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Assessment Policy Engineering Technology

MECHANICAL ENGINEERING (BSC & MSC)
CIVIL ENGINEERING (BSC & MSC)
INDUSTRIAL DESING ENGINEERING (BSC & MSC)
SUSTAINABLE ENERGY TECHNOLOGY (MSC)

UNIVERSITEIT TWENTE

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1. Introduction

Assessments are the bridge between teaching and learning (Williams, D. 2016). They partly determine the quality of the programme and therefore, it is important to formulate an assessment policy to safeguard the quality of assessments. The leading documents for assessments are the Test Plans (assessment plans) of each degree programme, but this policy will set a framework to provide stakeholders[1] with clear guidelines and criteria. The aim of this policy is to secure and increase the quality of testing and assessments within each degree programme of the faculty Engineering Technology.

In this document we first describe the policy at university level and how quality of assessment is secured within the organisation and how it relates to the vision of the faculty. In section 3 the principles of the framework are described and how it is organised within the faculty by describing the tasks and responsibilities of each stakeholder. This section also describes how the tasks and responsibilities of the stakeholders are secured (assessment ability). Section 4 describes how the principles of the framework are implemented to each degree programme and how the quality can be secured by using the PDCA cycle. In the final sections the translation is made to the assessments itself on a module/course level [section 5].

2. Policy at University Level

The assessment policy is one of the key pillars in quality assurance at the University of Twente (UT). The Quality Assurance Policy is based on the PDCA-cycle[2], so the quality of assessment is implemented in these cycles as well (appendix I) to ensure continuous improvement. With the implementation of the assessment policy within the PDCA-cycle of quality assurance, we meet the NVAO requirements of standard 3 "the programme must have an adequate system of student assessment in place" and standard 4 "programme demonstrate that the intended learning outcomes are achieved" (see appendix II).

On a central level, the University of Twente has established a quality framework for assessment policies[3] which is the base for this Assessment Policy for Engineering Technology. The UT framework describes the Plan-Do-Check-Act (PDCA) cycle of quality assurance and how the assessment policy is integrated. It defines who is responsible for what and which aspects need to be considered at the different levels. Also, government legislation (NVAO/WHW) are considered. Based on this framework, the Assessment Policy of Engineering Technology:

- reflects the UT vision and strategy;
- is aligned with the EU, Dutch and UT developments in higher education;
- is aligned with the Meijers criteria (These criteria are divided into 7 learning target areas);
- provides a basis for the development of rules and procedures for each programme of ET;
- and provides a structure for its monitoring and evaluation.

The quality of assessment is secured as described in the pyramid of Sluijsmans et al (2013) [figure 1]. In this pyramid the quality of assessment is translated into six major elements. The assessment policy explains how test plans and assessments are organised within the faculty of ET and sets a framework for each degree programme. The assessment organisation defines all roles and

[1] Stakeholders: dean, vice dean of education, programme directors, Examination Board, Programme Committee, Faculty Council, staff and examiners, students and externals (e.g., accreditation committee members).
[2] Quality Assurance Policy Faculty ET. November 2018
[3] Quality Assurance Framework for Student Assessment UT. December 2016

responsibilities of the stakeholders within the faculty and the assessment ability describes how capabilities of the members of the assessment organisation are secured on a faculty level.

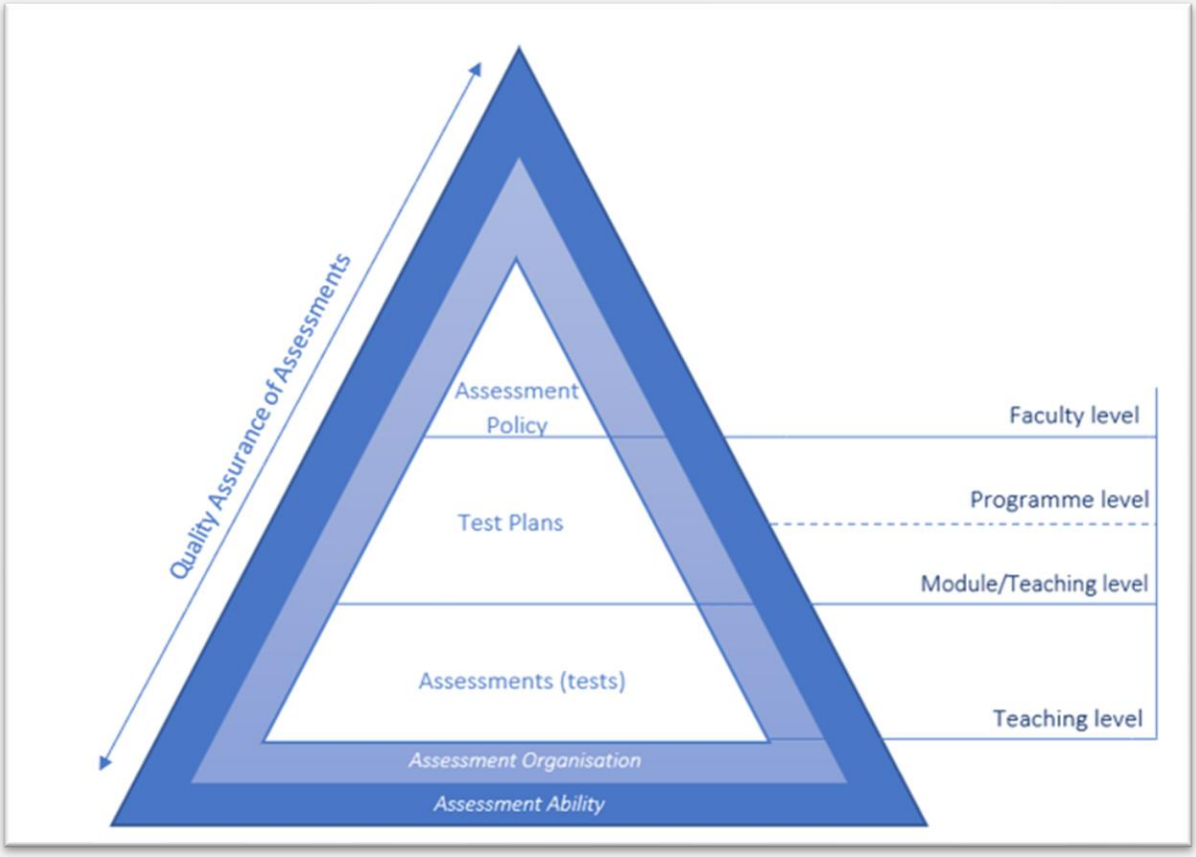


Figure 1: The quality pyramid of contemporary testing and assessment.

