requests. Following assessment, the request can be moved to the last column (labeled 'done' or 'assessed'). This should include a link to the feedback for the grading request (e.g. using a comment or feedback functionality) so that the students can easily go to the assessment result.

[1] A Kanban board is used for managing work, having issues that move from right to left on the board according to their status in the overall process (e.g. todo, in progress, done). See also `https://en.wikipedia.org/wiki/Kanban_board`

Kanban boards are widely available and often also part of other software systems that are used in education, e.g. in Jira[2]. There also are other free alternatives that can be used, such as Trello[3].

Aim for a short period of time between the grading request and assigning the feedback on it from you (or other assessor) – the students will then be more likely to experience grade requests as a valuable exercise. Optionally, if students can see how many grading requests still are waiting for feedback helps them to estimate how long it will take before their request is being handled. Seeing that the teachers are working on the grading requests is an important aspect of transparency and helps students to understand teachers better.

Positive Consequences:

+ You always have a clear overview of the open grading requests. You will know which ones have been waiting the longest time for feedback and should be handled first. The students can also see when their requests are handled and by whom.
+ The time between handing in a grading request and getting feedback from the teacher on it will be as short as possible, making the feedback more relevant for the students as they are likely still in the mindset of the assignment elements and can use the feedback for improvements or future work.
+ If the GRADING QUEUE is also visible for students, then they can see how many requests are still open for assessment. This way, when they submit a new request, they can estimate the time it will take to get feedback. They can also check regularly if there's progress in the handling of all the grading requests.
+ Applying GRADING QUEUE will increase the positive effects of STUDENT-DRIVEN GRADING.

Negative Consequences:

- It might be that some grading requests can only be handled by teachers with appropriate background (e.g. when there's a research paper assignment and a software implementation assignment). So it might be that newer requests are handled faster than longer waiting requests. Make clear to the students if this is the case; otherwise they might feel treated unfairly (as some students get faster feedback than others).
- If the GRADING QUEUE is not visible to the students, e.g. because of technical or privacy restrictions, then the system might be seen as a kind of black box. In that case a timely handling of all grading requests is more important or, if possible, information has to be provided to the students when they can expect to get feedback.
- The average waiting time is highly influenced by the size of the chunk of work and the quality of the student's motivation. In order to keep the waiting time low, students should be encouraged to keep the chunks small. Furthermore, students should get help with increasing the quality of their motivations as part of feedback on the first grading requests.

Known Uses:

Figure 3 shows the grading center of the Blackboard LMS. Assignments which need grading can be sorted by "Date Submitted". The grading request information is part of the submission. However, no information is available to students on their position in the queue respectively their anticipated waiting time.

Figure 4 shows the Kanban board used in the SE semester at HAN University of Applied Sciences. There were 3 teachers who did the assessments.

