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M Water Technology

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Project code P2315

Contents

Summary

Standard 1. Intended learning outcomes

The MSc Water Technology has a strong profile and relevant aims. These are appropriately translated into intended learning outcomes formulated at an academic master's level. It draws on the strengths of the participating research institutions to provide a relevant programme that focuses on the challenges of water treatment and resource recovery, with a distinctly academic and applied character. Alignment with the professional field is an integral part of the programme through its embedding in the Wetsus ecosystem and the programme-specific Advisory Board. To further strengthen the intended learning outcomes in relation to the engineering characteristics of the programme, the panel recommends adding learning outcomes related to design, for example by using the Meijers criteria for engineering programmes.

Standard 2. Teaching-learning environment

The panel found the curriculum of the MSc Water Technology to be designed in accordance with the goals and objectives of the programme. It builds up from fundamental scientific knowledge to design and application of solutions. The teaching methods are very interactive and focus on learning in a research community. The individual projects in the second year provide students with the opportunity to work on actual (research) projects of their own choice under close personal guidance of a supervisor. The choice of English for the language of instruction and the programme name is well substantiated and fits the international character of the field of water technology. There is sufficient attention to English language proficiency of staff member and students. To further improve the coherence of the curriculum, the panel believes that the programme could benefit from a clearer description of the connections between courses, for example in the form of cross-curricular learning trajectories. These could help staff and students see how knowledge and skills are built across the courses, and provide a basis for skills assessment. The panel suggests adding elective design assignments to the first three blocks to allow students to focus on an area of their choice and prepare for the Business Case Design Project.

Due to the small-scale nature of the programme and its interweaving with the Wetsus research community, students can receive close and personal guidance as well as use state-of-the-art research facilities, which the panel considers to be a strong asset of the programme. Students experience very low thresholds for support and information provision, and feel well supported throughout the curriculum. The curriculum is feasible in two years. Even so, some students struggle in the first half of the first year due to deficits in their pre-knowledge, particularly in biology or mathematics. The panel believes that, due to the breadth of the programme, the admission requirements cannot fully encompass all relevant prior knowledge without excluding many qualified prospective students. Therefore, it approves of the current admission requirements, but recommends that they be supplemented in individual cases by required additional educational units before or shortly after the start of the programme in order to reduce the workload of the first blocks. The teaching staff is qualified, both in terms of expertise and didactic qualities. They come from all three universities involved in the joint degree, as well as from Wetsus itself. The Programme Committee plays an important role in safeguarding the quality of the programme. Each university brings significant expertise and capacity to the joint degree, making the programme a truly collaborative effort, according to the panel. The single location at Wetsus and strong coordination by the programme management, especially the internal and external management of the programme director, contribute to the coherence and efficiency of the joint degree as experienced by students and staff. The panel commends the programme for this efficient and fruitful organization of the joint degree.

Standard 3. Student assessment

The assessment system of the programme is well designed, with varied assessment methods aligned with course objectives. There are clear regulations for assessment, which are clearly communicated to students. The quality assurance mechanisms for assessment are appropriate, monitored by a well-functioning Examining Board with members from all three universities participating in the joint degree. The panel recommends introducing cross-curricular learning trajectories to assess the skill development of students throughout the curriculum. Master's theses are evaluated through a thorough process involving two examiners, a good assessment form, and helpful rubrics. While all of this promotes alignment between examiners, the panel believes that the programme could still benefit from the introduction of calibration sessions between examiners, as consistent grading in a programme with examiners from multiple institutions is an continuous challenge.

Standard 4. Achieved learning outcomes

The quality of the master's theses as well as the performance of graduates demonstrate that students achieve the intended learning outcomes of the programme. Graduates find relevant jobs in the water technology sector, with a relatively large percentage pursuing a PhD, demonstrating their acquired academic qualities.

Score table

The panel assesses the programme as follows:

Master's programme Water Technology

Standard 1: Intended learning outcomes	meets the standard
Standard 2: Teaching-learning environment	meets the standard
Standard 3: Student assessment	meets the standard
Standard 4: Achieved learning outcomes	meets the standard
General conclusion	positive

Dr. C. (Cees) Terlouw
Chair

P. (Peter) Hildering MSc.
Secretary

Date: 03-02-2025

Introduction

Procedure

Assessment

On 20 November 2024, the master's programme Water Technology of Wageningen University, the University of Twente and the University of Groningen was assessed by an independent peer review panel. The assessment followed the procedure and standards of the NVAO Assessment Framework for the Higher Education Accreditation System of the Netherlands (April 2024). It also followed 'Protocol Joint Degree 2021'.

Quality assurance agency Academion coordinated the assessment upon request of Wageningen University. Peter Hildering acted as coordinator and as secretary in the assessment. He has been certified and registered by the NVAO.

Preparation

Academion composed the peer review panel in cooperation with the institutions and taking into account the expertise and independence of the members. On 12 June 2024, the NVAO approved the composition of the panel. The coordinator instructed the panel chair on his role in the site visit according to the Panel chair profile (NVAO 2016).

The programme composed a site visit schedule in consultation with the coordinator (see Appendix 3). The programme selected representative partners for the various interviews. It also determined that the development dialogue would be made part of the site visit. A separate development report was made based on this dialogue. The site visit took place in Wetsus at Leeuwarden, the single location of the programme where educational facilities and students are located, and where the majority of the teaching staff members have a (partial) appointment.

