UNIVERSITY OF AMSTERDAM

FACULTY OF SCIENCE

TEACHING AND EXAMINATION REGULATIONS

PART B

Academic year 2019-2020

MASTER'S PROGRAMME MATHEMATICS

Contents

Chapter 1. General Provisions

Article B-1.1 – Definitions

In addition to part A, the following definitions are used in part B

a. Personal Education Plan: An individual study plan for the student's master programme.
b. Master Project: Compulsory internship/master thesis always resulting in a written report.

Article B-1.2 – General information master's programme

The Master's programme Mathematics, CROHO 66980, is offered on a full-time basis. The language of instruction for the programme is English. This means that the Code of Conduct governing Foreign Languages at the UvA and the provisions laid down in Section 7.2 of the Act apply.

1. The programme has a workload of 120 EC. The study programme is offered in collaboration with all Dutch universities that participate in Mastermath.
2. Students choose between a regular programme and programmes with a major or minor. Each major and minor has its specific exit qualifications.
3. The student may choose a major or a minor from the list below (see Article B-4.1).
    - Major Science in Society;
    - Major Science Communication;
    - Major Teaching;
    - Minor Tesla.
    - Minor Teaching
    - Minor Science for Sustainability

Article B-1.3 – Enrolment

Students may enrol to start the programme at the beginning of the first and second semester of the study year (September and February).

Chapter 2. Aim of the programme and exit qualifications

Article B-2.1 – Aim of the programme

The aim of the programme is:

a) The objectives of the Master's programme are to provide students with knowledge, abilities and insight in the field of mathematics, to enable them to work as an academic professional, or to become qualified to pursue advanced training as scientific researcher.
b) The programme also aims at furthering the understanding of the position, role and responsibility of mathematics in science and society.

Article B-2.2 – Exit qualifications

1. The student graduating from the programme:

a) has a thorough theoretical and practical knowledge of mathematics, including the knowledge of other disciplines required for that purpose;
b) has insight in the development and heuristics of modern mathematics;
c) has specialist knowledge and research experience in at least one sub-area within the mathematics discipline;
d) is able to formulate a research plan, based on a relevant problem within the mathematics discipline;
e) is able to analyse and formulate research results and to draw conclusions from them;
f) is able to write a scientific report;

g) is able to participate in discussions about mathematical problems with fellow researchers;
h) is able to consult (international) professional literature in the relevant sub-areas and to apply the knowledge gained from that;
i) is able to apply one's knowledge of mathematics in a broader (multidisciplinary) context;
j) is employable in those positions in which knowledge and research skills in the field of mathematics are a prerequisite;
k) has in depth knowledge of, and insight in the social role of mathematics to make sound choices regarding one's own profession, as well as in the exertion of this profession;
l) is able to cooperate with other people, to convey knowledge to other people and to give a presentation both to discipline specialists and to a broader audience.

2. In addition to paragraph 1, the student finishing the regular programme described in Article B-4.1 is able to:
a) place the obtained results and conclusions in the context of the results obtained by other scientists;
b) carry out literature research in mathematics from various sources, and combine and enrich these with one's own contribution;
c) develop a vision on the development of scientific research in the field of study.
3. The exit qualifications of the major and minor programmes and the learning outcomes of the minor Tesla are listed in appendix 1.

More information of the majors and minors can be found on:
https://student.uva.nl/math/shared/studentensites/fnwi/ew-gedeelde-content/en/az/majors-and-minors/majors-and-minors.html?origin=nzksw95RSfC%2BUP7U7NCF5w

Chapter 3. Admission to the programme

Article B-3.1 – Entry requirements

1. Students who have successfully completed a Bachelor's degree *Wiskunde* awarded by a Dutch University may be admitted.
2. Students who have successfully completed a Bachelor's degree *Beta-gamma met een Wiskunde major*, awarded by the University of Amsterdam may be admitted.
3. Without prejudice to the provisions of paragraph 1, the Admissions Board may grant admission to the study programme when concluding that the previous education of the candidate is equivalent to the Bachelor's degree referred to in paragraph 1.

