

Assessment report
Limited Framework Programme Assessment

Master Chemistry

Radboud University

Contents of the report

1. Executive summary	2
2. Assessment process	4
3. Programme administrative information.....	7
4. Findings, considerations and assessments per standard	8
4.1 Standard 1: Intended learning outcomes	8
4.2 Standard 2: Teaching-learning environment	11
4.3 Standard 3: Student assessment.....	13
4.4 Standard 4: Achieved learning outcomes	15
5. Overview of assessments.....	16
6. Recommendations	17

1. Executive summary

In this executive summary, the panel presents the main considerations which led to the assessment of the quality of the Master Chemistry programme of Radboud University, which has been assessed according to the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, as published on 20 December 2016 (Staatscourant nr. 69458).

The programme objectives are sound. The programme has the broad chemistry profile. The panel welcomes the strong research-orientation of the programme and regards the programme objectives to be up-to-date. The panel is positive about the research specialisations and societal specialisations offered.

The programme objectives are within the boundaries of the domain-specific reference framework for academic chemical sciences programmes. The panel appreciates the efforts by the joint programmes in chemical sciences in the Netherlands to draft this framework and regards this to be a sound and up-to-date description of this domain. The programme profile may be clearly distinguished within the framework.

The panel is positive about students being prepared for both PhD positions and positions in industry in the programme domain. The panel recommends, however, to align the programme more to professional field requirements, preparing students better for future careers in industry.

The intended learning outcomes of the programme correspond to the programme objectives, are well-articulated and are conform to the master level.

The student inflow numbers of the programme are appropriate. The panel advises to monitor the student influx in view of material facilities and laboratory constraints. The entry requirements and admission procedures are adequate.

The panel is positive about the contents of the curriculum. The curriculum meets the intended learning outcomes of the programme. The contents of the curriculum components are up to standard. The panel considers the curriculum to be coherent. Both the research specialisations and the societal specialisations are well organised.

The panel regards the lecturers in the programme to be good researchers and very skilled in the contents of the courses. The lecturers are also very motivated. The educational capabilities of the lecturers are up to standard, as may be deduced from the proportion of BKO-certified lecturers. As the workload as experienced by the lecturers appears to be very demanding, the panel advises to monitor the work load and to arrange productive discussions between programme management and lecturers to design and implement efficient procedures to reduce the workload.

The panel considers the educational concept and the study methods to be in line with the programme characteristics. The programme is working on new study methods, which is positive. The number of

hours of face-to-face education is appropriate. The study guidance is adequate. The student success rates are rather disappointing. The panel recommends to analyse the causes.

The panel approves of the examinations and assessment rules and regulations of the programme, these being in line with Faculty of Science policies. Although the Examination Board, among others, reviews course dossiers on a regular basis, the panel advises for the Board to monitor examination and assessment processes more consistently.

The examination methods adopted by the programme are consistent with the goals and contents of the courses. The measures to counter free-riding are effective.

The supervision processes for the Research internships are appropriate. The assessment procedures are satisfactory, involving two examiners and assessment scoring forms being adopted. The panel advises to require examiners to substantiate their grades on the Research internship assessment scoring forms.

The panel considers the measures ensuring the validity, reliability and transparency of examinations and assessments to be satisfactory. The course dossiers are comprehensive and are to include examination matrices and answer models. As not all examiners do so, the panel advises to require examiners to present examination matrices and answer models. In addition, the panel recommends to analyse examination results more systematically.

The course examinations are up to standard. The Research internships match the intended learning outcomes and are appropriate research projects. No internships were found by the panel to be unsatisfactory. The panel supports the grades given by examiners of the programme.

The panel regards the programme graduates to have reached the intended learning outcomes and to be qualified to find appropriate positions in this domain.

The panel that conducted the assessment of the Master Chemistry programme of Radboud University assesses this programme to meet the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, judging the programme to be satisfactory. Therefore, the panel advises NVAO to accredit the programme.

Rotterdam, 13 March 2019

Prof. dr. M.A. Cohen Stuart
(panel chair)

drs. W. Vercouteren
(panel secretary)

2. Assessment process

The evaluation agency Certiked VBI received the request by Radboud University to manage the limited framework programme assessment process for the Master Chemistry programme of this University. The objective of the programme assessment process was to assess whether the programme would conform to the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, published on 20 December 2016 (Staatscourant nr. 69458).

