Assurance of assessment quality at the Mechanical Engineering BSc and MSc programme

Drs. E.M.Gommer, May 2012 [1] (last update: August 2018 [2])

Introduction – vision on assessment

In accordance with its vision on education[3] the programme has formulated the vision on assessment stated below.

> *"The BSc and MSc programmes of Mechanical Engineering aim to deliver mechanical engineers to the work field with a T-shaped profile; professionals with depth within the ME discipline who have access to a rich array of Mechanical Engineering knowledge and skills to solve problems both individually and in teams. And also professionals with a broad perspective, that enables them to connect and communicate with other disciplines and nationalities to cope with the complexity of current and future engineering problems.*
>
> *The programme aligns with this vision by implementation of thematic project education as the educational concept. In projects, students are asked to integrate and apply knowledge and skills from different areas. Assessment is closely aligned with this educational concept. In project examinations the ability of students to apply what was learned in different module components in an integrated way by creating a new design is assessed. On an individual level as well as on group level. Application of knowledge and skills on a new and complex problem demand a rather high level of cognition from students. Just to know and be able to reproduce is not sufficient. Assessments focussed on reproducing knowledge (e.g. multiple choice examinations) are therefore rarely seen in the programme*
>
> *From the first year onwards, assessment focusses on application of knowledge and understanding to solve problems. During the bachelor (and especially the master) this level increases to analysis, design and critical evaluation."*

The vision described above constitutes the basis for the way in which assessment within the programme is designed. This document describes how assessment quality is assured at the bachelor and master programme of Mechanical Engineering.

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[1] This document was written in cooperation with the examination board ME/SET, the bachelor and master coordinator and was accepted by all parties involved as assessment policy document for the bachelor and master programme ME.

[2] For this version, the document was translated from Dutch to English. To avoid misunderstandings about vocabulary regarding the topic of assessment and tests, a Dutch-English word list was added in appendix 1.

[3] See: self-evaluation report ME/2018

Just like quality assurance of educational units (modules and courses) can be described with a PDCA (Plan Do Check Act) cycle, this can also be done for the assurance of the quality of assessment within the programme.

Through the different Phases in the Deming cycle (Plan – Do – Check – Act) we describe the assessment quality assurance system of the programme.

The quality assurance system of the bachelor assignment, the master internship and the master assignment are described separately in this document.

Figure 1. PDCA or Deming cycle
http://iso9001-2008awareness.blogspot.nl/2014/04/pdca-cycle.html

1. Conditions

1.1 Staff development regarding assessment
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. At the faculty of Engineering Technology more than 47% of the teaching staff have this qualification. Others are either currently working on their UTQ (17%) or have dispensation (36%).

Besides this, existing knowledge about formulating learning goals and assessment quality was refreshed by a recent action (in January 2018) to update and improve the test plans for the bachelor modules and the master courses.

The website of the examination board[4] has a special section for teaching staff where information and rules/regulations about assessment can easily be found.

1.2 Staff development of examination board members regarding new legislation and assessment quality
Most members of the examination board are a lecturer in the bachelor or master programme of mechanical engineering and comply with the standards for staff development as described above.

Expertise on testing and assessment is added by an external member (an educational specialist from CELT[5]).

If necessary, external expertise or consultancy is acquired. For example to bring the committee up to date on new legislation or responsibilities of the examination board.

On a regular basis the chairs of different examination boards meet to be informed about the latest developments and exchange experiences / knowledge.

1.3 Appointing examiners
The examination board is responsible for appointing examiners for the ME programme and composes a list of examiners. In general, the staff member who is the first responsible person for the module component or course is also the person responsible for the evaluation of the results.

For the appointment of examiners, a set of criteria is used which can be found in the rules and regulations of the examination board (rule 2, granting examination rights).

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[4] URL: https://www.utwente.nl/en/bscme/organisation/examination-board
[5] Centre of Expertise in Learning and Teaching: https://www.utwente.nl/en/ces/celt/

2. PLAN (preparation and development of an assessment)

2.1 Test plan for each module or course
For each module (BSc) or course (MSc) a test plan is drawn up by the lecturer(s) of the course. In this test plan the learning goals, the assessment matrix, the evaluation method, scoring guidelines and determination of cutting score are described. Also the relation of the course with the intended learning outcomes of the programme is made explicit. All test plans are reviewed by the bachelor or master coordinator and the educational advisor and revised or supplemented in consultation with the lecturer if necessary.

The final versions of the test plans are confirmed on the authority of the examination board. This test plan serves as the basis for the yearly development of new assessments and should be revised by the lecturer if:
   a. a new responsible lecturer is appointed to the course
   b. a redesign of the course and / or the assessment of the course took place
   c. the learning objectives of the course are altered
   d. the examination board asks for this (e.g. after complaints about the assessments, noticeable assessment results or a negative evaluation)

2.2 Collegial peer review
In the EER of the programme it is stated that all lecturers are expected to submit their newly developed assessments and answering models to a colleague (fellow lecturer or PhD who is familiar with the course content) for peer review. This resolution was mandated by the examination board (rule 4.1). 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?