Article B-3.2 – Premaster's programme

Without prejudice to the provisions of Article B-3.1 the Admissions Board may grant admission to a student whose previous education does not meet aforementioned admission requirements to the study programme, when concluding that the candidate is able to meet these admission requirements within a reasonable period of time. At the request of a candidate, and when the Admissions Board has decided additional education feasible, the Admissions Board may draw up a programme of at most 30 EC as an admission requirement, a so called `Premaster's programme'. After completion of this Premaster's programme a letter of admission will be issued, exclusively for the stated Master's programme.

Article B-3.3 – Restrictions on the number of students admitted to the Master's programme

Not applicable.

Article B-3.4 – Intake dates

A request for admission to the Master's programme starting in September must be received before 1 July in the case of EU/EEA/Swiss students, and before 1 February in the case of non-EU/EEA/Swiss students. For the programme starting in February, applications must be received before 1 December for EU/EEA/Swiss students and before 1 October for non-EU/EEA/Swiss students. Under exceptional circumstances, the Admissions Board may consider a request submitted after these intake dates.

Article B-3.5 – English Language Requirements

1. The proficiency requirement in English as the language of instruction can be met by the successful completion of one of the following examinations:
    - IELTS: 6,5, at least 6 on each sub-score (listening/reading/writing/speaking);
    - TOEFL paper-based: 580;
    - TOEFL Internet-based test: 92, at least 22 on each sub-score (listening/reading/writing/speaking);

    The foregoing examination must have been taken within two years before the student's enrolment.
    - C1 Advanced (CAE): minimal result 170
    - C2 Proficiency (CPE): minimal result 170

    Please note that the TOEFL-code for the University of Amsterdam is 9011.
2. An exemption from the English examination referred to in the first paragraph shall be granted to students who:
    - had previous education in secondary or tertiary education in one of the following English-speaking countries: Australia, Canada (English), New Zealand, Ireland, the United Kingdom or the United States of America;
    - hold an English-language 'international baccalaureate' diploma;
    - students who possess a Bachelor's degree from a Dutch university satisfy the requirement of sufficient command of the English language;
    - passed the final examination for the subject of English as part of one of the following diplomas: VWO, Belgian ASO (Flemish).

Chapter 4. Content and organisation of the programme

Article B-4.1 – Organisation of the programme

1. The curriculum comprises the following:

Components	Regular programme	Programme with Major	Programme with Minor
Master Seminar	6 EC	6 EC	6 EC
Restricted-choice electives	66 EC	30 EC	48 EC
Master Project Mathematics	36 EC	24 EC	24 EC
Free-choice electives	12 EC		12 EC
Major/minor programme		60 EC	30 EC
Total EC	**120 EC**	**120 EC**	**120 EC**

In consultation with the coordinator of the Master's programme the contents of the study programme will be determined. These contents are laid down in a Personal Education Programme (PEP). Students submit their study programme (PEP) for approval to the Examinations Board.

2. The student can choose between the regular programme and a programme containing one of three majors or one of two minors. The majors and minors are:
   a. Major Science in Society;
   b. Major Science Communication(partly in dutch);
   c. Major Teaching (in dutch);
   d. Minor Tesla;
   e. Minor Teaching (in dutch).
   f. Minor Science for Sustainability
3. Students of the regular programme or the programme with minor choose one of four specializations. The specializations are
   a. Algebra and Geometry,
   b. Analysis and Dynamical Systems,
   c. Mathematical Physics,
   d. Stochastics.

In their first year, students take the Master Seminar in their chosen specialization. Depending on the specialization the choice of restricted-choice electives (see Art. B4.4) is restricted in the following way.

a. Algebra & Geometry

Students take at least three courses from the following list of basic courses:

- Additive Combinatorics
- Algebraic Topology 1
- Algebraic Geometry 1
- Algebraic Number Theory
- Commutative Algebra
- Differential Geometry
- Riemann Surfaces
- Lie algebras
- Lie Groups
- Modular Forms
- Quivers

Students take at least two courses from the list of specialised courses. For 2019/2020 the list is

- Advanced Algebraic Geometry
- Advanced Combinatorics: zeros of graph polynomials, Markov chains and algorithms
- Algebraic Geometry 2
- Algebraic Topology 2
- Blowing Ups and Deformations: an Introduction to the Theory of Singularities
- Elliptic curves
- Poisson Geometry
- Selected Areas in Cryptology
- Symplectic Geometry
- Topology of Algebraic Varieties

b. Analysis & Dynamical Systems

Students take at least three courses from the following list of basic courses:

- Complex Dynamical Systems
- Differential Geometry
- Functional Analysis
- Partial Differential Equations
- Dynamical Systems
- Numerical Linear Algebra
- Numerical Methods for Stationary PDEs

Students take at least two courses from the list of specialised courses. For 2019/2020 the list is:

- Advanced Topics in Stochastic Analysis
- Calculus of Variations
- Introduction to Numerical Bifurcation Analysis of ODEs and Maps
- Inverse Problems in Imaging
- Operator Algebras
- Parallel Algorithms
- Symplectic Geometry
- Uncertainty Quantification and Data Assimilation

c. Mathematical Physics

Students take at least three courses from the following list of basic courses:

- Differential Geometry
- Algebraic Geometry 1
- Algebraic Topology 1
- Functional Analysis
- Lie Groups
- Lie Algebras
- Riemann Surfaces
- Topology in Physics

Students take at least two courses from the list of specialised courses. For 2019/2020 the list is

- Advanced Combinatorics: zeros of graph polynomials, Markov chains and algorithms
- Algebraic Geometry 2
- Algebraic Topology 2
- Blowing Ups and Deformations: an Introduction to the Theory of Singularities

- Operator Algebras
- Percolation: from Introduction to Frontiers of Current Research
- Poisson Geometry
- Quantum Computing
- Quantum Information Theory
- Random Walks
- Symplectic Geometry

Students take at least one course from the following list of restricted-choice elective courses from the master Physics and Astronomy (track Theoretical Physics):

- Statistical Physics and Condensed Matter Theory I
- Quantum Field Theory
- String Theory

d. Stochastics

Measure Theoretic Probability (8EC) is compulsory.

Students take at least three courses from the following list of basic courses:

- Machine Learning Theory
- Asymptotic Statistics
- Simulation Methods in Statistics
- Stochastic Networks
- Stochastic Integration
- Stochastic Simulation

Students take at least two courses from the list of specialised courses. For 2019/2020 the list is:

- Advanced Topics in Stochastic Analysis
- Complex Networks
- Data-driven Decision Making in Operations Research
- aNonparametric Statistics
- Portfolio Theory
- Queues & Levy Fluctuation Theory
- Random Walks
- Statistics for Stochastic Processes
- Stochastic Processes
- Interest Rate Models
- Topological Data Analysis
- Uncertainty Quantification and Data Assimilation

4. Regarding the majors:
   A major consists of 60 EC. It must be combined with a research programme, comprising at least 60 EC credits as listed in the table in paragraph 1 in order to meet the general requirements of the programme. Students have to go through a separate intake procedure for admission to one of the majors. The student compiles with the master coordinator a 60 EC research programme, containing the master seminar (6EC), the master project (24EC) and a coherent choice of 30EC of elective components related to the topic of his/her master project, which has to be approved by the Examination Board. The student does not have to satisfy the requirements for one of the four specialization directions as described in 2, but chooses the master seminar of the specialisation direction corresponding to the topic of the master project. Students first have to finish 48 EC of the obligatory research part of the programme before starting one of the majors. The exit

qualifications of the majors can be found in appendix 1.

5. Regarding the major Teaching:
   In addition to paragraph 4, the major Teaching (in Dutch) consists of the *Lerarenopleiding Wiskunde* offered by the *Interfacultaire Lerarenopleidingen*. Students who have completed the *Educatieve Minor* of 30 EC credits during their Bachelor's programme may submit a non-standard study programme for approval to the Examinations Board. The non-standard study programme is structured as the programme with minor, as described in the table in paragraph 1, with the 30 EC credits from the *Lerarenopleiding Wiskunde* at the *Interfacultaire Lerarenopleidingen* replacing the minor. Students first have to finish 48 EC of the obligatory research part of the programme before starting the major Teaching. The components of the *Lerarenopleiding* are listed in appendix 1.
6. Regarding the minor Tesla:
   The minor Tesla consists of 30 EC credits. It must be combined with a research programme, comprising at least 90 EC credits as listed in the table in paragraph 1 in order to meet the general requirements of the programme. Students have to go through a separate intake procedure for admission to the minor. Students first have to finish 48EC of the obligatory research part of the programme before starting the Tesla minor. The learning objectives of this minor can be found in appendix 1.
7. Students may submit a non-standard compilation of the regular programme for approval to the Examinations Board, containing courses and a topic of a Master Project Mathematics in a different specialization field of mathematics.