2.1 Assessment policy in relation to vision

The University of Twente designed its own educational model: Twents Onderwijs Model (TOM). With this model we help students to be T-shaped, take responsibility for their own development by Student Driven Learning (SDL), and become skilled as researchers, designers, and organisers. Therefore, they start working on projects as early as possible in their study career. The faculty of Engineering Technology (ET) aims for professionals with a broad perspective and therefore aligns with this vision by implementation of thematic project education as the educational concept. In projects, students are asked to acquire, integrate, and apply knowledge and skills from different areas. Learning outcomes, learning activities and assessments are closely aligned with this.

All programmes aim to deliver 'engineers of the future'; professionals with in-depth knowledge of their engineering discipline, who have access to a rich array of knowledge and skills to solve problems both individually and in teams. But also, students who can apply their knowledge in a broader context, in collaboration with other disciplines, nationalities and society (T-shaped professionals).

3. Framework of principles at faculty level

Each degree programme defines test plans for every (integrated) module, study unit or master course. The test plans[4] describe how assessments are organised and focus on the relation of the learning objectives with respect to the final qualifications of the programme, which matches with the expectations of the working field and the international standard (ESG). The following principles are valid for all degree programmes within the Faculty ET:

- For each degree programme, the test plans describe the relation of the learning objectives with respect to the final qualifications of the programme.
- For each degree programme, a standardized format is available to set up a test plan (see appendix IV). This format contains the final qualifications of the programme, so the learning objectives can parallelise to it.
- The Bloom Taxonomy is used to indicate on which level (remembering, understanding, applying…etc.) is tested, so the basic knowledge [cognitive], the skills [psychomotor], the attitudes [affective] and the more complex behavioural competences all are assessed.
- The grading part of the test plan (assessment criteria, answering model, scoring, etc) describes the relative weight of each learning objective.
- The determination of the cutting score substantiated the end result (pass/fail limit).
- All master's degree programmes determine the relationship with research (e.g., how is it integrated, use of research papers as course materials, doing research etc.).
- Evaluation results (e.g., student evaluations, panel discussions, assessment committees) are used to describe improvements for the course for next year.
- The tests are well-spread in time and a balance is maintained between summative and formative purposes and individual and group testing.
- All degree programmes make sure that each assessment mentioned in the test plan fulfil the quality criteria of assessment (transparency, validity, and reliability).

Additional principles for the bachelor's degree programme:

- For the Bachelor programmes, next to the project assessments, there are separate learning lines throughout the integrated modules (*e.g., Mathematics and Academic Research Skills*) which are assessed in different forms (e.g., open book, written exam, oral exam, digital exam) as well.
- For each learning objective a variation of assessment tools is used, including a project examination (in line with the vision of TOM education), so students are tested in an integrated way.

3.1 Assessment organisation

A clear definition of tasks and responsibilities is a prerequisite to assure the quality of assessments on a faculty level. Stakeholders include: Faculty Board, Programme Directors, Examination Boards and Examiners.

Faculty Board:

At a faculty level the Vice-Dean Education (Portefeuillehouder onderwijs) is the main stakeholder and they are responsible for the content and the quality of the programmes, the implementation of government legislation and for safeguarding the independence and expertise of members of Examination Boards. The quality assurance at the faculty level is

[4] See appendix IV; Format Test plan (example)

reported in the annual faculty development plan, faculty regulations, EER per programme and the annual reports of the examination boards. The faculty is monitored by the Executive Board in annual faculty development plans and bi-annual formal performance management meetings.

Programme Directors:
The Programme Director (authorised by the Faculty Board) is responsible for the content (education and assessments), quality and organisation of the programme. The quality is assured in the combination of the final qualifications of the programme, the intended learning outcomes, curriculum planning, assessment planning, and the quality assurance system for the programme. The programme director is monitored by the Vice-Dean Education in performance meetings and through the programme development plans.

Examination Boards:
Examination Boards are responsible for monitoring the assessment quality, have an advising role in assessment planning, ensure the quality of the degrees, apply rules of academic integrity, and appoint examiners. To that end the Examinations Board is by law - the Dutch Higher Education and Research Act (WHW, chapter 7) - entrusted with specific tasks and powers, while operating within the framework set by the Education and Examination Regulations drawn up for the degree programme.

Members of an Examination Board are in most cases lecturers in the Bachelor and/or Master programmes and comply with the standards for staff development. Expertise on testing and assessment are (sometimes) added by an external member (an educational specialist from CELT). If necessary, external expertise or consultancy is acquired.

On a regular basis, the chairs (and/or secretaries) of different Examination Boards meet, to be informed about the latest developments and exchange experiences/knowledge.
The annual reports[5] reflect the activities of the examination board as part of the PDCA-cycle. The annual report is presented to the Faculty Board and is publicly available.
The independency of Examination Boards is ensured by appointing one external member and making sure that members do not have a financial responsibility for the faculty.