There is no formal monitoring on this collegial peer review. The reason for this is that this might stimulate a tendency for lecturers to just 'tick off the checkbox' in order to fulfil a formal bureaucratic duty. This would lead to a considerable amount of administrative work, but does by no means assure that mutual review and feedback on assessment and scoring effectively takes place. The culture of the programme is as such, that lecturers do this from an awareness that this will improve the quality of their assessment.
In case of signalled problems with an assessment however, the examination board will ask for this.

3. DO (performance of the assessment)

3.1 Information supply on assessment methods and evaluation criteria (transparency)
Information about the courses learning objectives, assessment methods, evaluation criteria and the determination of the final grade is provided to students through Osiris (student information system) or Canvas (electronic learning environment).
Besides this, the lecturer is expected (article 4.1.3a EER for UT Bachelor's Programmes) to make practice examinations (including answers and scoring) or practice assignments available to students. By doing this, expectations are made clear to students and also provides students with the possibility to practice. Finally, the (written) examination is accompanied by assessment instructions about at least the time available for the examination and the number of points per assignment (see the rules and regulations of the examination board, rule 5: written and oral examinations).

3.2 Information regarding project evaluations
Because projects often use more complicated assessment methods consisting of different components like presentation, oral interrogation, project report and final product, assessment and evaluation are described more elaborately in the project manual (study guide) of every project. In this description evaluation criteria

are given for all components of the assessment. In this document students can also find if a particular component of the project evaluation will be individual or group based.

3.3 Administering examinations
Rules for administering examinations can be found in the rules and regulations of the examination board (for the BSc rule 5 and 11, for the MSc rule 5 and 10).

3.4 Evaluation of student work
Written examinations are evaluated and scored with an answering model that is part of the test plan (see par 2.1) and that has been reviewed by a colleague (see par. 2.2). When other assessment methods are used, a scoring model based on the learning objectives of the module or course is made and used. Determination of the final grade is also described in the assessment plan. Determination of the cutting score (pass / fail decision) is made in accordance with the regulations in the EER (rule 11).

3.5 Project evaluations
The assessment of a project usually consists of (at least) the following components:
a. Project report (written report)
b. Project examination (oral interrogation)
The report (a) is often a group product for which the student receives a group grade. Part b usually consists of a presentation and an oral interrogation / discussion. This is often carried out in a (project-)group setting, but the student receives an individual grade for his or her contribution and comprehension of the subject matter.
The assessment plan of the module (see section 2.1) describes how the learning objectives of the module are related to the assessment methods and what their weight is.
A project evaluation form is used to communicate to the student how the different components of the assessment were evaluated and how the final grade for the project was determined based on the partial grades. For evaluation of a project report, evaluation criteria derived from the project goals are used.
For the oral part of a project evaluation (the project examination), a scoring form is made for scoring the individual contribution of a student (presentation, answers and / or questions to fellow students). An example of this is the scoring form used during the project examination of module 1. After the project examination, the examiners sit together to compare scoring and annotations made to discuss and determine the grade per student.

3.6 Examiners in a project examination
At least to examiners are present during a project examination; the supervisor of the project group and an examiner who was not involved in the process but who only sees the end results. The reason for this combination is that the 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 end result.
Other guidelines used for project examination 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 examination
-   Before the project examination, 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 he or she evaluates a group by him/herself
-   An inexperienced (new) examiner is always matched with an experienced examiner

4. CHECK (evaluation and analysis of an assessment)

4.1 Analyses of assessment results
After an examination, the lecturer analyses the assessment results him/herself in a straightforward way, meaning that the lecturer looks at the results based on the questions below:
a. Is the examination made noticeably good or bad? (compared to previous examinations)
b. Is there anything noticeable about the distribution of the scores / grades?
c. Did students score noticeably well or bad on certain parts or questions in the examination?
d. Is there anything else that is noticeable about the results?
e. Do the results of the questions above give any cause for to adjusting the scoring or the examination?
When scoring is adjusted, the lecturer passes this by the examination board for approval. Points for improvement of the assessment are noted by the lecturer for a next performance of the course.

4.2 Evaluation of assessment
Through standard module and course evaluations, the quality of assessments is also evaluated by students. In these evaluations, students are asked about:
a. Clarity of the evaluation criteria (transparency)
b. Relation of the examination to the course (validity)
c. Clarity of the examination questions (transparency)
d. Availability of sufficient and representative practice exercises (transparency)
Evaluation of a module component or a course (including assessment) takes place once every three years or when a course is either renewed or in case of problems / complaints. Projects are evaluated each year.

In case of a negative evaluation of a module component or course, this is first reported to the lecturer who has the opportunity to react on the results. The evaluation results including the reaction of the lecturer are discussed in the Programme Committee. If the programme committee finds that there is a need for improvement, they will ask the lecturer to improve a certain aspect of the course. The programme director sees to it, that this happens. In a next evaluation round, the effects of this improvement are checked. Results and actions regarding testing and assessment are forwarded to the examination board.