The programme provided the secretary with a list of graduates over the period 2022 - 2024. In consultation with the secretary, the panel chair selected 15 theses. He took the diversity of final grades and examiners into account, as well as the three participating universities in the joint degree. The selection included three theses supervised by the University of Twente, three by the University of Groningen, and nine by Wageningen University. Prior to the site visit, the programme provided the panel with the theses and the accompanying assessment forms. It also provided the panel with the self evaluation report and additional materials (see appendix 4).

The panel members studied the information and sent their findings to the secretary. The secretary collected the panel's questions and remarks in a document and shared this with the panel members. In a preliminary meeting, the panel discussed the initial findings on the self-evaluation report and the theses, as well as the division of tasks during the site visit. The panel was also informed on the assessment frameworks, the working method and the planning of the site visits and reports.

Site visit

During the site visit, the panel interviewed various programme representatives (see appendix 3). The panel also offered students and staff members an opportunity for confidential discussion during a consultation hour. No consultation was requested. The panel used the final part of the site visit to discuss its findings in an internal meeting. Afterwards, the panel chair publicly presented the preliminary findings.

Report

The secretary wrote a draft report based on the panel's findings and submitted it to an Academion colleague for peer assessment. Subsequently, the secretary sent the report to the panel for feedback. After processing this feedback, the secretary sent the draft report to the programme in order to have it checked for factual irregularities. The secretary discussed the ensuing comments with the panel chair and changes were implemented accordingly. The panel then finalised the report, and the coordinator sent it to the three participating universities.

Panel

The panel assessing the master's programme Water Technology consisted of the following members:

- Dr. C. (Cees) Terlouw, senior researcher and consultant at Terlouw Advies & Onderzoek [panel chair];
- Prof. dr. ir. D.C. (Kitty) Nijmeijer, professor and chair of the research group Membrane Materials and Processes at Eindhoven University of Technology;
- Prof. dr. ir. E.R. (Emile) Cornelissen, senior scientific researcher in the water treatment team at the KWR Water Research Institute in Nieuwegein, and part-time professor at the Particle and Interfacial Technology research group at Ghent University;
- E.S. (Sibel) Gökbekir MSc, alumn Complex Systems Engineering and Management at Delft University of Technology and International and European Union Law at the Erasmus University Rotterdam [student member].

Information on the programme

Name of the institution:	Wageningen University
Status of the institution:	Publicly funded institution
Result institutional quality assurance assessment:	Positive
Name of the institution:	University of Twente
Status of the institution:	Publicly funded institution
Result institutional quality assurance assessment:	Positive
Name of the institution:	University of Groningen
Status of the institution:	Publicly funded institution
Result institutional quality assurance assessment:	Positive
Programme name:	Water Technology
CROHO number:	65005
Level:	Master
Orientation:	Academic
Number of credits:	120 EC
Location:	Leeuwarden
Specifics:	Joint degree (Wageningen University, University of Twente, and University of Groningen)
Mode(s) of study:	Fulltime
Language of instruction:	English
Submission date NVAO:	1 May 2025

Description of the assessment

Organization

The master's programme Water Technology is a joint degree of the University of Groningen (UG), University of Twente (UT) and Wageningen University (WU), with WU as coordinating partner. It is offered at Wetsus, European centre of excellence for sustainable water technology, in Leeuwarden. Wetsus is a research institute focusing on solutions for global water challenges. It creates an innovation community via networks of companies, universities (including, UG, UT and WU) and public bodies for generating, testing, and evolving innovative ideas and science-based approaches in water technology. These are often shaped as interdisciplinary PhD programmes aimed at implementable innovations. Wetsus and its projects are funded jointly by its partners. It has a building at the WaterCampus Leeuwarden that hosts the Wetsus-funded researchers and laboratories, as well as the educational facilities for the MSc Water Technology, and is a meeting point for water technology researchers in the Netherlands and beyond. The programme is managed by a programme director located at Wetsus and has teaching staff originating at Wetsus, UG, UT and WU. The MSc follows the quality assurance frameworks of the WU, and has a separate programme committee and Board of Examiners with representatives from all three partner universities. The panel's assessment of how the joint degree works in practice is included at the end of the discussion of Standard 2.

Recommendations previous panel

The previous accreditation panel provided several suggestions for improvement, such as a better link between ILOs and course objectives, diversifying assessment methods and extension of the internship. The panel found that these advices have been generally considered carefully, leading to further improvement of the programme. The recommendation to promote calibration among thesis examiners was addressed by the introduction of a new rubric with more elaborate criteria rather than the calibration sessions that were suggested by the previous panel. The panel agrees that the rubric encourages calibration, but also believes that calibration sessions would still be helpful for this purpose. See for further discussion the respective sections in the report on these topics.

Standard 1. Intended learning outcomes

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.