[2] https://www.atlassian.com/software/jira
[3] https://trello.com

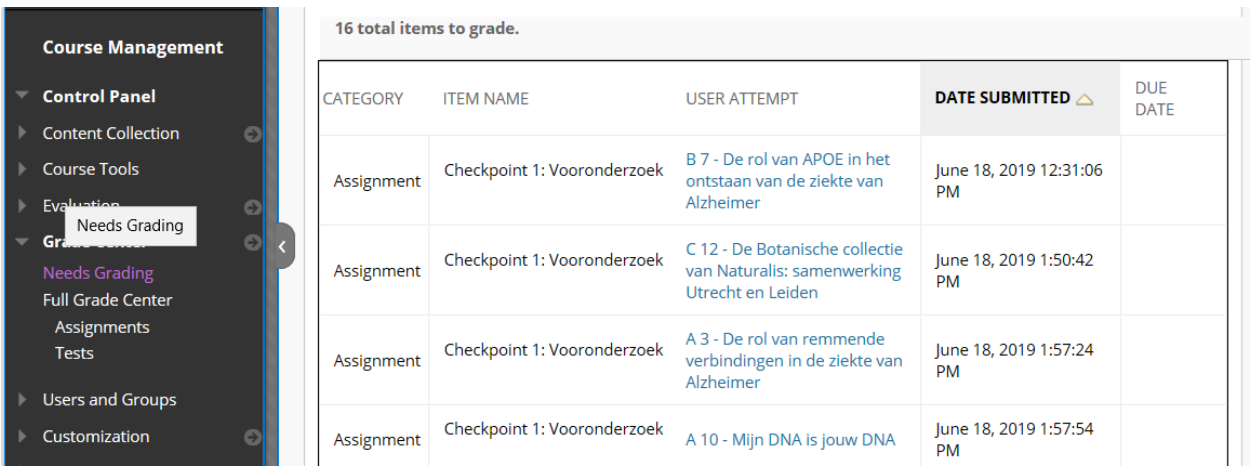


Fig. 3. GRADING QUEUE in the Blackboard LMS.

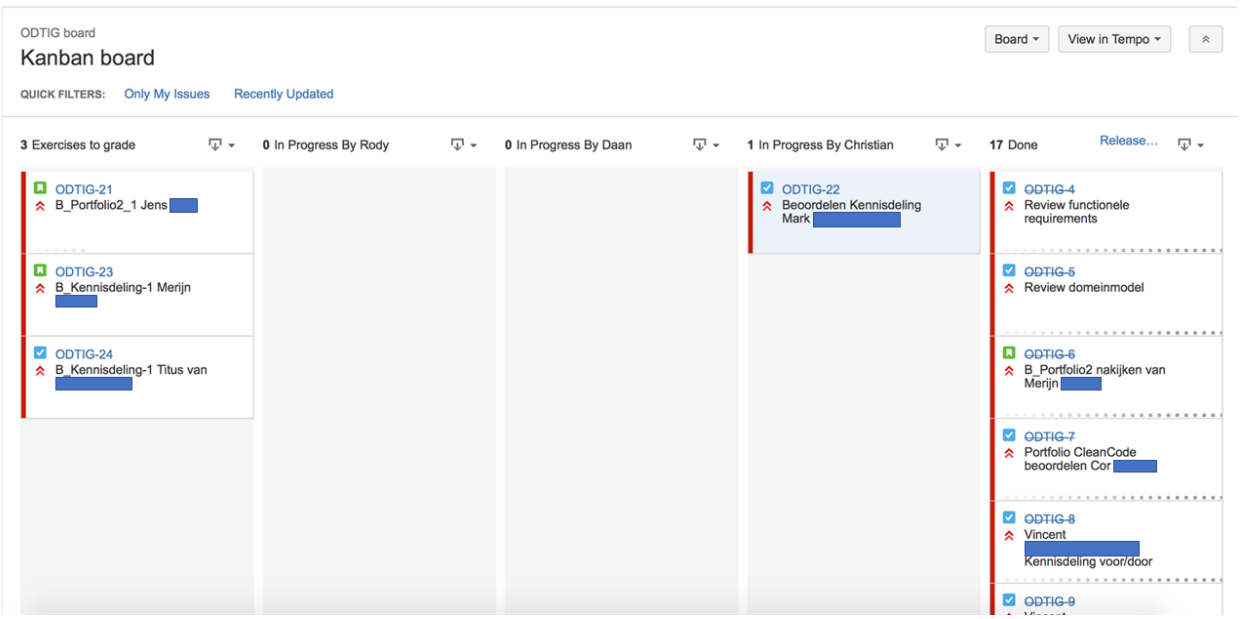


Fig. 4. GRADING QUEUE with a Jira Kanban board (adapted from [Köppe et al. 2019]).

Pattern: GRADING DASHBOARD

Context: Students performed WORK SELF-ASSESSMENTs and got grades acknowledged after applying STUDENT-DRIVEN GRADING.

Problem: When students don't know where they stand in a course, they may make the wrong assumptions about how well they believe they are doing.

Forces:

➔ Students may overestimate their achievements in a course, leading to surprises and frustration when the final grade shows they did not do as well as they thought. On the other hand, some students may underestimate their in-progress achievements, leading them to become overwhelmed and perhaps give up much too soon.