4.3 Screening of assessment (pilot)
To further improve quality assurance of assessment, a pilot was started in academic year 2017 - 2018 with screening of assessments. In this pilot, members of the module team of a preceding module together with a member of the examination board screen the tests, examinations and assignments of the succeeding module and provide their colleagues with recommendations for improving their module assessment. The pilot is started in the bachelor. When the screening proves to be successful, this will be extended to the master.
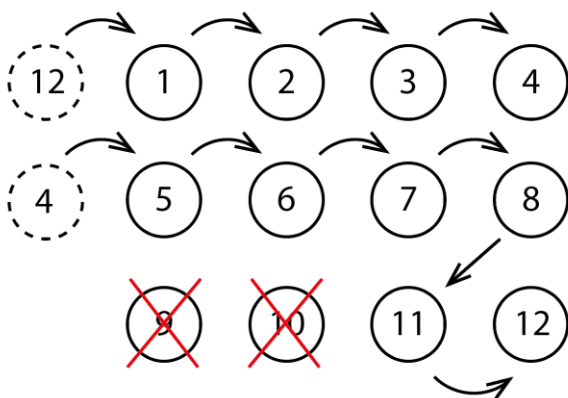

Figure 2. Schedule for screening of assessment between module teams

4.4 Other measures for quality control
Besides quality assurance by the lecturer, the screening procedure and the course evaluations, the student also has the possibility to approach the lecturer when he or she has the feeling that something might be a problem with the assessment. Because of the small scale and personal approach of the ME programme, the threshold to do so is relatively low.
When the student is unable work it out with the lecturer in question, he or she 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 the examination board informs the students about the possibilities.

5. ACT (improvement or adjustment of the assessments)

5.1 Formulating and giving feedback about improvements
Based upon the results of the evaluations described in section 4, the lecturer / examiner is the one who decides how the improvement of the assessment will be implemented. The examiner then informs the programme committee about planned improvements.
When larger modifications are implemented, for example in the learning objectives, the assessment method or the evaluation of a course/ module, an adjusted test plan is submitted to the examination board.

5.2 Consultation and support
When a lecturer requires consultation or support with the improvement of the course / module assessment, and assessment expert is available. Besides this, the lecturer can go to the programme director or programme coordinator for advice. Also in this case the threshold to do so is relatively low.
When a lecturer requires formal training on assessment and evaluation, a course is available at the universities Centre of Excellence in Learning and Teaching (https://www.utwente.nl/en/ces/celt/). The faculty has a strong educational culture where staff development is stimulated.

6. Quality assurance of the Bachelor assignment

To finalise their bachelor programme, students do a bachelor assignment covering part of module 11 and all of module 12. 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 a result 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.

7. Quality assurance of the Master thesis and the internship

7.1 Master thesis
The assessment of the master thesis consists of five components:
- Written report
- Presentation (public, 30 – 40 minutes, followed by questions from the audience)
- Oral defence (closed session, 60 min, oral examination where the graduation committee goes into depth on the subject matter)
- Content (quality of the research or the design)
- 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 has to 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[6] 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 evaluation of 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.

7.2 Internship
Before students start their master thesis project, students go on an internship. The goal of this internship is for the student to fain experience as a junior professional in industry or at a research institution. Part of the students also gain international experience by doing their internship abroad.

The evaluation of the internship is based on three components:
a. Internship report
   Evaluation criteria for the report are derived from the learning objectives of the internship[7].
b. Individual conversation with the internal supervisor
   During the conversation, the supervisor addresses point that were not made clear in the report. This can also prevent that communication skills or English language skills will have too much weight in the evaluation of the internship.
c. Evaluation by the external internship supervisor
   The external supervisor is asked to evaluate the quality of the contribution of the student on a 5-point scale. Aspects addressed are: independency / self-responsibility and depth regarding content. Besides, this, some open ended questions were added:
   - What were the strong points of this student?
   - What points for improvement would you like to give to the student?
   - Would you consider hiring this student? If yes, for what position?
   - Did you miss any knowledge or skills with this students? If so, what knowledge or skills?

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

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[6] In most cases, the examination committee for a master thesis consists of four to five members.

[7] As of January 1st 2019, a new assessment protocol for the internship will be used according to which students are asked to hand in three products: an internship plan, an internship report and a reflection report. Assessment forms with criteria are used to support the internal as well as the external supervisor.

Appendix 1. Word list English – Dutch[8]

Assessment	Toetsing
Evaluation	Beoordeling
Examiner	Examinator
Examination board	Examencommissie
Final qualifications	Eindtermen
Test	Deeltoets, voortgangstoets
Assignment	Opdracht
Examination	Tentamen
Project evaluation	Project beoordeling (alle onderdelen samen)
Project examination	Mondeling projecttentamen
Supplement	Aanvulling
Determination of the cutting score	Cesuurbepaling
Programme committee	Opleidingscommissie
Graduation committee	Afstudeercommissie

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[8] In consultation with the universities language center (https://www.utwente.nl/en/ces/tcp-language-centre/)