Findings

Profile and aims

The MSc Water Technology aims to educate students to be able to develop sustainable innovations and create new insights in the field of water technology. Students are expected to bridge science and engineering applications, and to be able to address challenges related to pollution and scarcity of raw materials, energy, and water. The MSc is an multidisciplinary programme that combines life sciences, physics, chemical engineering and biology. It is focused on the key areas of water treatment (drinking and wastewater treatment, desalination, filtration and disinfection) and resource recovery (recovery, recycling and reuse of nutrients, metals and polymers from processed water and wastewater). These key areas are closely aligned with the Wetsus research programme and the research expertise of the three participating universities: WU provides expertise in bioprocess engineering, UT in membrane technology and chemical engineering, and UG in physical chemistry and physiochemical water treatment . During the programme, students are

equipped not only with fundamental and applied knowledge and skills, but also with the mindset to study topics from a broad perspective, including sustainable and societal perspectives. After graduation, they should be well prepared for either a career in the public or private water sector, or as (PhD) researcher in a water technology-related research institution. Student numbers in the past six years fluctuate between 9 and 19 (median 15) students, from diverse international backgrounds.

The panel concludes that the programme has a strong profile and relevant aims. The programme has a clear interdisciplinary focus, with topics necessary to study challenges related to water treatment and resource recovery, based on the available expertise of the four participating institutions (the three universities as well as Wetsus itself). As a result, the programme has a strong academic orientation due to its alignment with the Wetsus research programme: the topics that students work on in courses and individual and group projects are directly related to ongoing research projects.

The many connections with companies and governmental organizations through Wetsus contribute to the professional relevance of the MSc. The programme launched an Advisory Board in 2023 with the aim of receiving external feedback and advice on the alignment of the programme with the requirements of the professional field. This Board consists of four members of organizations in the water section. Recent advice included increased attention to digital skills, such as programming, data science and AI, which the programme is now considering strengthening in the curriculum. The panel commends the programme's strong ties to the field. Universities, governmental organizations especially water authorities, and companies working in water technology are an integral part of Wetsus, which makes the programme strongly embedded in the field. This is further enhanced by the students' projects in the companies and partner institutions, and the advice of the Advisory Board.

Intended learning outcomes

The programme goals have been translated in a set of learning outcomes that describe the orientation and academic knowledge, skills and competencies relevant to the field (see appendix 1). As per recommendation of the previous panel, the programme has adapted the ILOs since the previous accreditation to better reflect the programme characteristics. The panel got an overview of the alignment of the intended learning outcomes with the Dublin descriptors.

The panel noted with appreciation that the updated ILOs are an appropriate translation of the programme's profile, and highlight the programme's academic and applied characteristics. They are also clearly aligned with the Dublin descriptors, demonstrating the academic master's level. The panel noted that design skills are not explicitly mentioned in the ILOs, even though several courses include design elements. It recommends updating the ILOs to explicitly mention design skills, and connect the various courses that cover this in a coherent design skills learning trajectory (see standard 2). To this end, the programme could consider using the Meijers criteria in addition to the Dublin descriptors to formulate the intended learning outcomes, as is already the practice in design-oriented programmes at engineering universities. This could also further highlight the engineering characteristics of the programme, and ensure that these are structurally embedded in the MSc.

Considerations

The MSc Water Technology has a strong profile and relevant aims. These are appropriately translated into intended learning outcomes formulated at an academic master's level. It draws on the strengths of the participating research institutions to provide a relevant programme that focuses on the challenges of water treatment and resource recovery, with a distinctly academic and applied character. Alignment with the professional field is an integral part of the programme through its embedding in the Wetsus ecosystem and

the programme-specific Advisory Board. To further strengthen the intended learning outcomes in relation to the engineering characteristics of the programme, the panel recommends adding learning outcomes related to design, for example by using the Meijers criteria for engineering programmes.

Conclusion

The panel concludes that the master's programme Water Technology meets standard 1.

Standard 2. Teaching-learning environment

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

Findings

Curriculum

The MSc Water Technology curriculum is structured over two years, comprising 11 mandatory courses (60 EC) in the first year, and an internship (20 EC) and thesis (40 EC) in the second year. The nine core courses in the first three quartiles (9 x 5 EC) provide students with fundamental scientific knowledge across disciplines relevant to water technology, as well as design skills to apply knowledge in design and optimization of technologies. Students with demonstrable pre-knowledge in one of the core courses can replace a core course with an elective offered by one of the three participating universities after approval from the Board of Examiners. The programme core is complemented in the fourth quartile by the skills-based courses Computational Methods in Water Technology (5 EC) focusing on research and digital skills, and the Business Case Design Project (10 EC), where students work in teams on real-life water challenges provided by external partners, and develop a business case for their solution. The internship in the second year is focused on applying knowledge and developing skills in practice. Students can suggest their own internship organization or find one in the extensive network of Wetsus. It is supervised by an internal supervisor within the programme, and a daily external supervisor at the internship organization. Following the recommendation of the previous accreditation panel, the length of the internship was increased from 15 EC to 20 EC to give students more time to develop their professional skills. The thesis is an individual research project. Students choose the research topic for their thesis, which is often a topic offered by a researcher associated with Wetsus. Most students do their project at Wetsus, but upon request of the student or if the facilities or supervision require it, it can also be done at one of the three partner universities or at other universities.

The panel concludes that the curriculum of the MSc Water Technology is designed in accordance with the goals and objectives of the programme. It has a clear build-up, starting from fundamental scientific knowledge to design and application of solutions. The latter is most clearly visible in the Business Case Design project and the individual projects in the second year, where students apply the knowledge and skills acquired in the courses in real-life challenges. The internship provides students with the opportunity to gain experience with working in a professional environment, and develop the associated professional skills. The panel found this to be a valuable addition to the programme and clearly differentiated from the thesis in terms of goals and context. The panel commends the coherence of the curriculum design, which is noteworthy given the joint organization by four partners.

