

WBTP303: BSc research and design project

Course contents:

The main contents of this course are small-scale projects of scientific research and design. The research projects are complemented by lectures about the methodology of scientific research and design: cycles of science and design, formulating hypotheses and lists of requirements for design, design of the research, statistical methods, and logical reasoning. Four plenary sessions are organized in which the students present the progress of their project, defend their approach/results, and criticize the approach/results of the projects of their fellow students. The students write a two-page mini-paper and a research file about the research and/or design results. During a scientific symposium the students present and defend their research/design-project.

Objectives

General:

The student is capable to critically reflect on small-scale projects of scientific research and design. The student is capable to scale down complex technical and/or scientific problems. Basic knowledge and experience on research methodology (measuring scales, deduction and induction, statistics) has been obtained. The student is capable to present and justify the scientific results both orally and in written form. The student is capable to perform the scientific research or design within a group consisting typically of four students.

Plenary sessions:

1. The student learns to present the essence of the progress of the scientific research in a short presentation for an audience of fellow students and teachers who are not directly involved in the research.
2. The student learns to defend his research approach, the method to analyze the experimental data, and the conclusions in front of an audience of fellow students and teachers who are not directly involved in the research.
3. The student learns to develop a critical attitude towards the research of fellow students and his own research. In addition, the student learns to develop a critical attitude towards the project supervisors and the teachers. The students in the audience have to ask questions to the student that presents his research during the plenary session.
4. The students learn from each others research approach.

Education Method

1. Research/Design project,
2. Group work (4 students),
3. Obligatory plenary sessions,
4. Lectures on Research/Design Methodology.

The projects-proposals are typically written by staff-members of 3mE. Students can approach staff-members with their own ideas for a research or design-project. However, the project-proposal must always be submitted to the responsible of the course (Erik Offerman) by a staff-member of 3mE. By submitting the project-proposal, this staff-member commits him/herself to supervising the project. Moreover, the staff-member should be knowledgeable in the field of the project. Projects CANNOT be carried out in industry.

Literature and Study Materials

1. Hoofdstuk 2 tot en met 6 van Methodologie van technisch []wetenschappelijk onderzoek Henri H.C.M. Christiaans, Alex L.A. Fraaij, Erik de Graaff, Charles F. Hendriks ISBN 978-90-5189-839-8, Jaar van uitgave 2004
2. Paragrafen 4.1 t/m 4.3, 5.1, 5.2, 5.5, 6.3 t/m 6.5 en Hoofdstuk 9 helemaal van Productontwerpen, structuur en methoden N.F.M. Roozenburg, J. Eekels, ISBN 978-90-5189-706-7, Jaar van uitgave 1998
3. Hoofdstuk 3 van de syllabus (fundering kennis)
4. Inhoud en vragen van alle sheets

Prerequisites:

1. Foundation course (propedeuse) successfully finished
2. At least 40 ECTS of the 2nd year, including the following courses
 - a. Stromingsleer (wb1225)
 - b. Kansrekening en Statistiek (wi2013wbmt)
 - c. Dynamica 2 (wb1216-06)

Algemeen:

Omdat de tentamens onmogelijk op tijd nagekeken kunnen worden, kunnen de resultaten van de augustus tentamenperiode niet meetellen bij de vaststelling of je aan de ingangseisen voor een project dat in periode 1A start voldoet. [Deze resultaten tellen pas mee voor de projecten die starten in periodes 1B (Maritieme Techniek) en 2A (Werktuigbouwkunde en Maritieme Techniek).]

Hetzelfde geldt voor tentamens en/of herkansingen op andere momenten: de resultaten kunnen niet meteen meetellen om toegelaten te worden in een project van de eerstvolgende periode.

N.B. Voor de ingangseisen voor het studiejaar 2010-2011 wordt verwezen naar de studiegids 2009-2010 op <http://studiegids.tudelft.nl>

Type of projects

Research project or design project: see document written by Sjoerd Zwart en Peter Wieringa on Blackboard.

Assessment (note: this has been changed since 12 April 2012)

Five grades will be given for the project-work by the members of the jury and the project-supervisors.

The jury present at the symposium of the BSc-project assesses the *results* project-work of the students based on:

1. The mini-paper
2. The presentation at the symposium (15 minutes)
3. The defense at the symposium (10 minutes)

This results in three grades. This approach is followed to reach an independent and uniform judgment of the *results* of the projects throughout the faculty. The jury makes a report to justify the three grades.

Note: The members of the jury grade the mini-paper before the mini-symposium. The members of the jury have access to the electronic version of the research file.

The supervisor of the project (assistant, associate, or full professor) assesses:

1. The research file. Criteria for the research file are provided on BlackBoard. This approach is followed in order to judge the experimental, theoretical, and design work of the students according to the standards that apply to the field of research in which the project is carried out.
2. The learning process of the students:
 - a. To what extent have the students shown through discussions with the supervisor that they have mastered the scientific methodology for conducting scientific research?
 - b. To what extent have the students shown through discussions with the supervisor that they have developed a critical attitude towards their own research and the research of others (e.g. the literature)?
 - c. To what extent were the students capable of performing the research independently?
 - d. How creative and persistent were the students in finding solutions when confronted with problems?
 - e. The originality of the solutions/findings presented by the students

The supervisor of the project makes a report to justify the grades.