➔ Students may focus mainly on the assignments they like most or which challenge them most, hereby increasing the chance that they won't be able to finish the other assignments with sufficient quality and/or in time.

➔ Students often want to know what assignments they have completed and those they have not started so they can plan ahead or catch up. This can help them assess the cost/benefit of completing specific assignments.

Solution: Provide each student with a clear illustration of how far they have advanced in the course requirements by presenting them all acquired grades together on one dashboard. Show them what they have accomplished already as well as what they still need to do.

Such a dashboard can show all assignment elements, including the ones that are graded ones as well as the ones that are not. The more fine grained the dashboard is, the better the students know where they stand.

One effective way of implementation is with a spreadsheet, having the assignments (or assignment parts) as one axis and the assignment criteria (such as RUBRICS) as the other axis. The cells then contain the achieved grade per criterion. The total or final grade can also be provided by calculating it based on the percentage or amount of points given per assignment (element).

The commonly used approach of Electronic Grade Books[4] can also be used as Grading Dashboard. This way, the students can look at their Grading Dashboard inside of the Learning Management System. Another input for a GRADING DASHBOARD could also be a PERFORMANCE SHEET, where the assessment criteria are rated and the grades can be taken over from.

A REWARD SYSTEM can be added to the dashboard, using different colors for different grades, depending on the cultural meaning of the colors. In many European countries and in the United States, red is negative and green is positive; therefore consider using red colors for failing grades and light green to dark green colors for passing grades.

Positive Consequences:

+ Students get the big picture and can clearly identify the parts of the assignments which they should focus on. They have the information they need to plan for moving forward to achieve the best grade/s possible or their desired grade/s.
+ Students do not need to rely on regularly requesting the status of their grades from the instructor.
+ This opens the door helping students to become more self-regulated learners when they understand and take more responsibility for what they still need to accomplish or where they could improve.
+ The dashboard can also provide students with an EARLY WARNING by clearly indicating the absence of progress.

[4] https://en.wikipedia.org/wiki/Electronic_grade_book

Negative Consequences:

- The dashboard does not tell the complete story – it is only an overview that does not provide details of exactly what the students need to do. This can frustrate students who keep pushing forward in the wrong direction, and therefore do not see progress on their dashboard. However, if the students are encouraged to ask for feedback regularly, either directly or by sending in a grading request, the chance of focusing on the wrong things will decrease. Rubrics or other criteria can also be added to provide further details.
- If a dashboard is not provided automatically by the Learning Management System, preparation takes time for the teacher and needs to be carefully done, especially with respect to the calculations of the grades. It can be problematic if this method displays incorrect information. And when the dashboard provides a way to enter or calculate grades, as a teacher you end up with double bookkeeping which can also take extra time and can be error prone.
- As a teacher, you can't force students to look at the dashboard or to use it for self-directed learning. Students need to learn how to use the dashboard correctly, but may be resistant especially if they are accustomed to more classical grading which is done at the end of a course or where teachers report grades in more traditional ways.

Known Uses:

Figure 5 provides an example dashboard from Moodle.