The curriculum has no elective components other than the capita selecta for a limited number of students. The panel understands this choice, given the need to acquire knowledge in several areas in the first part of the curriculum, but also notes that the rigid structure of the first year goes against the trend of offering

students opportunities to deepen or broaden their knowledge in more flexible curricula. It suggests the introduction of smaller elective assignments in the first three blocks, in which students can apply the knowledge acquired in that block to an area of their choice. This could also provide more opportunities to practice design skills in preparation for the Business Case Design Project.

The panel found that although the basic design of the curriculum was clear to the panel from the discussions during the site visit, the coherence and building of knowledge and skills could be more clearly structured and described. The panel learned that students tend to view first-year courses as separate modules without strong connections. It recommends creating cross-curricular learning trajectories that connect courses and show students how they develop knowledge and skills across the curriculum. This is particularly the case for skills training. Most skills, particularly communication and design skills, are not taught separately but are integrated into content-based courses. The panel considers this to be a valid choice, but believes that both staff and students would benefit from clearly described learning trajectories for these skills. This will help staff and students to see the coherence of the curriculum and provide greater insight into the development and assessment of these skills throughout the curriculum.

The teaching methods of the programme are based on the concept of learning in a research community in a master-apprentice relation. This means that students do not only learn about research activities, but also contribute to them in a strong interaction with experts in a team with experienced researchers and PhD-students. Several courses also have practicals based on ongoing research project using the labs at Wetsus. Due to the small number of students, both lectures and tutorials in the courses have an interactive and activating character, and there is room for lecturers to include their own research activities and experiences in the courses. The panel is positive about the teaching methods used in the programme. Due to the small scale, teaching is inherently interactive. This is further enhanced by methods such as flipping the classroom and project-based education. The small size and embeddedness in a research environment give the curriculum a strong academic orientation. Students work closely with researchers and participate in research projects in a master-apprentice approach. The small-scale community with a low student-staff ratio adds to the success of this approach.

Language of instruction
The MSc Water Technology is designed to educate and prepare students to join the international community working on water technology. To this end, the programme pursues an international classroom and chose for English as language of instruction and in the programme name. For international students as well as new scientific staff at each of the three universities, proficiency in English is one of the selection criteria. The panel approves the choice of English language education for the programme. It confirms the programme's rationale that this corresponds to the nature of water technology as an internationally oriented field. Graduates can be expected to work in an international environment after graduation, which is already apparent in the very international nature of Wetsus itself. The panel appreciates the attention to English language proficiency for new staff members and students.

Guidance
The programme has a small-scale character with close interaction between staff and students. As a result, lecturers can give support and guidance to individual students where they need this. Furthermore, the programme has a dedicated study advisor located at Wetsus who is the first point of contact for any programme-related or personal issues of students. The panel found that students are very positive on the intensive and close guidance as well as the information provision in the programme. They feel that they can easily approach the teaching staff as well as the study advisor for guidance and information, and experience a very low threshold for student support. Students have no problems finding suitable internship positions

and thesis projects. They can either suggest their own project or use the extensive network of Wetsus to find a topic that suits their interests and a supervisor that is able to oversee the project. Students are happy with the supervision in the individual projects, and report that they have at least one or sometimes even more meetings per week with their supervisor to discuss the project and progress.

Feasibility and admission
The average time it takes students to graduate is 24 months. Excluding dropouts, between 50% and 80% of students graduate within the required two years, with the remainder usually graduating shortly thereafter. As a multidisciplinary master's programme, the feasibility of the curriculum depends to a large extent on the prior knowledge of the admitted students. The programme admits students with an academic or professional bachelor's in bioprocess engineering, chemical engineering, chemistry, biotechnology or environmental technology. An Admission Committee consisting of one staff member from each of the three universities decides upon the admissibility of applicants. Due to the diversity of background knowledge, the programme provides students with self-assessment tests prior to the start of the curriculum, as well as supplementary reading materials to catch up on any identified knowledge gaps.

Based on the success rates and average graduation time, the panel concludes that the curriculum is feasible in the designated time. The programme management explained that due to the fixed structure of the curriculum, students tend to follow the courses as a group with their cohort and graduate at approximately the same time. If students struggle with the content of the programme, this is usually associated with a gap in pre-knowledge due to the diversity of the intake. The panel appreciates the possibilities the programme offers to address this with self-assessment test and supplementary studying materials. At the same time, the panel noted from the student chapter and discussions with students that some students still struggle in the first part of the curriculum and put in many hours beyond the envisioned 40 hours per week to be able to pass their courses. This is mainly the case for students without prior knowledge in biology or with a deficiency in mathematics.

The panel believes that the current admission requirements are appropriate and that gaps in knowledge are partly unavoidable due to the broad scope of the programme and the wide variety of bachelor's backgrounds of the students. Stricter admission requirements would exclude too many students who are basically qualified for the programme but lack some elements relevant to the programme in their previous education. To address this, the panel believes that the programme could impose individual admission requirements on students, requiring them to take additional mathematics or biology courses (e.g., through suggested distance-learning courses or a Massive Open Online Course (MOOC)) prior to or shortly after admission and to provide evidence of successful completion. This could prevent this additional study load from piling up in the first months, making this period more manageable for students. In the longer term, the programme may consider a pre-master's programme in collaboration with the partner universities, which could also serve the purpose of opening the programme to a broader group of prospective students. The panel understands that the programme management is exploring this and fully supports it. At the same time, the panel was pleased to learn that almost all students eventually make it through the first half year and are able to complete the curriculum, demonstrating that the programme is ultimately feasible for admitted students.