Having conferred with management of the Radboud University programme, Certiked invited candidate panel members to sit on the assessment panel. The panel members agreed to do so. The panel composition was as follows:

- Prof. dr. M.A. Cohen Stuart, professor emeritus, chair of Physical Chemistry & Colloid Chemistry, Wageningen University, professor emeritus of Physical Surface Chemistry, University of Twente, professor East China University of Science and Technology, Shanghai, China (panel chair);
- Prof. dr. A.H.T. Boyen, associate professor emeritus, Faculty of Sciences and Bio-engineering Sciences, Faculty of Medicine and Pharmacy, Vrije Universiteit Brussel (panel member);
- Prof. dr. M.K. Van Bael, professor Inorganic and Physical Chemistry, head of Inorganic and Physical Chemistry Research Group, University of Hasselt (panel member);
- Prof. dr. R.M.J. Liskamp, professor, chair Chemical Biology and Medicinal Chemistry, School of Chemistry, University of Glasgow, United Kingdom, professor of Molecular Medicinal Chemistry, Utrecht University (panel member);
- Dr. P. Berben, senior research manager BASF, member leadership team BASF De Meern (panel member);
- A.E.M. Melcherts BSc, student Master in Nanomaterials Science, Utrecht University (student member).

On behalf of Certiked, drs. W. Vercouteren served as the process coordinator and secretary in the assessment process.

All panel members and the secretary confirmed in writing being impartial with regard to the programme to be assessed and observing the rules of confidentiality. Having obtained the authorisation by the University, Certiked requested the approval of NVAO of the proposed panel to conduct the assessment. NVAO have given their approval.

To prepare the assessment process, the process coordinator convened with management of the programme to discuss the outline of the self-assessment report, the subjects to be addressed in this report and the site visit schedule. In addition, the planning of the activities in preparation of the site visit were discussed. In the course of the process preparing for the site visit, programme management and the Certiked process coordinator regularly had contact to fine-tune the process. The activities prior to the site visit have been performed as planned. Programme management approved of the site visit schedule.

Well in advance of the site visit date, programme management sent the list of final projects of graduates of the programme of the most recent years. Acting on behalf of the assessment panel, the process coordinator selected the theses of 15 graduates from the last few years. The grade distribution in the selection was ensured to conform to the grade distribution in the list, sent by programme management.

The panel chair and the panel members were sent the self-assessment report of the programme, including appendices. In the self-assessment report, the student chapter was included. In addition, the expert panel members were forwarded a number of theses of the programme graduates, these theses being part of the selection made by the process coordinator.

Several weeks before the site visit date, the assessment panel chair and the process coordinator met to discuss the self-assessment report provided by programme management, the procedures regarding the assessment process and the site visit schedule. In this meeting, the profile of panel chairs of NVAO was discussed as well. The panel chair was informed about the competencies, listed in the profile. Documents pertaining to a number of these competencies were presented to the panel chair. The meeting between the panel chair and the process coordinator served as the briefing for panel chairs, as meant in the NVAO profile of panel chairs.

Prior to the date of the site visit, all panel members sent in their preliminary findings, based on the self-assessment report and the final projects studied, and a number of questions to be put to the programme representatives on the day of the site visit. The panel secretary summarised this information, compiling a list of questions, which served as a starting point for the discussions with the programme representatives during the site visit.

Shortly before the site visit date, the complete panel met to go over the preliminary findings concerning the quality of the programme. During this meeting, the preliminary findings of the panel members, including those about the theses were discussed. The procedures to be adopted during the site visit, including the questions to be put to the programme representatives on the basis of the list compiled, were discussed as well.

On 2 and 3 October 2018, the panel conducted the site visit on the Radboud University campus. The site visit schedule was as planned. In a number of separate sessions, the panel was given the opportunity to meet with Faculty Board representatives, programme management, Examination Board members, lecturers and final projects examiners, and students and alumni.

In a closed session at the end of the site visit, the panel considered every one of the findings, weighed the considerations and arrived at conclusions with regard to the quality of the programme. At the end of the site visit, the panel chair presented a broad outline of the considerations and conclusions to programme representatives.

Clearly separated from the process of the programme assessment, assessment panel members and programme representatives met to conduct the development dialogue, with the objective to discuss future developments of the programme.

The assessment draft report was finalised by the secretary, having taken into account the findings and considerations of the panel. The draft report was sent to the panel members, who studied it and made a number of changes. Thereupon, the secretary edited the final report. This report was presented to programme management to be corrected for factual inaccuracies. Programme management were given two weeks to respond. Having been corrected for these factual inaccuracies, the Certiked bureau sent the report to the Board of Radboud University, to accompany their request for re-accreditation of this programme.