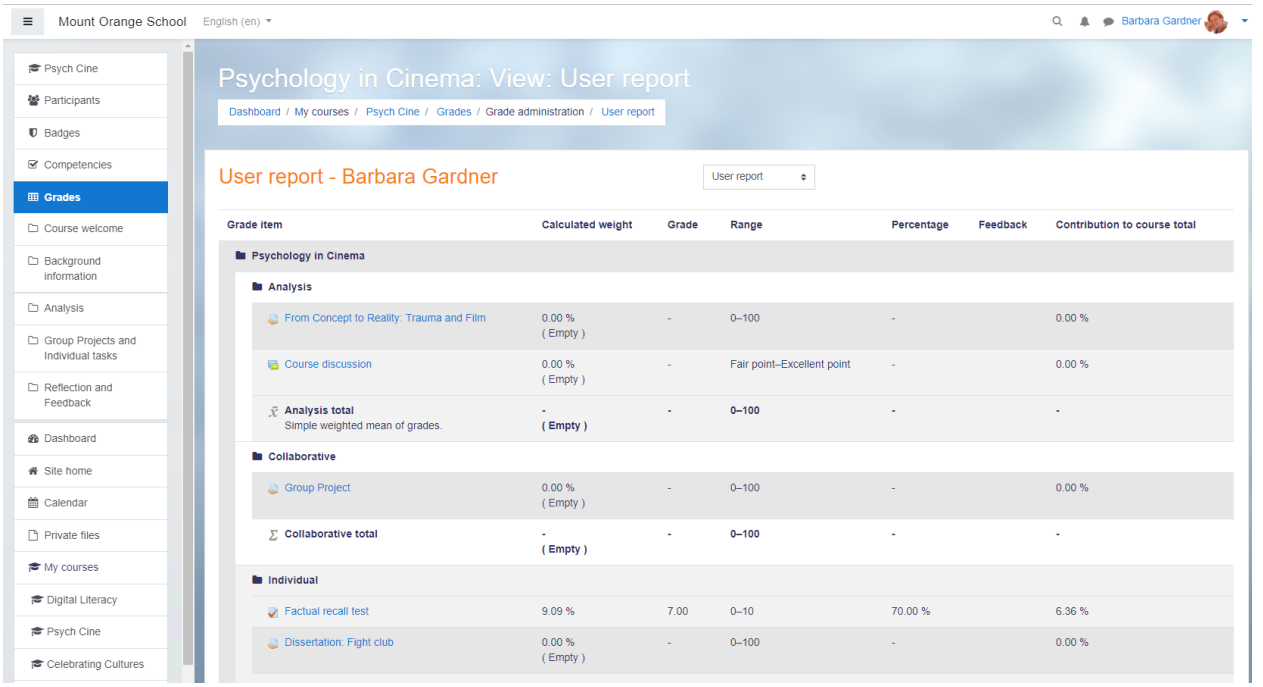


Fig. 5. GRADING DASHBOARD in Moodle LMS (screenshot taken from official Moodle demo).

Figure 6 shows an example of such a dashboard from the implementation of a semester on Object-Oriented Software Engineering at HAN University of Applied Sciences. The codes for the assignments in the first two columns and per assignment the codes of the rubrics are shown above the achieved grades. In the example, "S_Toets1-1.1" is the code for the first rubric of assignment "S_Toets1" and the student got the grade 6 for that part.

At the end of each assignment row, the achieved grade for this assignment is given. At the bottom right, the total grade for the whole course is calculated. The grading system here is the Dutch one, where 1 is the lowest and 10 the highest possible grade. Every time after a grading request, the dashboard was updated and a link to the latest version (using Dropbox) was sent to the student.

Semester: OOSE-DT Student: anonymised

EVL	Toets										
Software Analysis & Design	S_Toets1	S_Toets1-1.1	S_Toets1-1.2	S_Toets1-1.3	S_Toets1-2.1	S_Toets1-2.2	S_Toets1-3				Eind
		6	**6**	**4**	**4**	**4**	**8**				**5,8**
	B_Casus1	B_Casus1-1	B_Casus1-2	B_Casus1-3.1	B_Casus1-3.2	B_Casus1-3.3	B_Casus1-4	B_Casus1-5&6			Eind
		6	**6**	**6**	**6**	**4**	**8**	**6**			**6**
Distributed Application Development	B_Casus2	B_Casus2-1	B_Casus2-2.1	B_Casus2-2.2	B_Casus2-3	B_Casus2-4.1	B_Casus2-4.2	B_Casus2-4.3	B_Casus2-5.1	B_Casus2-5.2	Eind
		8	**6**	**8**	**8**	**6**	**8**	**6**	**6**	**10**	**6,8**
	S_Toets2	Basic	Presentation	Domain	Data						Eind
		V	**V**	**V**	**V**						**V**
Software Process	B_Portfolio1	B_Portfolio1_1	B_Portfolio1_2.1	B_Portfolio1_2.2	B_Portfolio1_2.3	B_Portfolio1_3	B_Portfolio1_4	B_Portfolio1_5			Eind
		6	**6**	**8**	**6**	**6**	**6**	**6**			**6,4**
Craftsmanship	B_Portfolio2	B_Portfolio2_1	B_Portfolio2_2	B_Portfolio2_3							Eind
		8	**8**	**8**							**8**
	B_Kennisdeling	B_Kennisdel-1									Eind
		6									**6**
	B_LearningJournal	B_LearnJour_1	B_LearnJour_2	B_LearnJour_3							Eind
		10	**6**	**10**							**8**
											Eind
											6,425