Facilities
All lectures are organized in the Wetsus building in Leeuwarden, where the programme has a dedicated classroom and silent room for studying, as well as laboratories to use for practical sessions and for the thesis projects. The laboratories offer 600 m^2 of state-of-the-art equipment and set-ups, as well as analytical and technical support staff. All MSc students are invited to join activities organized by the Wetsus staff

association, which include lunch presentations and drinks, and use general facilities such as the restaurant and recreational rooms. Students that do their thesis research at Wetsus are treated as employee and receive their own workplace. The facilities have been designed to promote accessibility for students with physical impairments. For students with other functional impairments, tailored facilities are available to remove or limit possible obstacles. These are usually discussed with the study advisor.

During the site visit, the panel had the opportunity to tour the facilities in the Wetsus building. It was very impressed with the research and teaching facilities and consider this to be a strong asset of the programme. Students work in state-of-the-art laboratories and are able to join leading research groups for their projects. In addition, the panel found that sufficient attention is given to students with functional impairments. Because of its small size, the programme is very adaptable in order to find customized solutions whenever necessary.

Teaching staff
The courses and supervision of individual projects is the responsibility of the three participating universities, where each university takes care of the quality assurance for the courses given by their staff, and reports to the Programme Board of Water Technology, which is composed of representatives of all three universities. A total of 26 teaching staff members are involved in the courses. Most staff members are part of the Wetsus community, with about half employed or otherwise directly involved at Wetsus for one or more days per week. This means that these teaching staff members do not only come to Leeuwarden for their course, but are also available for students for consultation on-site. The other staff members make themselves available outside of courses via e-mail and video calls on appointment. The lecturers are all active researchers in Water Technology, most as assistant, associate or full professors. 25 out of 26 teaching staff members hold a PhD. About 65% has a University Teaching Qualification (UTQ) or is in the process of obtaining this. Wetsus is located at the Water Campus Leeuwarden, the core of the Dutch water technology sector, and houses several companies, knowledge institutes and governments, giving students the opportunity to interact with a broader community of researchers and professionals from industry and society.

The panel studied the qualifications of the teaching staff and spoke with several staff members during the site visit. It got a positive impression of both the research and didactic expertise of the staff. All staff members are active researchers and are able to provide students with current insights in the field, drawing from their own research activities. Students praise the approachability of the staff and the interactivity of the lecturers. The panel considers the percentage of staff with a UTQ to be relatively low, which it understands to be mainly due to administrative reasons at the WU, where previous qualifications do not automatically lead to a UTQ classification. However, the panel was happy to learn that the programme takes care that at least one of the core teachers of each course, as well as all examiners, have a UTQ.

Joint degree
During the site visit, the panel discussed the design and implementation of the joint degree on several occasions and also reviewed the joint degree agreement signed by the three participating universities. It concludes that the joint degree is well designed and implemented. Each of the three universities has a significant contribution to the curriculum, which was clearly evident to the panel in the content and associated staff of the various courses. All three universities, as well as Wetsus, offer thesis projects, and staff from all universities is involved in the supervision and grading of theses. In accordance with the regulations and quality assurance procedures of the WU, both the Programme Committee and the Examining Board consist of representatives from each partner university, which ensures short lines of communication in the alignment of rules and regulations. Although students still occasionally experience issues related to different information channels and procedures at the different universities, the panel found that overall these issues

are kept to a minimum. This is due in no small part to the excellent work of the programme director and management, who are dedicated to coordinating and integrating the efforts of the various participants into a coherent whole, with the programme director also effectively being the face of the programme, coordinating and representing it both internally and externally. In addition, the annual reports show that the Programme Committee and the Examination Board (see also Standard 3) function according to their tasks and regulations. The panel particularly liked the critical self-reflection in the form of a SWOT analysis of the programme - in combination with an annual plan and long-term ambitions - as reported in the annual reports of the Programme Committee. The single location in Leeuwarden also contributes to the efficiency of the programme by providing a home base for staff and students. Overall, the panel gives a positive assessment of the organization of the joint degree and concludes that the MSc Water Technology can be considered a true joint effort of WU, UG and UT.

Considerations

The panel found the curriculum of the MSc Water Technology to be designed in accordance with the goals and objectives of the programme. It builds up from fundamental scientific knowledge to design and application of solutions. The teaching methods are very interactive and focus on learning in a research community. The individual projects in the second year provide students with the opportunity to work on actual (research) projects of their own choice under close personal guidance of a supervisor. The choice of English for the language of instruction and the programme name is well substantiated and fits the international character of the field of water technology. There is sufficient attention to English language proficiency of staff member and students. To further improve the coherence of the curriculum, the panel believes that the programme could benefit from a clearer description of the connections between courses, for example in the form of cross-curricular learning trajectories. These could help staff and students see how knowledge and skills are built across the courses, and provide a basis for skills assessment. The panel suggests adding elective design assignments to the first three blocks to allow students to focus on an area of their choice and prepare for the Business Case Design Project.