Article B-4.2 – Compulsory components

1. Master Seminar:
   The content, format, and assessment criteria of the Master Seminar in Algebra, Geometry & Mathematical Physics, Master Seminar in Stochastics, Master Seminar in Analysis and Dynamical Systems are described in the Course Catalogue.
2. For students in the specialization direction Stochastics, the restricted-choice elective course Measure Theoretic Probability (8EC) is compulsory.
3. Master Project Mathematics:
   b. The Master Project Mathematics consists of a thesis, a midterm presentation in the Master Seminar of the specialization of the student, and a final presentation. The assessment criteria are the quality and content of the written thesis (50%), the student's attitude and execution (35%), the midterm presentation (5%) and the final presentation (10%).
   c. At the end of the Master Project Mathematics the supervisor (first examiner) checks on the basis of the assessment criteria, whether the student has sufficiently achieved the exit qualifications.
   d. In the assessment of the Master Project Mathematics
      a. An independent examiner will act as a second reviewer;
      b. the coordinator of the Master Seminar will assess the midterm presentation;
      c. the final presentation will be attended by the supervisor and the second reviewer;
      d. the final grade for the master project will be determined in a private meeting by the supervisor and the second reviewer. A member of the Examinations Board will supervise the procedure.

Article B-4.3 – Practical components

Not applicable.

Article B-4.4 – Elective components

1. Restricted-choice elective courses are listed in Appendix 2.
2. Course components successfully completed elsewhere or that are not included in the list of restricted-choice elective components may be included in the student's programme, subject to prior permission from the Examinations Board.
   a. The courses have to be followed at an accredited university or institute that are according to the Examinations Board of a comparable level.

b. The course must be relevant to the programme.
c. The courses have to be followed in the period that the student is enrolled in the programme.

3. In terms of content, restricted-choice elective components must not show too much similarity to other components of the student's curriculum. The acceptable degree of similarity will be decided by the Examinations Board.
4. The content and examination method of *Reading Course Mathematics* needs to be approved by the Examinations Board prior to the start of the course. The supervisor of the reading course sends in a request for approval to the Examinations Board, containing a short description of the content, the reading material, and the exam rules.
5. The restricted-choice elective course Quantum in Business and Society (3EC) is a skills course.
6. Regarding the free-choice elective components:
   In terms of content, free-choice elective components must not show too much similarity to other components of the student's curriculum. The acceptable degree of similarity will be decided by the Examinations Board. In exceptional cases students may choose Bachelor's level free-choice elective components as part of their programme. The Examinations Board will determine whether a free-choice elective component at the Bachelor's level will be accepted as part of the programme. A free-choice elective component will only be accepted as part of the programme if the Examinations Board has given its prior approval.

Article B-4.5 – Free curriculum

The student may compile a curriculum of his/her own choice, which has to be approved by the Examinations Board. The free curriculum must possess at least the extent, breadth and depth of a regular Master's programme and must be in line with the learning outcomes of the degree programme. At least one half of the proposed curriculum has to consist of components of the regular programme (see Article B-4.1), including the Master Seminar and the Master Project Mathematics.

Article B-4.6 – Sequence and admission requirements

1. Participation in a restricted-choice elective course may require particular mathematical prerequisites. The prerequisites for each course are listed in the Course Catalogue.
2. The Master Project in the regular programme can only be commenced if the compulsory course components and the restricted-choice elective components in the discipline are completed.

Article B-4.7 – Participation practical training and tutorials

Not applicable.

Article B-4.8 – Exemption

A maximum of 60 EC can be accumulated in the programme through exemptions granted by the Examinations Board.

Article B-4.9 – Degree

A student who passes the final examination of a programme is awarded a Master of Science degree. The name of the degree awarded is stated on the diploma.

Article B-4.10 – Joint National Master's Programme

Students taking courses as part of Mastermath may also be subject to rules and regulations that have been agreed on nationally. These regulations can be found on: www.mastermath.nl -> 'General Rules & Guidelines'.