Examiners:
The Examination Boards are responsible for appointing examiners for each programme and compose a list of examiners. In general, the staff member who is the first responsible person for the module component or course is also the examiner, i.e., the person responsible for the assessment.
For the appointment of examiners, a set of criteria is used which can be found in the rules and regulations of the Examination Board:

- Education and Examination Regulations Bachelor Industrial Design (Engineering) [BSc]
- Education and Examination Regulations Bachelor Industrial Design (Engineering) [MSc]
- Education and Examination Regulations Master Sustainable Energy Technology [SET]
- Education and Examination Regulations for Civil Engineering (CE)
- Education and Examination Regulations for CEM and CME
- Education and Examination Regulations Bachelor Mechanical Engineering (BSc-ME)
- Education and Examination Regulations Master Mechanical Engineering (MSc-ME)

[5] Appendix V; Conceptual model of the activities of the Examination Board and the role of the annual report

3.2 Assessment Ability

The assessment ability is the expertise that must be present in an organisation in order to ensure the quality of assessments at all levels of the pyramid. An important aspect is to what extent members of the assessment organisation are educated and being capable to take exams since the quality of the examiner is reflected in the quality of the test (Sluijsmans et al, 2013). The test competency of examiners and the quality of assessments are the responsibility of the Programme Director, by making sure that all (starting) lecturers have obtained their UTQ (University Teaching Qualification) within the stipulated time.
The Examination Board supervises the quality of assessments and examinations as described Rules and Guidelines of each Examination Board[6].

All (starting) lecturers have an obligation to obtain their UTQ (University Teaching Qualification) within 3 years after their appointment. Assessment is an important part of this qualification.
All teachers have the attitude to continuously improve their teaching and are familiar with and competent in student-driven learning and project-led education.

The Centre of Expertise of Learning and Teaching (CELT) shaped a trajectory to acquire a Senior Qualification for Examination for staff members of examination boards. More information can be found on its website.

[6] See link to EER of each programme in section 'examiners'

4. Process and quality assurance at programme level

As described in the framework of section 3, each degree programme has a test plan for each (integrated) module/study unit or master course, which address the practical implementation of the faculty assessment policy. The programme director of each degree is responsible for these test plans. To safeguard the quality, the programme director monitors the process through the PDCA cycle.

Plan:
The Programme Director makes sure that lecturers can construct test plans by disposing a (standard) format and offering support [Plan]. When a lecturer requires formal training or toolbox information on assessment and evaluation, a course is available at the University: Centre of Excellence in Learning and Teaching.

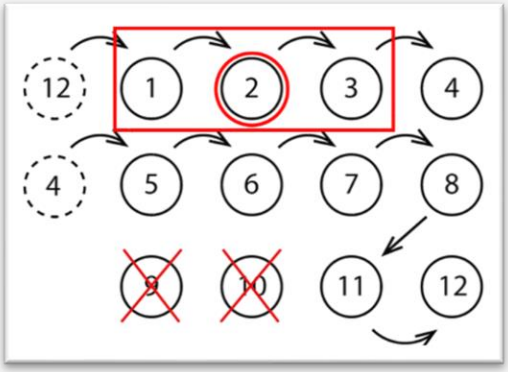
Do:
The examiner designs and executes the assessments in the curriculum (see section 4).

Check:
For the bachelor's degrees[7], all examiners are expected to submit their newly developed test plans to a colleague (fellow lecturer or PhD student who is familiar with the course content) for peer review. This approach was mandated by the Examination Board. The peer reviewer looks at the following aspects:

- Content: are questions and expected answers correct regarding content
- Transparency: are questions formulated clear and unambiguous?
- Validity: are the learning goals addressed proportionally and at the right level?

Lecturers evaluate the course, including assessment, analyse test results and consult educational advisors if they foresee or experience a problem. But also, on a higher level, in the educational programmes, a systematic approach (peer-to-peer review) regarding monitoring the quality of assessment and education is taken.

Central idea behind this approach is the dissemination of experiences between the peers in a comradely atmosphere. Although validity, reliability and transparency are the focus in the screening of assessment, it is not limited to this. Screening leads to a better understanding of colleague's courses which creates new opportunities for collaboration and a smooth continuation of the learning process over the courses.



[7] *For the master course the teaching staff strive to do this as well, but this depends on the level of expertise available regarding a specific subject.*

Figure 2: Example of schedule for screening of assessment between module teams (e.g., module 2 is screened by peers from module 1)

Through standard module and course evaluations, the quality of assessments is also evaluated by students. In these evaluations, students are asked about:

- Clarity of the evaluation criteria (transparency)
- Relation of the examination to the learning goals (validity)
- Clarity of the examination questions (transparency)
- Availability of sufficient and representative practice exercises (transparency)

Act:

Finally, the Programme Director is responsible for the revision of the plans. To keep the test plans up to date they are evaluated and redesigned in a three-year cycle. In the revision of the test plan, input can be provided by the programme director as well as by the lecturers/module team or the Examination Board. Instant revision should take place when:

- a new responsible lecturer is appointed to the course
- a redesign of the course and/or the assessment of the course took place
- the learning objectives (ILO's) of the course are altered
- the examination board asks for this (e.g., after complaints about the assessments, deviant assessment results, or a (repeatedly) negative evaluation)

5. Assessments at a module/course level

Within the faculty of ET, assessments are created on a module/course level by the examiner and/or the module team itself. The guidelines for these assessments are described in the test plans and each assessment fulfils the following quality criteria (Sluijsmans et al, 2013):

1. Validity: The assessment measures what it is supposed to measure. To check the validity, a peer-review can be done in addition to the use of rubrics (for assignments). Test matrices are useful as well.
2. Transparency: all information is available (beforehand) that enables students to prepare as good as possible. To be transparent, the learning goals, assessment criteria and an example test need to be available for students beforehand. For all degree programme's these are described in the module manual (BSc) and/or course descriptions (MSc) and are available on the information website (e.g., Canvas) of the course. Tools to enhance transparency are to provide clarity on grade composition and provide clear instructions before the exam (e.g., by using a cover sheet for (written) exams [8]). Also, clarity about the option for second corrections and the opportunity to look into the results of their exam contribute to transparency.
3. Reliability: The reliability of an assessment indicates to what extent there can be confidence in the test as a measurement, regardless of the content of the test. It provides insight if results are consistent. After an examination, the examiner analyses the assessment results him/herself in a straightforward way, meaning that the examiner can look at the results by taken these steps into account:
    1. Is the examination made noticeably good or bad? (compared to previous examinations)
    2. Is there anything noticeable about the distribution of the scores / grades?
    3. Did students score noticeably well or bad on certain parts or questions in the examination?
    4. Is there anything else that is noticeable about the results?
    5. Do the results of the questions above give any reason for adjusting the scoring of the examination?