Due to the small-scale nature of the programme and its interweaving with the Wetsus research community, students can receive close and personal guidance as well as use state-of-the-art research facilities, which the panel considers to be a strong asset of the programme. Students experience very low thresholds for support and information provision, and feel well supported throughout the curriculum. The curriculum is feasible in two years. Even so, some students struggle in the first half of the first year due to deficits in their pre-knowledge, particularly in biology or mathematics. The panel believes that, due to the breadth of the programme, the admission requirements cannot fully encompass all relevant prior knowledge without excluding many qualified prospective students. Therefore, it approves of the current admission requirements, but recommends that they be supplemented in individual cases by required additional educational units before or shortly after the start of the programme in order to reduce the workload of the first blocks. The teaching staff is qualified, both in terms of expertise and didactic qualities. They come from all three universities involved in the joint degree, as well as from Wetsus itself. The Programme Committee plays an important role in safeguarding the quality of the programme. Each university brings significant expertise and capacity to the joint degree, making the programme a truly collaborative effort, according to the panel. The single location at Wetsus and strong coordination by the programme management, especially the internal and external management of the programme director, contribute to the coherence and efficiency of the joint degree as experienced by students and staff. The panel commends the programme for this efficient and fruitful organization of the joint degree.

Conclusion

The panel concludes that the master's programme Water Technology meets standard 2.

Standard 3. Student assessment

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

Findings

System of assessment

The programme uses the assessment regulations and procedures of WU, the coordinating university. One key principle of this policy is the alignment of assessment with education, following the concept of constructive alignment. The programme uses a mix of assessment methods, related to the learning goals that are being assessed. These include written and oral examinations, projects with individual and group assignments, reports and presentations. The internship is assessed by the internal supervisor of the student (i.e. a staff member from one of the three partner universities), with advice by the external supervisor on the work and performance of the student in practice. Assessment is based on a report and presentation on the project results, and a reflection on the personal learning goals of the student.

All courses have a course guide that includes a transparent assessment strategy. These guides are available for students at the start of their course. The Examining Board (EB) checks assessment matrices, exam questions, answer models and assessment criteria. For written exams, courses typically provide example exams to students. In the case of written assignments, students are informed in advance about the assessment criteria, often through a rubric or grading form. Quality assurance mechanisms include peer review of exams between staff members, and individual elements in group projects to prevent free-riding.

The programme has its own Examining Board, with representatives from each participating university. The Board evaluates course assessment, advises on assessment procedures, and monitors assessment quality. This includes annual checks of a random selection of theses. In its annual reports, the Examining Board reports about these themes.

Furthermore, the panel examined the assessment system and found it to be well designed. It appreciates that the assessment methods are explicitly aligned with the learning objectives of the course, and that the rules and requirements for assessment are clearly described and communicated to students prior to a course. Quality assurance mechanisms such as peer review of examinations and review of assessment design and thesis quality by the Examining Board contribute to the reliability and validity of assessment, and are adequately reported in the annual reports. The Examining Board fulfils all of its statutory responsibilities in an appropriate manner, and its composition with members from all three universities supports the functioning of the joint degree. As discussed under Standard 2, the panel considers that the assessment of skills in the programme could be more structured. This is currently assessed as part of individual courses, but could be assessed more structurally across the curriculum so that students are able to demonstrate their progress. Cross-curricular learning trajectories, as recommended earlier, could facilitate this.

Thesis assessment

The thesis is assessed based on performance during the project, a written report, a presentation and a final defence for the supervisors and examiners. The thesis is assessed by a thesis committee of at least two members, with at least one examiner from one of the participating three universities, and an independent examiner not otherwise involved with the project. The committee can be complemented with other relevant expertise. The examiners independently grade the products, and align their assessment after the thesis defence, filling in the final grades and substantiation thereof on an assessment form. The weighted average of the grades (performance 40%, report 50%, oral presentation 5% and defence 5%) is the final grade of the

student. In determining the grades, examiners are assisted by a rubric for each component of the assessment form, describing the relation between level of performance and grades. This was developed in response to the observations of the previous accreditation panel that there were inconsistencies in grading between different examiners.

According to the panel, the assessment of theses is sufficiently reliable, valid and transparent. The panel considers the procedures to be well developed, with the involvement of two examiners, one of whom is not involved in the projects, who independently evaluate the products. The evaluation criteria are clear, and the new rubric forms, developed in response to the recommendations of the previous accreditation panel, is a good addition. The panel was impressed by the design of the evaluation forms. The completed forms, which the panel studied in preparation for the site visit, were usually filled out in an insightful manner and provided comprehensive feedback. At the same time, the panel still found occasional inconsistencies in grading. Some theses that the panel considered to be of comparable quality sometimes received different grades, apparently depending on the individual examiner. The panel agrees with the previous accreditation panel that calibration sessions would be beneficial in creating consistency among examiners. It understands the practical reasons given by the programme for attempting to address this recommendation with a rubric, but believes that calibration sessions would have additional benefits; there are examiners from four different organizations involved in the assessment, making the need for alignment more relevant than in other programmes. This does not need to be extensive; an annual exercise such as a half-day joint online session in which examiners assess the same theses together and critically compare and discuss the results in the light of the criteria would be sufficient.