3. Programme administrative information

Name programme in CROHO: M Chemistry
Orientation, level programme: Academic Master
Grade: MSc
Number of credits: 120 EC
Specialisations: Molecular Chemistry
Chemistry for Life
Physical Chemistry
Science and Education
Science in Society
Science, Management and Innovation
Location: Nijmegen
Mode of study: Full-time (language of instruction English)
Registration in CROHO: 66857

Name of institution: Radboud University
Status of institution: Government-funded University
Institution's quality assurance: Approved

4. Findings, considerations and assessments per standard

4.1 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

The Master Chemistry programme is offered by the Educational Institute for Molecular Sciences, one of the four educational institutes of the Faculty of Science of Radboud University. The dean of the Faculty has the responsibility for all programmes of the Faculty. The Institute is also the home to the programmes Bachelor Chemistry, Bachelor Molecular Life Sciences, Bachelor Science, Master Molecular Life Sciences and Master Science. The director of the programme is responsible for the delivery and quality of this and the other five programmes. The programme director is assisted by the study coordinator for all programmes and the programme coordinators for each of these programmes. The Programme Committee, being composed of lecturers and students, advises programme management on quality issues with regard to this programme. The Examination Board of the Educational Institute for Molecular Sciences has the authority to ensure the quality of examinations and assessments of all six programmes.

The Master Chemistry programme is a two-year, research-based, academic master programme in the field of chemistry. The programme is rooted in research done at the Institute for Molecules and Materials of the Faculty of Science, but is also nurtured by research done at other research institutes of this Faculty. The objectives of the programme are to educate students in-depth in chemistry. Students are thoroughly trained in research in this discipline.

The programme offers three research specialisations and three societal specialisations. The research specialisations are Molecular Chemistry, Chemistry for Life and Physical Chemistry. The Molecular Chemistry specialisation may be considered as the core of chemistry and studies the synthesis of molecules with new biological or physical properties to address scientific or societal challenges or problems. The Chemistry for Life specialisation finds itself at interface of chemistry and biology, being mostly chemical biology and studies the chemical dimensions of life sciences. The Physical Chemistry specialisation is directed towards the understanding, design and control of the functioning of molecules and materials. This specialisation studies the structure and the physical dimensions of molecules and molecular systems.

Within the programme, students may opt for research specialisations, but they may also choose societal specialisations. The latter are the Science and Education, Science in Society or Science, Management and Innovation specialisations. The first years of the research specialisations and societal specialisations are identical, students choosing one of the research specialisations mentioned. In the Science and Education specialisation, students take courses and the educational internship to become fully-qualified teachers in secondary education in Chemistry. The Science in Society specialisation trains students to be intermediaries between science and society, preparing them for positions in science communication. The Science, Management and Innovation specialisation educates students in societal, management and policy

dimensions and prepares them for positions as policy makers or managers in industry, non-profit organisations or the public sector.

For organisational and administrative reasons, programme management intends to merge the Master Chemistry, Molecular Life Sciences and Science programmes and to offer within this single programme the specialisations Molecular Chemistry, Physical Chemistry and Chemistry of Life.

The objectives of the programme are conform to the domain-specific reference framework for the chemical sciences in the Netherlands, which has been drafted by the joint programmes of this assessment cluster in the Netherlands. In this domain-specific framework, reference has been made to international frameworks and benchmark statements. The Radboud University programme may be regarded as positioned in the chemistry sub-domain of chemical sciences.

The programme primarily aims at preparing students for either the professional field in this domain or for PhD positions.

The programme objectives have been translated into intended learning outcomes, specifying knowledge and understanding in the programme domain, developing and application of ideas in the context of research, application of knowledge and understanding to problems in this field, integration of knowledge and formulation of judgments, communication skills about research findings and conclusions and competencies to direct the own professional development. For the societal specialisations, additional intended learning outcomes have been formulated, articulating and detailing the specific characteristics of each of these specialisations.

Programme management presented the comparison of the intended learning outcomes to the Dublin descriptors for the master level.

Considerations

The panel considers the programme objectives to be sound. The programme has the broad chemistry profile. The panel welcomes the strong research-orientation of the programme and regards the programme objectives to be up-to-date. The panel is positive about the research specialisations and the societal specialisations offered.

The programme objectives are within the boundaries of the domain-specific reference framework for academic chemical sciences programmes. The panel appreciates the efforts by the joint programmes in chemical sciences in the Netherlands to draft this framework and regards this to be a sound and up-to-date description of this domain. The programme profile may be clearly distinguished within the framework.