Fig. 6. GRADING DASHBOARD made with Excel.

Pattern: REWARD SYSTEM

Context: Students got (partial) grades, e.g. after STUDENT-DRIVEN GRADING, and these grades might be shown in a GRADING DASHBOARD.

Problem: Some students don't care much about a grade as long as they pass the course or the assignment. Their grade is seen as just a number (or letter or flag) and the difference between a passing grade and a slightly higher grade may seem insignificant. However, this difference may represent a significant improvement in their learning.

Forces:

- ➔ In order to provide opportunity for continuous improvement, students need to be informed of their errors. However, it can be discouraging and demotivating if we concentrate only on pointing out errors.
- ➔ A grade which is presented just as a number or letter or a flag (passed/not passed) is simply a textual representation which does not automatically trigger an emotional reaction. But such a reaction can serve as a motivational reward.

Solution: Therefore, make all achievements on assignments – smaller and larger ones – visible to students in a visually rewarding way. These rewards should be open, ongoing, and systematic.

When grading an assignment, point out the successful work of each student, or team, in a celebratory way. Clearly display their successes and show how these fit into the bigger picture of their final grade. Emphasize the positive aspects because the goal is to show progress and reward it. Share this information in a timely manner so that the students can relate their achievements to their most recent work.

A common way to add these rewards in a systematic way is through applying aspects of gamification: students can earn badges, have colors changed in overviews, unlock new course options, etc. There are also other well-known project management practices such as burndown charts which can be used as REWARD SYSTEMs. You can also show how individuals or teams performed compared to the rest of the group. Students can even be encouraged to celebrate their Small Successes [Manns and Rising 2015] and/or the instructor may wish to schedule some type of a celebration when students reach specific milestones.

Whereas a GRADING DASHBOARD is used to mainly provide information on the student's progress, the main goal of a REWARD SYSTEM should be to increase student engagement and motivation. However, these two can be in many cases combined in order to increase the positive effects.

Positive Consequences:

+ Rather than being overwhelmed with all that they still need to do to complete the project or the course, students can watch the big effect of many small accomplishments. The positive feedback of seeing what they've done so far can encourage them to keep moving towards even bigger accomplishments. It may even inspire them to continue improving even after they already passed an (element of an) assignment.
+ Students likely gain more self confidence because they can clearly see and what they have accomplished and feel rewarded for it.

Negative Consequences:

- There might be accessibility issues when using colors as some people might be colorblind or have other disabilities. Having alternative ways of rewarding might solve this issue, but also be more difficult to implement.
- Not all students are motivated by the same kind of rewards, depending on their background and preferences. If a REWARD SYSTEM does not seem to work, then it should be adjusted based on the preferences of the student population.

Known Uses:

One type of REWARD SYSTEM is to make use of colours in a GRADING DASHBOARD, making it easily identifiable which (elements of) assignments have already been graded sufficiently. The example in Figure 7 shows the Moodle Completion Progress Block.