Considerations

The assessment system of the programme is well designed, with varied assessment methods aligned with course objectives. There are clear regulations for assessment, which are clearly communicated to students. The quality assurance mechanisms for assessment are appropriate, monitored by a well-functioning Examining Board with members from all three universities participating in the joint degree. The panel recommends introducing cross-curricular learning trajectories to assess the skill development of students throughout the curriculum. Master's theses are evaluated through a thorough process involving two examiners, a good assessment form, and helpful rubrics. While all of this promotes alignment between examiners, the panel believes that the programme could still benefit from the introduction of calibration sessions between examiners, as consistent grading in a programme with examiners from multiple institutions is an continuous challenge.

Conclusion

The panel concludes that the master’s programme Water Technology meets standard 3.

Standard 4. Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

As part of the preparation for the site visit, the panel studied a selection of 15 recent master’s theses of the programme. It found all 15 theses to be of the required master’s level. Students demonstrate that they are able to carry out scientific research, and report about and reflect upon the results. The panel noted the broad variety of topics related to water technology, which reflects the broadness of the curriculum. The theses also

contain many references to experiments and experimental data, showing that the students are able to work with the many experimental facilities offered by the programme.

Further evidence that the programme's learning outcomes are being met can be found in the performance of its graduates. A recent alumni survey presented to the panel shows that 95% of graduates find relevant employment within one year of graduation. Graduates find jobs in industry, public utilities, small and medium-sized enterprises, consulting firms, and government agencies. Approximately 30% of graduates pursue a PhD after graduation. Many alumni stay involved with the programme, offering internships or jobs to students, or contributing to education as guest lecturers. The panel was impressed with the careers of the programme's graduates. Most find relevant jobs in the water technology sector, with a relatively high percentage pursuing PhDs, demonstrating the academic qualities of the graduates. The panel appreciates that many alumni of the programme are still in contact with Wetsus and the programme. It commends the programme for this, as alumni can be an important source of feedback for the programme as well as good ambassadors.

Considerations

The quality of the master's theses as well as the performance of graduates demonstrate that students achieve the intended learning outcomes of the programme. Graduates find relevant jobs in the water technology sector, with a relatively large percentage pursuing a PhD, demonstrating their acquired academic qualities.

Conclusion

The panel concludes that the master's programme Water Technology meets standard 4.

General conclusion

The panel's assessment of the master's programme Water Technology is positive.

Recommendations

1. Add learning outcomes related to design to the intended learning outcomes, for example by using the Meijers criteria for engineering programmes.

2. Reduce the workload in the first part of the curriculum for students with deficiencies, particularly in biology and mathematics, for example by requiring them to remedy this as part of their admission to the programme.

3. Introduce cross-curricular learning trajectories describing how the competences in terms of knowledge and skills are built up across the courses, and use this to show the connection between courses to students, as well as to assess skill development of students throughout the curriculum.

4. Add elective design assignments to the first three blocks to allow students to focus on an area of their choice and prepare for the Business Case Design Project.

5. Implement calibration sessions for thesis examiners to promote consistent grading, for instance an annual (online) exercise in which examiners assess the same theses together and critically compare and discuss the results in the light of the criteria.

Appendix 1. Intended learning outcomes

After successful completion of this MSc programme graduates are expected to be able to:

1. Demonstrate scientific knowledge and understanding pertaining to the areas of environmental biotechnology, process, and chemical engineering.

2. Translate and apply theory in designing technical solutions in the field of sustainable water technology.

3. Independently design and execute experiments; analyze and compare results, and formulate conclusions with a critical attitude and insight into the nature of water technology demonstrating ethical conduct and integrity throughout the research process.

4. Conduct independent research in water technology in accordance with academic standards, contributing to academic development and innovative solutions, while considering global challenges and perspectives.

5. Handle and understand complexity in the context of water technology by integrating fundamental knowledge and practical skills.

6. Apply research skills such as literature search, design and execution of experiments, interpretation of data, and computer simulation in at least one sub-area of water technology.

7. Professionally relate, and clearly communicate complex ideas and results to researchers, professionals, and involved parties in the interdisciplinary field of water technology, considering diverse cultural backgrounds and professional fields.