Article B-4.11 – Double Master's Degree Mathematics and Physics and Astronomy / track Theoretical Physics

1. A student can be awarded the Master's degrees Mathematics and Physics and Astronomy / track Theoretical Physics after successfully completing a combined programme described in this article. The candidate must be admitted to both Master programmes.
2. The total study load of the programme of the candidate should amount to at least 180 EC, comprising
    - 46 EC Compulsory components
    - 72 EC Master Project Mathematics and Theoretical Physics
    - 12 EC Restricted-choice electives physics courses
    - 38 EC Restricted-choice electives mathematics courses
    - 12 EC Free-choice elective courses
3. The candidate has conducted an integrated research project Master Project Mathematics and Theoretical Physics (72 EC), replacing Master Project Mathematics (36EC) and Research Project Physics and Astronomy (60EC). This must be supervised by examiners from the two Master's programmes. The project must be assessed as a pass by both examiners according to the standards and procedures for Master project assessment of the respective master degrees.
4. The integrated research project of article B-4.10, point 3 can be replaced by two separate projects: Master Project Mathematics (36 EC), and Research Project Physics and Astronomy (60EC). In this case the total load of the programme must be at least 192 EC.
5. The compulsory components are

    - Differential Geometry (8EC, replaces Mathematical Methods from MSc Physics&Astronomy)
    - Lie Groups (8EC, replaces Group Theory from MSc Physics&Astronomy)
    - Quantum Field Theory (6EC)
    - Statistical Physics & Condensed Matter Theory 1 (6EC)
    - A joint course in Mathematics and Theoretical Physics (8EC). In 2019/2020 the course will be Topology in Physics, 6EC
    - Master seminar Algebra, Geometry & Mathematical Physics (6EC).
    - Student seminar Theoretical Physics (6EC).
6. The restricted-choice elective physics courses consist of 12 EC of physics courses from the MSc Physics & Astronomy, including at least 6 EC from the track Theoretical Physics. The courses Mathematical Methods and Group Theory cannot be taken as as part of these 12 EC. The Teaching and Examination Regulations of the MSc Physics & Astronomy contains the list of courses of the MSc Physics & Astronomy, and the sublist of courses from the track Theoretical Physics.
7. The restricted-choice elective courses from MSc Mathematics consist of 38 EC. It includes at least one of the courses Algebraic Topology 1, Algebraic Geometry 1 or Riemann Surfaces and contains two restricted-choice electives from the lists of advanced courses of the specialization directions Algebra & Geometry and Mathematical Physics. The Teaching and Examination Regulations of the MSc Mathematics contains the list of restricted-choice elective courses of the MSc Mathematics (appendix 2), as well as the list of advanced courses in the specialization directions Algebra & Geometry and Mathematical Physics (art. B4.1.2).

Article B-4.12 – Double Master's programme (Mathematics and other two-year programmes)

In case a student combines two other Master programmes and their components than mentioned in articles B-4.11 and B-4.13, the following requirements must be met in order to be awarded two Master's degrees:

1. The total programme of the candidate should amount to at least 180 EC credits.
2. The two master programmes may not show too much similarity.

3. The candidate's work for the programme (lectures, research work, etc.), must be of such a standard that all the exit qualifications of each of the two programmes have been met.
4. The candidate must have conducted separate research work for both Master's degrees. This may consist of two separate research projects with supervisors from the respective study programmes. In the case of an integrated research project, this must be supervised by examiners from the two Master's programmes. The project must be assessed as a pass by both examiners according to the standard and procedures for Master project assessment of the respective master degrees. The total number of credits given for an integrated research project is 3/4 of the sum of the credits given for two independent research projects.
5. In addition to 1-4, the other study programme may impose further requirements.
6. The Examinations Boards of both study programmes must approve the student's double Master's programme before the student commences on the double Master's programme.

Article B-4.13 – Double Master's Degree Econometrics and Mathematics

A student can be awarded the Master's degrees Econometics and Mathematisc after successfully completing a combined programme described in this article. In order to be awarded the two different Master's degrees, the following requirements must be met:

1. The total study load of the programme of the candidate should amount to at least 150 EC.
2. The candidate's work for the Master's programme (lectures, research work etc.) is of such a standard that all exit qualifications of each of the two programmes have been met. The specific programme requirements for double degree students are described in the document "Double degree programmes in Econometrics and Mathematics/SFM", which is available at the study guide pages of the master programmes.
3. The candidate has conducted an integrated research project Master Project Econometrics and Mathematics (36 EC), replacing Master Project Mathematics. This must be supervised by examiners from the two Master's programmes. The project must be assessed as a pass by the examiners according to the standards and procedures for Master project assessment of the respective master degrees.
4. The Examinations Boards of both study programmes must approve the student's double Master's programme before the student commences on the double Master's programme.