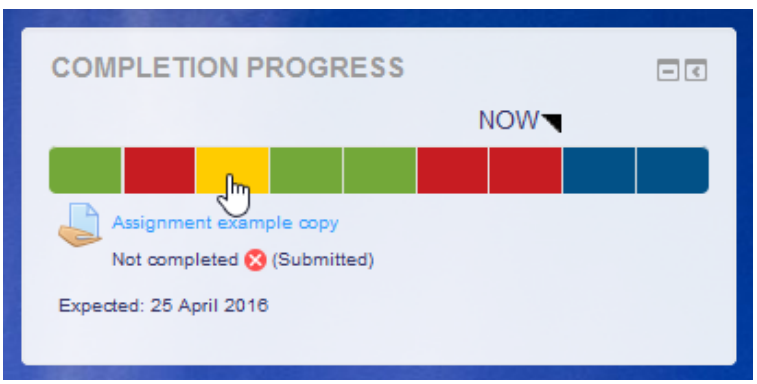


Fig. 7. Moodle Completion Progress Block (Screenshot taken from demo).

Starting with a dashboard with only dark red cells and incrementally getting them to light green on more and more places with the goal of ending up with a total as dark green as possible has shown to be very motivational for

students. Especially the difference between light green (just passed that part) and dark green (getting the highest possible grade for that part) can lead to improvement of already sufficient parts.

For the GRADING DASHBOARD in the course on Object-Oriented Software Engineering at HAN University of Applied Sciences, a coloring scheme was used for the cells in the dashboard. That scheme contained dark red (not graded or with major obstacles), orange (a serious try, but mostly still insufficient, light green (fulfilling the minimum quality requirements), green (solidly fulfilling most the quality requirements), and dark green (excellent quality). An example is shown in Figure 8.

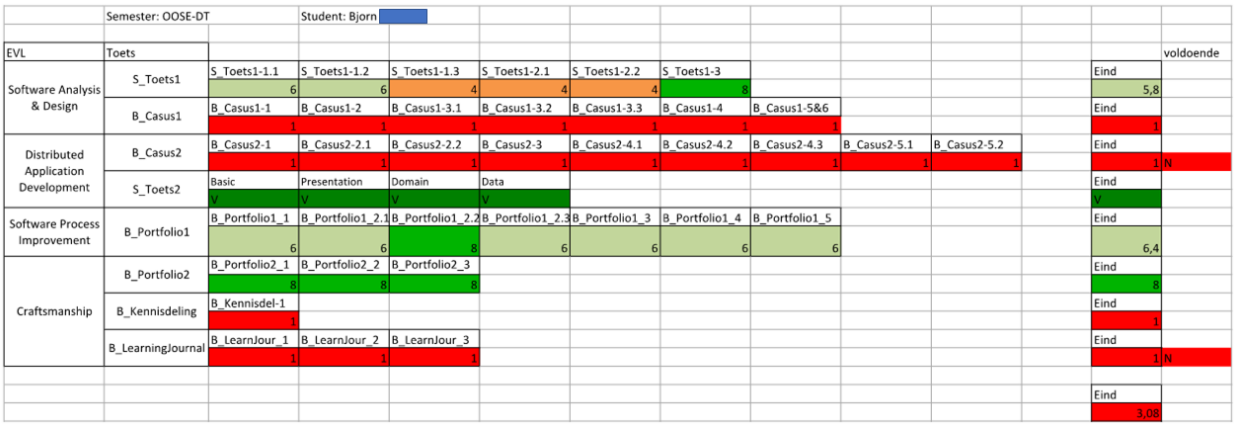


Fig. 8. REWARD SYSTEM as part of a GRADING DASHBOARD in Excel.

Pattern: GO FOR GOLD

Context: Students received grades, e.g. as a result of STUDENT-DRIVEN GRADING, and some or all of these grades are already sufficient for passing the course or assignment.

Problem: Students often believe a passing grade means they have learned enough, even though there are areas where they still lack knowledge and/or skills.

Forces:

- ➔ The focus in education is often on the achievements made, not on the many things one still can learn. As a result, students may learn less than they could have.
- ➔ Some students do not have the intrinsic motivation to aim for higher than simply a passing grade. This is especially true if a higher assignment grade does not add to the total points that have already been achieved to pass the course.
- ➔ Having a passing grade which is not the highest possible grade is also misleading for students; they get the impression that they've learned enough when achieving the passing grade.