    Results are processed in the Student Information System (via the Examination Office) and individually announced to the students (via Osiris or Canvas).
4. Objectivity: indicates that when a test is assessed by two or more people to the same set of groups, you should get similar results.
5. Intersubjectivity: indicates that the test results are independent of the interfering influences of the examiner.

[8] See appendix III for an example.

5.1 Assessment Methods

When designing an assessment, many steps need to be taken into consideration. These steps are explained in the Test Life Cycle (figure 3). Further explanation of this model can be found in the Toolbox Examination.

Figure 3: Test Life Cycle (form Toolbox Examination CELT)

Test Life Cycle steps[9]:

1. The first step of the test cycle is designing your test. Here you formulate your learning objectives, your purposes of testing, and you make your test plan to check if your assessment program is in line with your learning objectives and your teaching activities.
2. When you have decided to use a written test as an examination method, you will have to think about the construction of your test (e.g., essay vs multiple choice questions). For assignments/projects/oral exam: create the criteria or a rubric.
3. Assemble test (determine the order, #questions, scoring etc.). Edit assignments/projects/oral exam. If applicable, organise a Peer-Review in this step.
4. Organise test taking. Beware of problems (e.g., fraud, plagiarism). For assignments/projects/oral exam: provide intermediate feedback
5. Grading questions. Pass/Fail cutting score points → grade. Analyse results (item analysis) → review scores
6. Determine and communicate grades. Grades can be sent to the Examination Office for registration. Communication of individual/sub grades is done via Canvas. Administration actions. For assignments/projects/oral exams: provide overall feedback
7. Use test analysis for evaluation & improvement of test and education. Reflect on test cycle for improvements.

[9] https://www.utwente.nl/en/examination/toolbox-examination/

5.1.1 Projects/Assignments

One of the most important learning activities in the bachelor programmes is projects (project-based education). With a project, the student is tested for mastery of secondary skills, such as collaboration, research, analysis, decision making, applying, designing, presenting, advising, evaluating, and improving. Therefore, projects often use diverse assessment methods, consisting of different components like presentation, oral interrogation, project report or final product.

These assessment methods and the evaluation are described more elaborately in the project manual (study guide) of every project. In this description, assessment criteria are given for all components of the assessment, but also if it will be individual or group based.

Examiners

For projects there are two forms of examiners: 1) the supervisor of the project group and 2) an examiner who was not involved in the process but who only sees the end results. All projects have a supervisor of the project group (which is also the examiner) and in some cases the second examiner is involved.

The reason for this combination is that the (potential) tutor has more insight in the process within the group and individual contributions. The 'external examiner' has a fresh and possibly more objective view on the final product. Other guidelines used for project evaluations are:

- If possible, both assessors have a different background covering a different part of the project's content
- The composition of the teams administering a project examination is changed after every project evaluation
- Before the project evaluation, the project coordinator and the examiners come together and go over the procedure for the project examination
- A new examiner observes at least one project examination before the examiner evaluates a group by themself.
- An inexperienced (new) examiner is always matched with an experienced examiner

Oral exams[10]

The task of the examiners is making an objective assessment and make sure all criteria are covered during the oral exam. In order to do this properly, some criteria for an examiner are given to overcome most of this (related to the Test Life Cycle steps):

1. Advise students to train for the oral exam (students can train talking about assessment topics or asking questions to each other);
2. Write out all exam questions: you may not be able to handle them all, but in retrospect it is clear what your candidates could have expected and that you have been consistent in your questions;
3. Prepare an answer model that you can use during the test. Determine the number of examiners (in case of more than 2 students) and consult with colleagues before the exam;
4. Make a recording of the conversation and/or make notes, e.g., write down the additional questions and answers so that they can be referred to later;
5. Avoid uncertainty with the candidate: indicate whether additional questions are asked to clarify the answer or to gauge the insight. Let the candidate know whether, in addition to substantive criteria, other elements, such as the language used or the structure of the answer, are included in the assessment.
6. Communicate the result to the student

[10] https://blog.sbo.nl/onderwijs/tips-voor-examinatoren/

7. Reflect on your actions, beliefs, and assumptions after the exam.

5.1.2 Written test

Written assessments are often used as method to test the ability to apply the theoretical part of a module(unit)/course. Written examinations are evaluated and scored with an answering model that is part of the test plan and that has been reviewed by a colleague. There will be a scoring model based on the learning objectives of the module or course.
Determination of the final grade is described in the assessment plan and determination of the cutting score (pass/fail decision) is made in accordance with the regulations in the EER of each programme.

The physical written examination is accompanied by an assessment instructions form (see appendix III) about at least the time available for the examination, the attributes students can use and the number of points per assignment. Besides this, the lecturer is expected to make practice examinations (including answers and scoring) or practice assignments available to students beforehand. By doing this, expectations are made clear to students and provides students with the possibility to practice.
The quality of the written exams is primarily ensured by a thorough preparation. The analysis of the test results and the student comments afterwards are intended to contribute to a better matching between the learning process and the test which must measure the degree to which the learning outcomes are fulfilled.

5.1.3 Remote testing

Remote testing is used as a term for any test activity in which the students are not physically present and supervised. A framework of remote testing can be found in the toolbox remote assessments.
In the context of digitalisation, the learning facilities are extended with the possibility to perform exams digitally. This can be done by 1) online proctored exams[11] and 2) via a secured environment on Campus (Chromebook).
The Chromebook exams on Campus can be executed web-based and software-based:

- Web-based exams; are performed on a Chromebook in a secured environment. The system is provided in a secured cloud environment. The questions and answers are saved in this cloud environment as well. Web-based exams consist of Multiple Choice and Open questions.
- Software-based exams; are also performed on Chromebooks and the software that is used can be integrated in the exam (e.g., MATLAB software for a mathematics test). The exams are taken in a secured environment where a remote desktop on a virtual computer is used to implement the software.