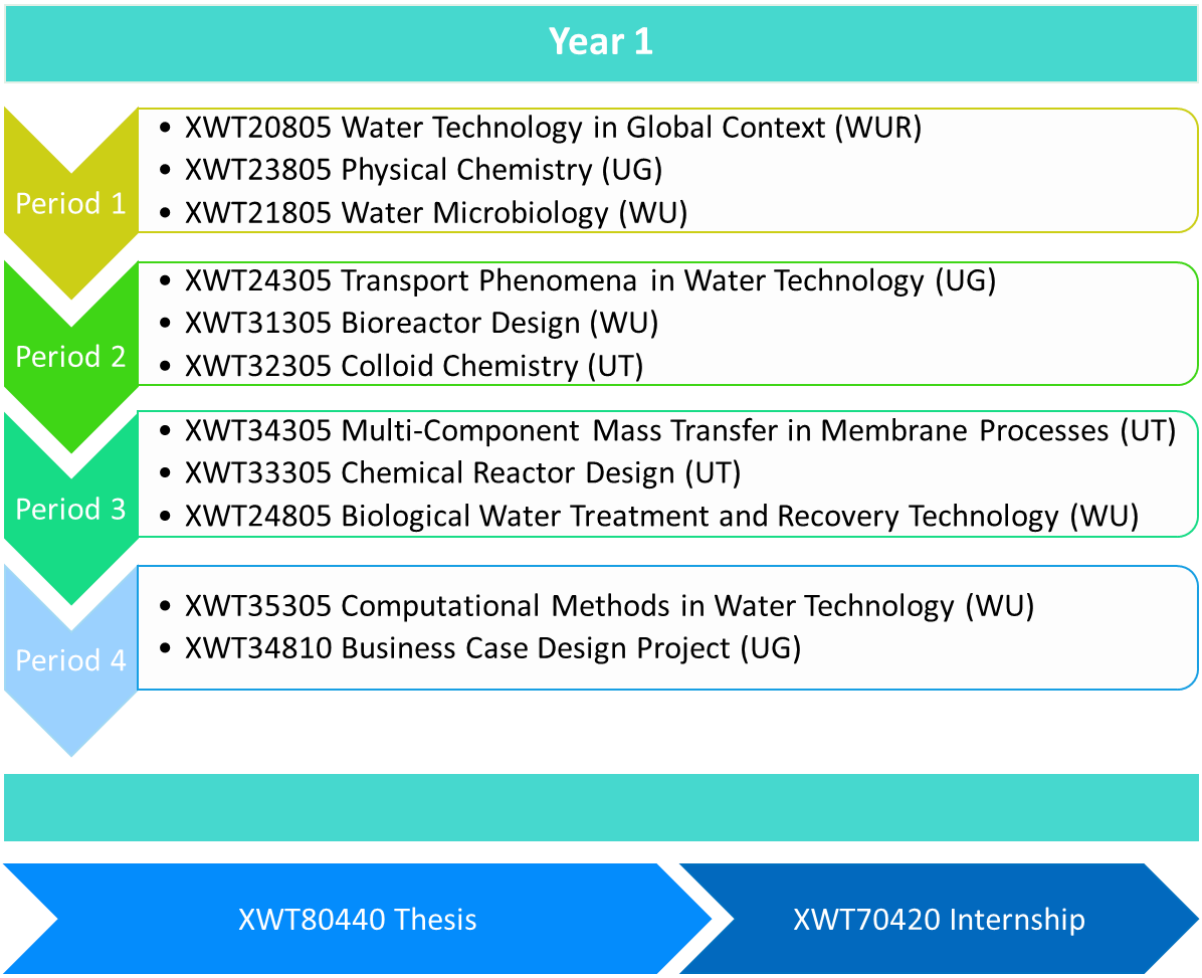
8. Be critical and self-critical, weigh arguments, perspectives, and use evidence to form arguments, theories, ideas, and well-reasoned opinions.

9. Recognize diverse roles in the professional field of applied water technology worldwide and evaluate the socio-economic, ethical, and normative aspects of water-related technological innovations in a global context.

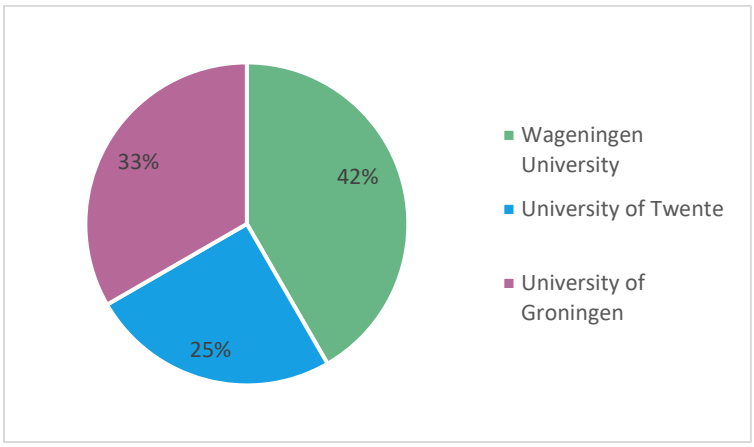
10. Design and plan their learning path based on reflection on personal knowledge, skills, and performance.

Appendix 2. Programme curriculum

Schematic overview of the programme curriculum. Course codes are shown before the course name. The last two digits of the course code indicate the number of ECs per course. The partner university responsible for the course is indicated in brackets (WU: Wageningen University, UG: University of Groningen, UT: University of Twente).



Distribution (%) of course hours per partner university:



Appendix 3. Programme of the site visit

20 November 2024

08:45 - 09:00	Welcome and arrival
09:00 - 09:30	Preparatory panel meeting
09:30 - 10:15	**Interview programme management**
10:30 - 11:15	**Interview students & alumni**
11:15 - 11:45	Break
11:45 - 12:30	**Interview teaching staff**
12.30 - 13.15	Lunch break
13.15 – 14.00	**Tour of the facilities**
14:00 - 14:30	**Interview Board of Examiners**
14:30 - 15:15	Internal panel session
15:15 - 15:45	**Concluding session programme management**
15:45 - 16:30	Internal panel session
16:30 - 17:15	**Development dialogue**
17:15 - 17:30	Oral feedback

Appendix 4. Materials

Prior to the site visit, the panel studied 15 theses of the joint degree master's programme Water Technology. Information on the theses is available from Academion upon request. The panel also studied other materials, which included:

- Overview Intended programme learning outcomes and Dublin descriptors
- Programme curriculum
- Course descriptions
- Examples of course and assessment materials
- Assessment matrix: Relation programme learning outcomes, courses and examinations
- Education and Examination Regulations
- Staff overview
- Internship guide
- Thesis guide
- Joint degree agreement WU, UG and UT
- Overview governance and coordination of the programme
- NSE results
- Annual reports Board of Examiners and Programme Committee