Solution: Therefore, continually encourage students to improve their work and strive for the highest possible quality, even–or especially!–when they have already acquired a passing grade. Keep an eye on what they are doing and point out ways how it can be improved. Show that you believe they can do better and cheer them on when needed.

An appropriate moment is immediately when the student receives a passing grade, but not the highest possible grade and there is still time until the assignment deadline. At that moment, the feedback is still relevant and easy to relate to the product and its application before the student begins to work on other assignments.

GO FOR GOLD is supported by using a REWARD SYSTEM that makes the improvements visible, e.g. through changing the color of a grade from light green to dark green when it has improved.

Positive Consequences:

+ Students can learn more and deeper when stimulated to continue learning.
+ Some students appreciate the chance to get high grades. In their experience it does often not seem to be possible to get the highest possible grades, either because they don't know exactly how their work is graded and focus on the wrong elements, the grades are given for snapshots of their work which is not final yet and they can't change these grades, or the teachers simply refuse to give the highest grades as principle. Having the chance to improve their own work in combination with clear criteria for also the highest possible grades solves these issues.
+ Your encouragement demonstrates your commitment towards your students, which is an important motivator in education.
+ The results of a course and the students will likely improve, both in terms of fulfilling the learning objectives and the final grades.

Negative Consequences:

- This requires extra time because it's best when you watch how the students are doing and then personally encourage them to do more.
- While focusing on improving some parts, students might forget to work on other parts which are not yet of sufficient quality. This could lead to some parts with high quality, while other parts do not have not sufficient quality.
- If students are not interested in the course subject or specific assignments, then they likely are not open for improving– they will simply want to get a passing grade. You may then want to become a CONSIDERATE LECTURER, observing what students are working on and intervening if necessary.

Known Uses:

In the semester on software engineering, students were encouraged to make use of the improvement possibility until the final deadline. One way of encouragement was as part of feedback on their grading requests– they are made aware of the next quality level according to the rubric and what they are missing for reaching that level. 4 (out of 17 students) requested higher grades for 8 criteria, even though they already had passing grades for all of them.

Basic	Presentation	Domain	Data
V	V	V	V
B_Portfolio1_1	B_Portfolio1_2.1	B_Portfolio1_2.2	B_Portfolio1_2.3
6	6	8	6

Fig. 9. Using a REWARD SYSTEM as motivator to GO FOR GOLD.

Another implementation of GO FOR GOLD in the same semester was the use of the REWARD SYSTEM in the GRADING DASHBOARD (see Figure 9). When achieving the passing grade of 6, the corresponding cell was colored light-green. Cells with a higher grade used darker greens for coloring, showing visually the options for improvement and therefore stimulating the students to work towards a more rewarding darker green.

In a course at Utrecht University on ”Assessing and Grading" which is part of teacher education, the students were encouraged to improve their work. This resulted in 3 times the highest possible grade and the students gave feedback that they liked most the possibility to get such high grades.

3. SUMMARY AND FUTURE WORK

In this paper we described six practices of assessment design as educational design patterns. These patterns are applicable in various contexts and they form an essential part of Incremental Grading, a student-driven assessment approach.

Even though all six patterns are based on good practices, their validity still needs to be shown empirically. In future work, we will research the effectiveness of all the patterns (mostly as part of Increment Grading) in larger-scale educational interventions. These patterns will then be consciously applied when defining the solution space as part of a design-based research approach.

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Appendix A

Incremental Grading [Köppe et al. 2019] is an approach which is intended to address challenges such as procrastination, low self-assessment skills, low ownership of learning and high workload peaks of assessors in a holistic way. It is based on a configuration of well-known and proven good practices and was designed during development of a semester on Object-Oriented Software Engineering at HAN University of Applied Sciences. The core idea is that students assess their own work using pre-defined criteria (e.g. rubrics). Whenever they believe they've achieved a certain quality level, they request a self-determined grade (based on their self-assessment) and provide justification for how they believe they have fulfilled the requirements for the requested grade. This justification is an essential part of the approach, as it requires students to acquire necessary self-assessment skills and to pro-actively engage in a fair grading process.