5.1.4 Quality assurance of the Bachelor assignment and Master Thesis

To complete the Bachelor or Master programme, students do a final assignment/write a thesis which is the indicator of the achieved level of the student in relation to the Programme Intended Learning Outcomes. With this assessment/thesis the student shows that the final qualifications of the programme are achieved. A description of the process of a bachelor's assignment and the master thesis of each programme is given below.

[11] See document "University of Twente General Guidelines for Online Proctored Examinations with Online Proctoring System 2020-2021"

Bachelor Assignment Industrial Design Engineering

With the Bachelor Final Assignment, the student concludes his or her bachelor's Industrial Design Engineering. Conducting the assignment is required to demonstrate capabilities and skills to qualify for independent professional practice at the Bachelor level in the field of Industrial Design Engineering. Therefore, this individual assignment is preferably conducted externally at a company or organisation involved in product development. Students may choose available assignments or propose themselves an assignment if in cooperation with an external client.

To prepare an individual plan for the Bachelor Thesis, that is both feasible and meets the programme's requirements, students are obliged to participate in the course 'Developing a Project Plan for the Bachelor Final Assignment'. For approval to start with the own Bachelor Final Assignment, the student needs two-fold consent:

(1) Confirmation from the Examination Board that the Bachelor Final Assignment is the only remaining part of the bachelor's programme.
(2) Approval of the assignment's contents and approach by the Bachelor Assignment Coordinator (based on the individual project plan).

The project is tutored by an academic staff member from the bachelor's programme and also supervised by a company-tutor (if applicable). Examination of the assignment takes place during an individual oral exam conducted by the programme's tutor, company-tutor and an examiner.

Bachelor Assignment Civil Engineering

The Bachelor Thesis of Civil Engineering consists of an individual assignment in the civil engineering work field (by exemption at the UT). The assignment involves at least one of the following aspects:

- Systematic planning/management of (a part of) the production process of a civil engineering object or system
- Modelling (part of) a civil engineering object/system in a qualitative or quantitative way and use of this model to predict future changes in the object/system
- Systematically (re)design a civil engineering object/system

The student will write a final thesis report and an evaluation on the process. Students can only participate when the have completed module 1-8 and participated in CE module 11.

Bachelor Assignment Mechanical Engineering

To complete their bachelor programme, students do a bachelor assignment/write a thesis. The bachelor assignment consists of a research project (with one of the research chairs involved with the programme). Parallel to this, students also do a reflective assignment looking at the societal impact of the technology they are doing research on. Together these two components constitute the graduation assignment for the bachelor.
As part of the bachelor assignment, students write a research paper and a reflective paper. During a final conference, the results are presented orally to staff members and fellow students. The papers are assessed by the research supervisor based on an assessment format. In case of doubt, the lecturers of the 'Academic Research & Skills' course act as 2nd assessor.
During the final conference, the student is assessed by a committee of three staff members containing their supervisor and at least one professor or associate professor as chair of the committee. Students are assessed on their presentation, the discussion afterwards and the

quality of questions asked to fellow students. Together with the grades for both papers, this constitutes the final grade for the bachelor assignment.
In the same way as other modules, the bachelor assignment is evaluated on a yearly basis.

Master Thesis Industrial Design Engineering
To finalise the Master of Industrial Design Engineering, the student must show that he is capable of doing research and/or develop a product on an academic level (Master Assignment). This capability can be proved by carrying out fundamental or applied research or by the realisation of an innovative product design. Innovative either because of the result or because of the methods followed. The master assignment can be done within the university or outside, either in a company, at another university or in a research institute. There are three different tracks in which the Master Assignment can be carried out: 1) Emerging Technology Design (ETD), 2) Human Technology Relations and 3) Management of Product Development. The determination of the final grade is a weighted average of the 5 partial grades.

The master assignment is reviewed by a committee consisting of at least three persons: the professor of the professorial chair, an (assistant/associate/full) professor being the daily supervisor from the department, a professor from the University, but not belonging to the department of the chair holder. An external supervisor can be invited to participate in the exam as an advisor.

Master Thesis Civil Engineering and Management/Construction Management Engineering
The main objective of the MSc-thesis project is to – independently (1) - carry out a large (2) individual research or design project in one of the sub-fields of Civil Engineering and Management, at a level that is representative for an MSc-program, i.e. by applying state-of-the-art scientific knowledge of the sub-field.

1. With 'independently' we mean: the student acts as the project leader for this individual project with guidance from his/her supervisors. The amount of guidance needed will be reflected in the grading of the project.
2. With 'large' we mean one coherent project of 30 EC that requires about 21 full-time working weeks, i.e. about half a year of work. (The 30 EC includes finalizing the thesis and defending it in public, but not setting up a research or project plan, based on a scientific literature study, and acquiring additional required knowledge, since this is subject of the separate course 'preparation MSc-thesis'.)

See Master Thesis student guide for complete description of the Mater Thesis CEM/CME.

Master Thesis Mechanical Engineering
The assessment of the master thesis consists of five components:

1. Written report
2. Presentation (public, 30 – 40 minutes, followed by questions from the audience)
3. Oral defence (closed session, 60 min, oral examination where the graduation committee goes into depth on the subject matter)
4. Content (quality of the research or the design)
5. Professional attitude and approach during the master thesis (independency, communication skills, etc.)

Before the determination of the final grade (which a weighted average of the 5 partial grades), an 'Examination card' is used. This card must be filled in by the chair of the graduation committee in consultation with the other committee members.
The graduation committee exists of at least three members, of which one is an external member (from a different research chair). Each member of the graduation committee individually assigns grades for each component. After this, grades are compared, and a discussion is held to determine the grade for each component. After determination of the grades, the candidate enters the room and reveries all five grades supplemented by an oral explanation.
The written motivation of the partial grades is archived in JOIN (in case the determination of a final grade has to be accounted for at a later time, for example during a programme accreditation).