The panel is positive about students being prepared for both PhD positions and positions in industry in the programme domain. The panel recommends, however, to align the programme more to professional field requirements, preparing students better for future careers in industry.

The intended learning outcomes of the programme correspond to the programme objectives, are well articulated and are conform to the master level.

Assessment of this standard

These considerations have led the assessment panel to assess standard 1, Intended learning outcomes, to be satisfactory.

4.2 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

The number of incoming students for the last few years is approximately 30 students, rising over the last years as a consequence of increasing inflow numbers in the Bachelor programme. The entry requirements are academic bachelor degrees in chemistry, chemical technology or equivalent chemistry-related programmes. Bachelor programmes should be aligned to the research specialisations chosen. Students with non-chemistry academic bachelor degrees or with bachelor degrees from higher vocational education institutes have to complete the 30 EC to 45 EC pre-master programme. The prior education of students coming from abroad should meet the entry requirements. These students may have to take courses to remedy any deficiencies. Applications are screened by the programme admission officer and the programme study advisor. The Examination Board approves admission.

The curriculum of the programme takes two years, the study load being 120 EC. Programme management presented a table, showing the mapping of the intended learning outcomes and the courses. The contents of the curriculum mirror the specialisation chosen. In the first year, students take specialisation-specific compulsory courses, the Literature thesis, and the specialisation-specific Research internship, which continues into the second year. In addition, students take the Philosophy course and the Career orientation course. Students will also take electives and/or opt for a minor programme or second internship. The minor programme and the second internship may be outside of the research specialisation. In the Philosophy course, ethical dimensions of research in this domain are addressed. In the Career orientation course, career options are discussed. Academic skills' training is part of the internships. Students' choices and individual curricula are subject to approval by the Examination Board. Students opting for societal specialisations take in the first year compulsory courses, the research internship, Philosophy and Career orientation courses and elective courses. In the second year, they take courses, internships or thesis projects geared toward the specialisation.

A total number of 78 lecturers are involved in the programme. The lecturers are researchers at the Institute for Molecules and Materials, but also the other research institutes of the Faculty of Science. The research institutes received high to very high scores in the most recent research evaluations. Practically all staff members have PhD degrees. Of the total number of permanent staff about 85 % have obtained the BKO-certificate. PhD students, postdocs and technicians are also involved in the programme. Lecturers meet in teacher meetings, but attendance is somewhat disappointing. Lecturers experience their work load as quite demanding. New staff is to be recruited.

The educational concept of the programme is research-based education. As has been mentioned above, the curriculum is composed of both courses and internships, the internships carrying most of the study load. In the courses, the number of hours of face-to-face education are as expected. Study methods adopted in the curriculum include lectures, tutorials, computer-aided education, response hours, journal clubs and working in groups. Educational innovation in the programme is pursued. The main study

method adopted in the internships is the apprenticeship, meaning individual supervision of students by lecturers and PhD students or postdocs. Students may contact the study advisor for guidance or assistance. The students-to-staff ratio is 20/1 for the Faculty of Science as a whole. The student success rates for the last few years are about 23 % after two years and about 63 % after three years.

Considerations

The student inflow numbers of the programme are appropriate. The panel advises to monitor the student influx in view of material facilities and laboratory constraints. The entry requirements and admission procedures are adequate.

The panel is positive about the contents of the curriculum. The curriculum meets the intended learning outcomes of the programme. The contents of the curriculum components are up to standard. The panel considers the curriculum to be coherent. Both the research specialisations and the societal specialisations are organised well.

The panel regards the lecturers in the programme to be good researchers and very skilled in the contents of the courses. The lecturers are also very motivated. The educational abilities of the lecturers are up to standard, as may be deduced from the proportion of BKO-certified lecturers. As the workload is experienced by lecturers as very demanding, the panel advises to monitor the work load and to arrange productive discussions between programme management and lecturers to design and implement efficient procedures.

The panel considers the educational concept and the study methods to be in line with the programme characteristics. The programme is working on new study methods, which is positive. The number of hours of face-to-face education are appropriate. The study guidance is adequate. The student success rates are rather disappointing. The panel recommends to analyse the causes.

Assessment of this standard

These considerations have led the assessment panel to assess standard 2, Teaching-learning environment, to be satisfactory.

4.3 Standard 3: Student assessment

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

Findings

The programme examination and assessment rules and regulations are in line with Faculty of Science policies. As has been indicated, the Examination Board for this programme and the other programmes of the Educational Institute for Molecular Sciences has the authority to monitor the quality of examination and assessment processes and products.