The final grade for the project-work is the average of the 5 grades (all grades have equal weight). In case the average grade of the jury differs by more than one point from the average grade given by the project supervisor the jury can decide to meet with the supervisor of the project to discuss the final grade.

The grade for the individual students can differ from the grade for the project-work (group-grade), based on:

1. Results of the exam (toets) related to the theoretical aspects of the methodology for scientific research and design
2. Evaluation of daily supervisor (± 0.5 or ± 1 point)

3. Evaluation by group members (± 0.5 or ± 1 point)
4. Evaluation by jury members related to presentation or defense (± 0.5 or ± 1 point)

The grade for the exam has the following effect on the individual grade for the student:

Result exam	Final individual grade
Did not show up for the exam	Final grade project – 2
1, 2, or 3	Final grade project – 1
4 or 5	Final grade project – 0.5
6 or 7	Final grade project
8 or 9	Final grade project + 0.5
10	Final grade project + 1

Note: In case a student received a grade lower than 6, the student has only one more opportunity to redo the exam. The grade for the exam can never be higher than 6 for students that have a grade lower than 6 the first time. Students that have a grade of 6 or higher cannot redo the exam.

Evaluation criteria of the jury:

Mini-paper:

1. Does the title of the mini-paper reflect the topic sufficiently and clearly?
2. Does the abstract contain a sufficient summary of the work done?
3. Does the introduction present the importance of the topic and position it based on recent literature?
4. Does the introduction present a clear objective?
5. If applicable: have the experimental set-up and experimental methodology been described accurately?
6. Is the set-up suitable in view of the objectives?
7. Has an error/accuracy analysis been executed?
8. Is the processing of information original and technically correct, showing critical (scientific) attitude?
9. Does the report include innovative ideas / designs / design strategies?
10. Does it contribute to new technology development?
11. Is theory, methods and/or tools effectively applied / developed to provide the solution?
12. Is the analysis clear and is the discussion original and technically correct?
13. Does the report cover the relevant topics adequately?
14. Are the conclusions sound and justifiable?

Presentation:

1. Was the presentation adequately structured?
2. Was the presentation audible and lively presented, making use of adequate audiovisual aids?
3. What was the general impression of the presentation?
4. Did the presentation provide a sufficient impression of the work?
5. Did the presenter stick to the allotted time?

Defense:

1. Does the student answer questions logically and with sound argumentation?
2. Does the student demonstrate sufficient knowledge of the relevant engineering principles?
3. Is the student competent in discerning the main aspects from the details of the thesis work?
4. Does the student demonstrate a solid and confident personality in the discussion?

There are three juries per symposium. Each jury typically evaluates 12 projects. Each jury consists of at least three staff-members of the 3mE-faculty that are not directly involved in the project. Each project is therefore evaluated by three independent jury-members. The main jury-member of a project is from the same department as the department at which the project is carried out.

Role of the people involved in the ‘BSc research projects’

Responsible & Coordinator: Erik Offerman

Review project proposals: Erik Offerman will review the project proposals. The project proposals are selected that contribute to the objectives of the course.

Teachers giving lectures: Sjoerd Zwart gives a general introduction into the research and design methodologies. He is also responsible for the exam.

Project supervisors: the people that take care of the weekly supervision of the students. They have written the project proposal. They sketch the research area and indicate to the students the innovative directions in which their research field is developing. This will be the starting points for the students to formulate the hypothesis and the approach of their research project. The project supervisors critically follow the progress of the students during meetings with the students. They challenge the students and question the approach taken by the students in order to check if the approach follows the scientific methodology. The project supervisors leave the responsibility for the research project with the students. They create the boundary conditions within which the students can perform the research. The project supervisors have regular meetings with the students:

- PhD-students meet the BSc-students once per week
- Professors meet the BSc-students at least 4 times during the project

Students:

Important: the students are responsible for their research project.

The students should take the initiative to formulate the hypothesis, make the project plan about the approach of the research, determine the data-analysis strategy, and formulate the conclusions that are backed-up by scientific evidence. The students have the freedom to choose the direction in which they conduct the research within the frame work that was defined by the project supervisors.

Teachers involved in the plenary sessions: these are the people that stimulate the development of a critical attitude of the students towards the research of fellow students and towards their own research. The teacher chairs a session in which several students present their research. The teacher stimulates the students in the audience to ask critical questions to the students that presented their work. The teachers guide the discussion and place the discussion in a broader perspective to make clear what the students can learn from the discussion for their own scientific research.

Teachers: Hugo Grimmelius (MT), Dimitra Dodou (BME), Lucia Nicola (MSE), Ton van den Boom (DCSC), Arjan Mol (MSE), Sjoerd Zwart (TBM), Joost de Winter (BME), Joris Dik (MSE), Jo Spronck (PME), Ron van Ostayen (PME), Brian Tighe (P&E) and Erik Offerman (MSE)

In case the student experiences an organizational problem that he cannot sort out with the project supervisor, he can contact the teacher of the plenary session who works in the department in which the project is executed.

Evaluation: A group of students and teachers (college-responsie-groep) will evaluate the course.

Note: No more poster session as of 2010-2011.

New since 2011/2012:

1. Students can refer to their research file (onderzoeksdossier) in their mini-paper for further explanations.
2. The methodology-exam (toets) is at the end of the first quarter.
3. Sten Ponsioen is student-assistant