To sharpen the assessment, an assessment protocol was made to evaluate the master theses. This protocol contains a list of criteria for each of the five components of the assessments. The partial grade is based on these criteria. This assessment protocol is strongly advised to all examination committees by the Examination Board.

Master Thesis Sustainable Energy Technology
The final project is carried out in one of the research laboratories of the cooperating faculties under supervision of a professor from one of the research groups participating in the MSc programme. A second supervisor is added from one of the other participating groups to support the multidisciplinary character of the program. Master's theses in industry are possible at each location. The Master's thesis project is primarily meant to allow the student to gain in-depth experience in research and/or design. Students learn to explore and formulate new research questions regarding sustainable energy technologies or related fundamental issues, recognising the pitfalls of exploring unknown territory and developing skills to circumvent these, while gaining an understanding that abstraction and simplification are important tools for success.

5.1.5 Quality assurance of the Internship (ME and SET)
Before students of ME/SET start their master thesis project, they go on an internship. The goal of this internship is for the student to gain experience as a junior professional in industry or at a research institution other than the University of Twente. Part of the students also gain international experience by doing their internship abroad.
The evaluation of the internship is based on three components:

1. Internship report; Evaluation criteria for the report are derived from the learning objectives of the internship. This is assessed by the UT supervisor.
2. Reflection; the students formulates SMART personal leaning goals and pays attention to the future professional development. This is assessed by the UT supervisor.
3. Evaluation by the external internship supervisor; The external supervisor is asked to evaluate the quality of the contribution of the student. Aspects addressed are independency/self-responsibility, working in a team, communication skills and depth regarding content. Besides, this, some open-ended questions were added:
    - What compliment and/or advice would you give the student for the future?
    - Do you have the feeling that certain aspects were missing in our student's education, which you would consider essential for an engineers in these fields?

The evaluation of the external supervisor is considered in the determination of the final grade.

6. General rules and guidelines

Students of all levels are familiar with the University's policy on plagiarism, cheating and academic misconduct. Examinations are assessments of the knowledge, insight and/or aptitude of the participating candidates, including an evaluation of the results of that assessment (article 7.10 of the WHW). A test or examination may consist of several parts. Cheating, plagiarism and fraud are actions or omissions on the part of a student that preclude an accurate assessment of his or her knowledge, understanding and aptitude (student's charter).

6.1 Fraud and freeriding

The EER specifies the rules with respect to cases of fraud. When detecting (possible) fraud, the responsible lecturer will notify the student in question and the Examination Board in writing via email or the surveillance can use the form of the examination office (process-verbaal tentamens"). The Examination Board then discusses the matter and if necessary, hears the lecturer and the student(s) involved and decides about measures to be taken.
Freeriding is an adverse consequence of project education. Research showed that more freeriding within a group seems to lead to lower study results (Ruël et al, 2003). Having a free-rider in the project, will not necessarily mean that the results are low, but this might appear when students feel demotivated by the free-riders. One way to prevent freeriding is to add an individual grade to the project(exam).
Plagiarism is checked via a tool in Canvas (where assignments are handed in) or via a standalone checker on assignments.
All rules and regulations about plagiarism, fraud and cheating can be found in the students' charter (institutional specific section).

6.2 Complaints and appeal

In case of concerns or complaints, students have the possibility to approach the lecturer when they have the feeling that there is a problem with the assessment. When the student is unable to work it out with the lecturer in question, the student has the possibility to address the Examination Board with a concern or complaint. The Examination Board will then decide on the matter. The website of every Examination Board informs the students about the possibilities and procedure.

6.3 Guidelines for assessment for students with a functional impairment

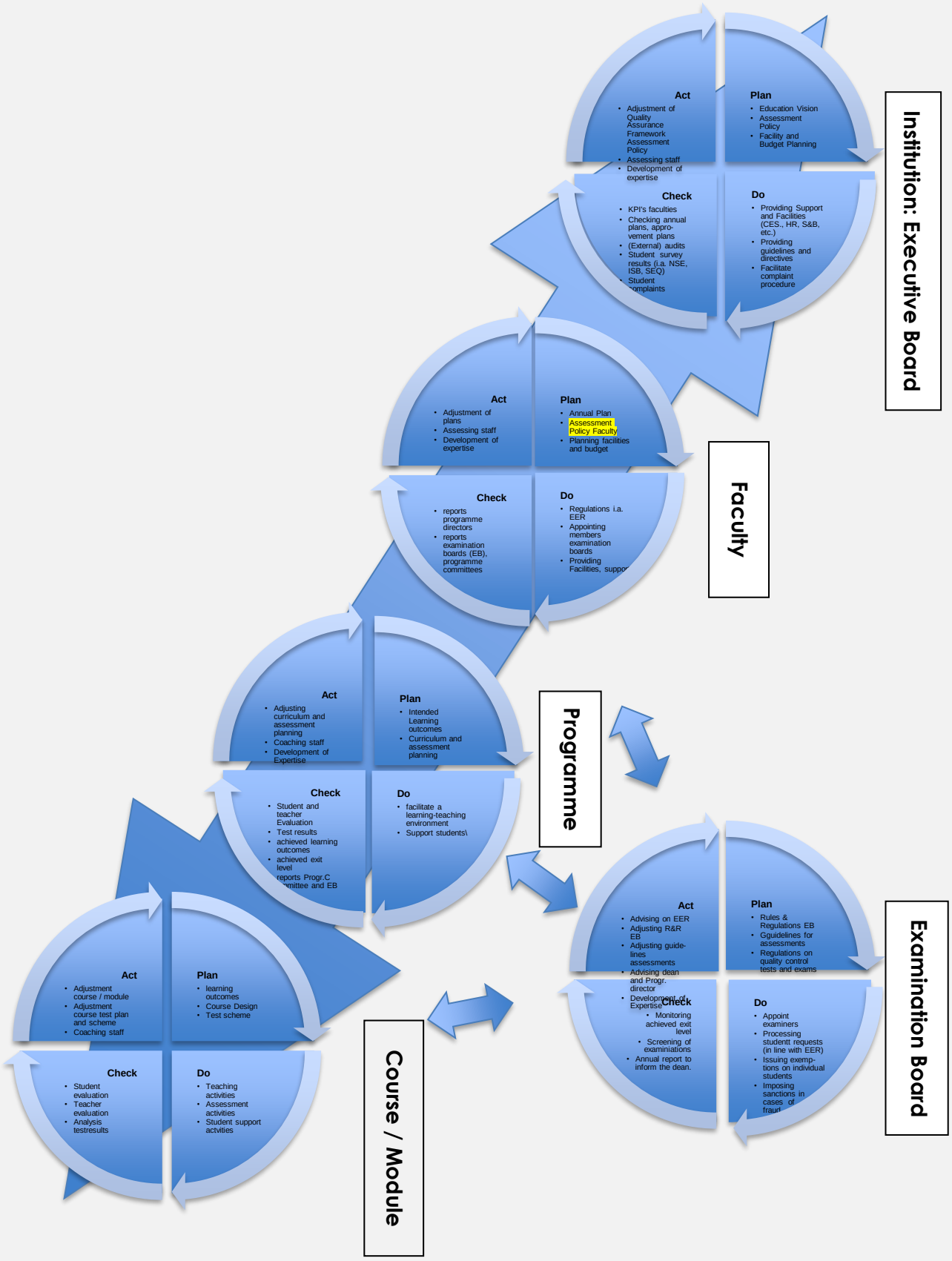
A functional impairment is a physical, sensory, or other impairment that might limit the student's academic progress. The UT offers extra facilities to help students with functional impairments.