The examination methods for the courses are selected in line with the courses' contents. The examination methods for the courses include written examinations, oral examinations, written assignments or oral presentations. Literature theses are assessed on the basis of the written report by the supervisor and the second reader. Free-riding in case of group work is countered by peer review among students, close surveillance by supervisors and accompanying individual examinations. Written reports are checked for fraud or plagiarism.

The Research internships are individual specialisation-specific research projects. Students are informed about subjects to be chosen at regularly scheduled information events or markets. Internships may be done either at Radboud University or Radboud University Medical Centre research groups or at research departments in industry or in research institutions abroad. At the start of the internships, students register the research group and submit their research proposal. The programme internship coordinator approves the start of the internship, having verified the research group and research proposal. During the internships, students are guided by a supervisor. PhD students or postdocs may be involved in the day-to-day supervision. Draft theses may be commented on. At the completion of the internships, students present their findings not only in writing but also in a presentation. Internships are assessed by the supervisor and the second reader, using assessment scoring forms with criteria. The assessment scoring forms have been standardised across research groups. In case of external internships, the second reader must be an approved examiner of the Educational Institute for Molecular Sciences. All theses are checked for fraud or plagiarism.

Programme management and the Examination Board have taken a number of measures to promote the quality of examinations and assessments. The Examination Board appoints examiners. For each of the courses, comprehensive course dossiers are available. These dossiers have to include examination matrices and answer models. Draft examinations have to be peer-reviewed. Papers are checked for plagiarism. Analyses of examinations are not performed. Students are presented trial examinations and are allowed to inspect their work. The Examination Board checks course dossiers on a regular basis.

Considerations

The panel approves of the examinations and assessment rules and regulations of the programme, these being in line with Faculty of Science policies. Although the Examination Board, among others, reviews course dossiers on a regular basis, the panel advises for the Board to monitor examination and assessment processes more consistently.

The examination methods adopted by the programme are consistent with the goals and contents of the courses. The measures to counter free-riding are effective.

The supervision processes for the Research internships are appropriate. The assessment procedures are satisfactory, involving two examiners and assessment scoring forms being adopted. The panel advises to require examiners to substantiate their grades on the Research internship assessment scoring forms.

The panel considers the measures ensuring the validity, reliability and transparency of examinations and assessments to be satisfactory. As not all examiners include examination matrices and answer models in the course dossiers, the panel advises to require examiners to do so. In addition, the panel recommends to analyse examination results more systematically.

Assessment of this standard

The considerations have led the assessment panel to assess standard 3, Student assessment, to be satisfactory.

4.4 Standard 4: Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

The panel studied the examinations of a number of courses of the programme.

The panel reviewed 15 Research internships of programme graduates of the last two years. The average grade for the internships was about 8.1 for the last five years.

Programme graduates are prepared to enter the labour market. The career prospects of the graduates are good. Graduates tend to find suitable employment shortly after graduation. About 40 % of the graduates proceed to PhD trajectories. Other graduates find positions in research and development within industry. The minority of graduates are employed in education, consultancy or management or find policy-related positions.

Considerations

The panel considers the course examinations to be up to standard.

The Research internships the panel studied, match the intended learning outcomes and are appropriate research projects. No internships were found by the panel to be unsatisfactory. The panel supports the grades given by examiners of the programme.

The panel regards the programme graduates to have reached the intended learning outcomes and to be qualified to find appropriate positions in this domain.

Assessment of this standard

The considerations have led the assessment panel to assess standard 4, Achieved learning outcomes, to be satisfactory.

5. Overview of assessments

Standard	Assessment
Standard 1. Intended learning outcomes	Satisfactory
Standard 2: Teaching-learning environment	Satisfactory
Standard 3: Student assessment	Satisfactory
Standard 4: Achieved learning outcomes	Satisfactory
Programme	Satisfactory

6. Recommendations

In this report, a number of recommendations by the panel have been listed. For the sake of clarity, these have been brought together below. These panel recommendations are the following.

- To align the programme more to professional field requirements, preparing students better for future careers in industry.
- To monitor the student influx in view of material facilities and laboratory constraints.
- To monitor the work load and to arrange productive discussions between programme management and lecturers to design and implement efficient procedures.
- To analyse the causes of the rather low student success rates of the programme.
- For the Examination Board to monitor examination and assessment processes more consistently.
- To require examiners to substantiate their grades on the Research internship assessment scoring forms.
- To require all examiners to present examination matrices and answer models and to analyse examination results more systematically.