Chapter 5. Academic student counselling

Article B-5.1 Academic student counselling

The academic student counselling for this programme consists of: master coordinators and study adviser.

Chapter 6. Teaching evaluation

Article B-6.1 – Teaching evaluation

Teaching evaluation shall take place as follows: UvA Q course evaluation system, assessment by Board of Studies, peer review, random quality assessment by the examination board.

Chapter 7. Transitional and final provisions

Article B-7.1 – Amendments

1. Any amendment to the Teaching and Examination Regulations will be adopted by the dean after taking advice, and if necessary approval by the relevant Programme Committee. A copy of the advice will be sent to the authorised representative advisory body.
2. An amendment to the Teaching and Examination Regulations requires the approval of the au-

thorised representative advisory body as stated in the WHW.

3. An amendment to the Teaching and Examination Regulations is only permitted to concern an academic year already in progress if this demonstrably does not damage the interests of students.

Article B-7.2 – Cancelled programme components and transitional provisions

1. The following course components of the past academic year have been cancelled:
   Advanced Complex Analysis
   Algebraic Methods in Combinatorics
   Algebraic Topology in Dynamical Systems
   Analytic Number Theory
   Applied Statistics
   Bayesian Statistics
   Coding Theory
   Control of infinite dimensional systems
   Discrete Optimization
   Entrepreneurship in data science and analytics
   Ergodic Theory
   Geometric Functional Analysis and its Applications
   Geometric PDE
   Heuristic Methods in Operations Research
   Interacting Particle Systems: Theory and Applications
   Inverse Problems in Imaging
   Lie Groups and Lie Algebras
   Mirror Symmetry
   Multiple Zeta Functions
   Nonlinear Waves
   Numerical Bifurcation Analysis of Large-scale Systems
   Numerical Methods for Time-Dependent PDEs
   p-Adic Numbers
   Performance of networked systems
   Statistical Theory for High-and Infinite-Dimensional Models
   Statistics for Networks
   Stochastic Differential Equations
   Symmetries and Conservation Laws of Nonlinear PDE
   Topics in Number Theory
2. These regulations apply to anyone enrolled in the programme. However, regarding the curriculum requirements as stated in article B-4, the student may make an appeal to the regulations of the academic year of the student's enrollment in the programme.

Article B-7.3 – Publication

1. The dean shall ensure a fitting publication of part A and B of these Regulations and the rules and guideline referred to in the Act.
2. These regulations can be accessed at the website of the Faculty of Science and the UvA Course Catalogue.

Article B-7.4 – Effective date

These Regulations enter into force with effect from 1 September, 2019.
Thus drawn up by the Dean of the Faculty of Science on 27 August, 2019.

Appendix 1. Final attainment levels of the major Science in Society (SS), the major Science Communication (SC) and Major Teaching, and learning objectives minor TESLA, Teaching and Science & Sustainability

A. Final attainment levels of the major Science in Society

Dublin descriptor 1: Knowledge and understanding
The graduate has theoretical and practical knowledge of management, policy analysis and entrepreneurship. The graduate:
1. has insight into the various relevant disciplines in the social and behavioural sciences. More specifically the student acquires insight into:
   a. important concepts and theories in the field of policy science, management studies, and entrepreneurship;
   b. the relation of these gamma sciences to the beta sciences;
2. has insight into concepts and the latest theories, research methodologies, analytical models and important research questions related to interdisciplinary research for addressing societal problems;
3. has knowledge of, and insight into, relevant concepts and theories for effective communication and collaboration.

Dublin descriptor 2: Applying knowledge and understanding
The graduate is experienced in carrying out interdisciplinary research, in applying techniques specific to the subject area and in applying scientific knowledge to societal problems. The graduate:
1. has the ability to integrate knowledge from the beta and gamma sciences, as well as from science and practice;
2. can apply scientific knowledge to formulate solutions to societal problems and assess them for appropriateness and societal relevance;
3. adopts an appropriate attitude towards the correct and unbiased use and presentation of data.