At the beginning of each academic year students must announce their functional impairment to the study advisor. The study adviser decides whether a student has permission to use extra facilities. These extra facilities are arranged as follows:

- Students who are only entitled to make use of extra time (25%) or an enlargement of the exam (A3), will participate with the exam in the regular examination room.
- Students who are entitled to use other facilities, will take their exam in a separate room (apply in advance).

More information about extra facilities for students can be found here.

Appendix I; PDCA cycles for Quality Assurance Student Assessment



Appendix II; Assessment Framework NVAO

Assessment Framework for the Higher Education Accreditation System of the Netherlands[12]

Intended learning outcomes

Standard 1: The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

The intended learning outcomes demonstrably describe the level of the programme (Associate Degree, Bachelor's, or Master's) as defined in the Dutch Qualifications Framework, as well as its orientation (professional or academic). In addition, they tie in with the regional, national or international perspective of the requirements currently set by the professional field and the discipline with regard to the contents of the programme. Insofar as is applicable, the intended learning outcomes are in accordance with relevant legislation and regulation.

Teaching-learning environment

Standard 2: The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

The intended learning outcomes have been adequately translated into educational objectives of (components of) the curriculum. The diversity of the students admitted is taken into account in this respect. The teachers have sufficient expertise in terms of both subject matter and teaching methods to teach the curriculum and provide appropriate guidance. The teaching-learning environment encourages students to play an active role in the design of their own learning process (student-centred approach). If the programme is taught in a language other than Dutch, the programme must justify its choice. This also applies if the programme bears a foreign language name. The teaching staff must have a sufficient command of the language in which they are teaching. Services and facilities are not assessed, unless they have been set up specifically for the programme concerned.

Student assessment

Standard 3: The programme has an adequate system of student assessment in place.

The student assessments are valid, reliable, and sufficiently independent. The requirements are transparent to the students. The quality of interim and final examinations is sufficiently safeguarded and meets the statutory quality standards. The tests support the students' own learning processes.

Final conclusion (weighted and substantiated)

As a rule, standard 4 is not addressed in an initial accreditation assessment. The panel will only assess this standard if, in the opinion of NVAO, the procedure involves an existing programme and final projects are available to be assessed.

Achieved learning outcomes

Standard 4: The programme demonstrates that the intended learning outcomes are achieved.

The achievement of the intended learning outcomes is demonstrated by the results of tests, the final projects, and the performance of graduates in actual practice or in postgraduate programmes.

[12] https://www.nvao.net/files/attachments/.139/Assessment_Framework_for_the_Higher_Education_Accreditation_System_of_the_Netherlands_2018.pdf

Appendix III; assessment instructions form/cover sheet for exams

Exam/(Partial)test (Fill in *Name Course/module/study unit*) ...
Bachelor (*year nr.*) *(Educational programme) (Faculty)*
Master (*year nr.*) *(Educational programme) (Faculty)*

Module/course code: .....
Date: .....
Time: ..... *(+25% for students who may use extra time)*
Module-coordinator: .....
Instructor: .....

Type of test:

- Open book, multiple choice…

Allowed aids during the test:

- (Scientific) calculator, formula sheet, notes…

Attachments:

- Formula sheet, Multiple Choice form…

Additional remarks:

- Quantity of questions,
- Quantity of pages,
- Scoring,
- ….

Appendix IV; Format Test Plan (example)

Course information and Test Plan (assessment plan)

Instructions
• Please fill in this form and send the form to the master coordinator from the programme: • Please note that this form is the base for all the SET programme information

Contents

- General information
- Course information
- Learning objectives and relation to the final qualifications of the programme
- Assessment plan
- Grading plan
- Determination of cutting score
- Relationship with research
- Appendix 1: Final qualifications

General information

Date	
Course code	
Course name	
Contact person	
Lecturer(s)	
Credits (# EC's)	
Prerequisite knowledge (compulsory)	
Prerequisite knowledge (recommended)	
Language of instruction	English
Compulsory study materials	
Recommended study materials	
Instructional methods (tutorial, lecture, etc.)	
Starting block (1A, 1B, 2A, 2B)	

Course information

Describe the general information of the course.