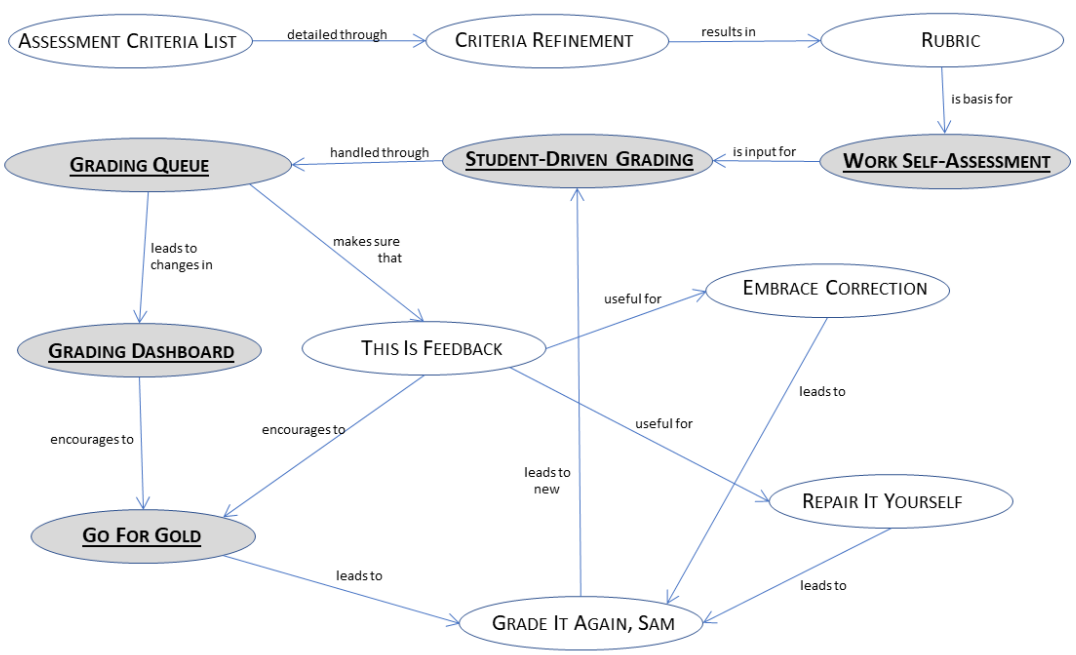

Fig. 10. Overview of core elements of Incremental Grading (adapted from [Köppe et al. 2019])

The students can request grades whenever and (optionally) as often as they want (until the final deadline), on new work products and also on assignment elements that were previously graded and have been improved or corrected. This way, the requests also serve as feedback (combining grading and feedback) and help the students with directing their own learning. Requested grades which match with the actual work product and the justification are given and added to an overview of all achievements (a grading dashboard) so that both students and teachers

have grip on the student's progress. Figure 10 gives a visual overview of the core elements of Incremental Grading (in the form of educational design patterns) and their relations. The highlighted patterns are described in this work. The full approach is described in [Köppe et al. 2019].

Appendix B

In the following table, we will provide an overview of all patterns which were referenced in the paper.

Pattern Name	Summary
ASSESSMENT CRITERIA LIST [Bergin et al. 2015c]	Clearly communicate to students what the criteria for assessment are.
EARLY WARNING [Bergin et al. 2012]	Give students an early warning when you see that they are headed for trouble or fall behind.
REBEL STUDENTS [Köppe et al. 2017]	When students rebel, don't resist. Open up the space for them to reconstruct the learning experience.
RUBRIC [Bergin et al. 2015c]	Rate each Refined Criteria on a sheet and aggregate the mark.
TRANSPARENT ASSESSMENT [Bergin et al. 2015a]	Ensure that your assessment scheme is visible to your students, from the criteria to the actual tools you use to apply them.
PERFORMANCE SHEET [Bergin et al. 2015c]	Undocumented assessment criteria are both unfair and impossible to apply. Rate each Refined Criteria on a sheet.