Learning objectives and relation to the final qualifications of the programme

Fill in the learning objectives of the course and relate them (by fill in a cross) to the final qualifications of the programme. Your learning objectives need to be formulated in a measurable and objective way.
With relate we mean which final qualifications you are actually assessing in your course.
The final qualifications are attached in appendix 1.
A learning objective can relate to more than 1 final qualification.

The student is able to…		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

Assessment plan (test matrix)

Describe in the table how the objectives will be assessed and please make a distinction in group assessments and individual assessments.
More assessment methods for one learning objective is possible.
Fill in the level of the Bloom Taxonomy which is most obvious and fill in the relative weight of the learning objective in the end result.
Please at the end fill in the total amount of assessments.

Learning objective [#]	**Individual assessment method**						**Group assessment method**			**Level** [Remembering; understanding/ explaining; applying; analysing; evaluating; creating]	**Weight** [%]	**Total tests for this objective**
	Assignment	Open question exam	Multiple choice exam	Combined exam*	Oral exam	Presentation	Assignment	Presentation	Oral exam			
1												
2												
3												
4												
5												
6												
7												
Total amount of tests												

* A combined exam is a combination of open and closed questions.

Grading plan

For every assessment method: how is the performance of the student graded? (think about: assessment criteria, answering model, scoring, etc.)

Determination of cutting score

Based on the information above, how is the final grade of the student calculated? How is the pass/fail limit set?

Relationship with research

How is research integrated and used in modules/courses? For example, are research papers used as course material? Or do students have to do a research assignment during the course? Etc.

Practising Information skills	
Research as an example	
Research papers as course material	
Research assignment	
Guest lectures (example PhD)	
Experiments/lab-work	
Remarks	

Appendix 1: Final qualifications

A Master of Science graduate of the … degree programme:

1) is qualified to degree level within the domain of 'science engineering & technology'
2) is competent in …..
3) …

Appendix V; Conceptual model of the activities of the Examination Board

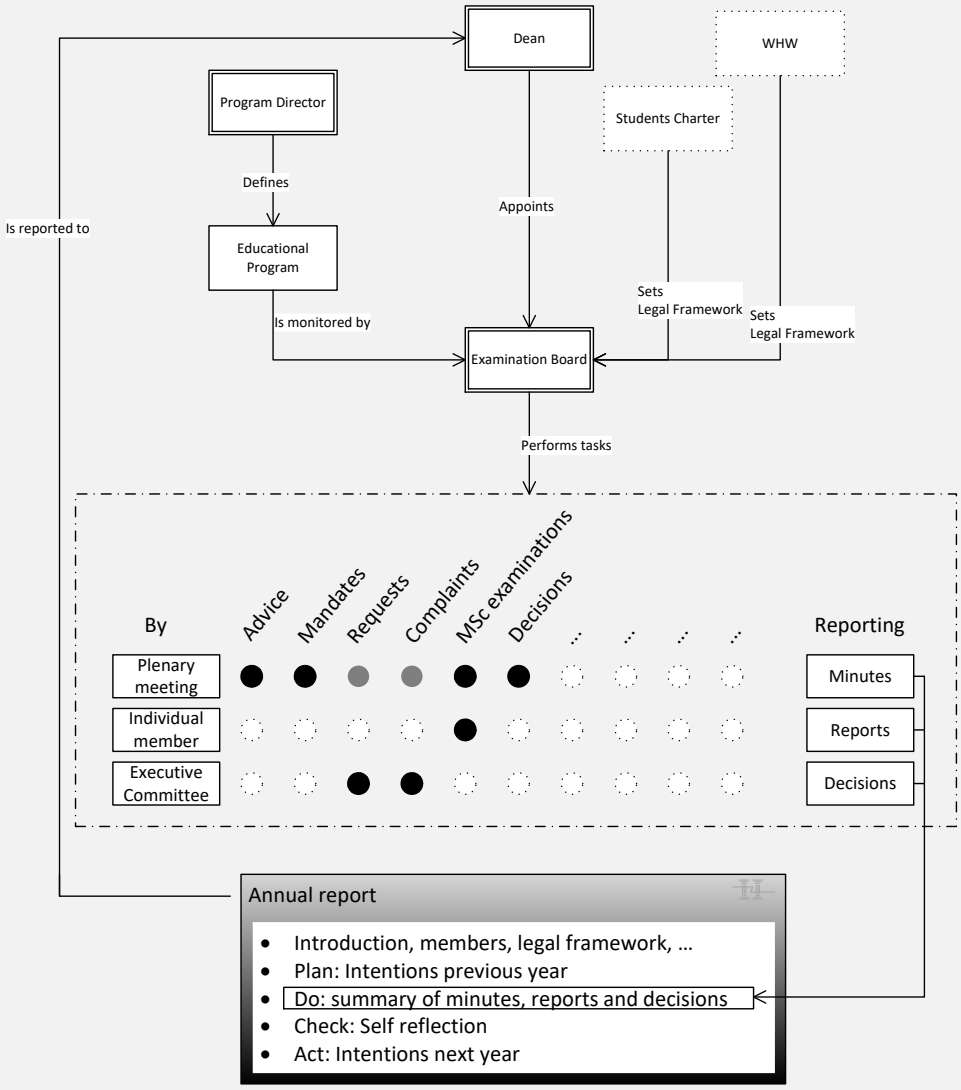


Figure 1 Conceptual model of the activities of the Examination Board and the role of the annual report [Annual report CE 2018].

Resources:

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Ruël, G. C., Nauta, A., & Bastiaans, N. (2003). Free-riding and team performance in project education. s.n. University of Groningen/UMCG research database

Schuwirth, L. Vleuten, van der C. Durning, S.J. (2017) What programmatic assessment in medical education can learn from healthcare. *Journal of Perspect Med Educ,* 6, 211–215. DOI 10.1007/s40037-017-0345-1

Williams, D. (2016, 15 July). Formative Assessment [YouTube]. Committed via https://youtu.be/sYdVe5O7KBE