Dublin descriptor 3: Making judgments
The graduate is able to independently and critically judge information. The graduate is able to:
1. independently acquire information in relevant scientific areas through a literature review and by conducting empirical research, as well as evaluate such information critically;
2. select and order information, distinguish essentials from trivialities, and recognize connections;
3. formulate personal learning objectives and critically evaluate own performance, both introspectively and in discussion with others.

Dublin descriptor 4: Communication
The graduate is able to transfer knowledge and skills related to his/her subject area to other people and to adequately reply to questions and problems posed within society. The graduate:
1. has acquired skills to report orally and in writing on research results in English;
2. has the ability to communicate research conclusions, and the knowledge and rationale underpinning them, to specialist audiences and non-specialist audiences clearly and unambiguously;
3. can collaborate with researchers from various scientific disciplines;
4. can make essential contributions to scientific discussions about plans, results and consequences of research.

ublin descriptor 5: Learning skills
The graduate has developed learning skills that enable him/her to continue with self-education and development within the subject area. The graduate:
1. has acquired skills to develop a research plan, giving details of the problem statement, objectives, research questions, research approach, research methods, and planning;
2. is familiar with the general scientific journals, such as Nature and Science, and with journals in the specialisation, such as Research Policy, Health Policy, Science, Technology & Human Values, Social Science & Medicine, and International Journal on Technology Management;
3. has the learning skills to allow him/her to continue to study in a manner that may be largely self-directed or autonomous (life-long learning).

B. Final attainment levels of the major Science Communication

The MSc graduate possesses an academic attitude, skills and competences to operate at the interface of science and society aiming to contribute to a fruitful science-society dialogue. This means that Master's graduates have the following focus:

• Understanding the dynamic relationship between science and society;
• Translating information from the natural sciences to society and vice versa;
• Shaping the dialogue between science and society.

Knowledge

1. Knowledge of and insight into the relevant concepts and theories in the field of science communication, sociology, communication science, philosophy and science & technology studies in relation to the natural sciences;
2. Familiarity with scientific journals in the field of science communication and science & technology studies, as well as familiarity with a variety of popular-scientific media;
3. Insight into the nature and course of interpersonal and group communication processes relevant to the formal and informal dialogue between science and society;
4. Insight into relevant concepts and theories for effective communication and collaboration in relation to diverse science-society interactions;
5. Insight into the popularization of the natural sciences in various media;
6. Insight into the roles and responsibilities of museums in science communication.

Skills

1. Independently acquire, analyze and evaluate relevant information in a variety of scientific disciplines, by conducting literature study and empirical research;
2. Communicate and collaborate effectively with diverse professionals of scientific and nonscientific disciplines as well as lay citizens;
3. Design and facilitate interactive processes in relation to the science-society dialogue;
4. Translate information from various natural science disciplines into more generally accessible language and formats;
5. Produce popular-scientific media output concerning developments in the natural sciences, aimed at a variety of publics;
6. Contribute to the design of museum exhibitions from the perspective of scientific content management and science communication theory;
7. Make an intrinsic contribution to the societal discussion of developments in science and technology.

C. Final attainment levels of the major Teaching

1. De bekwaamheidseisen Leraar Voorbereidend Hoger Onderwijs zijn, naast de voor alle wo-masteropleidingen geldende Dublin-descriptoren en algemene wettelijke eisen, richtinggevend voor de doelstellingen en eindtermen van de lerarenopleidingen Voorbereidend Hoger Onderwijs. Deze bekwaamheidseisen zijn vastgelegd in de Wet op het voortgezet onderwijs (artikel 36 e.v.) en het Besluit bekwaamheidseisen onderwijspersoneel (zie 'Besluit bekwaamheidseisen onderwijspersoneel' (http://wetten.overheid.nl/BWBR0018692/2017-08-01) en 'Besluit van 16 maart 2017 tot wijziging van het Besluit bekwaamheidseisen onderwijspersoneel en het Besluit bekwaamheidseisen onderwijspersoneel BES in verband met de herijking van de bekwaamheidseisen voor leraren en docenten' (https://zoek.officielebekendmakingen.nl/stb-2017-148.html)).

   De eindtermen zijn geordend in twee categorieën:
   - Eindtermen die rechtstreeks te maken hebben met de kern van het beroep: het onderwijsleerproces en het leren van leerlingen, te weten de vakinhoudelijke, vakdidactische en pedagogische bekwaamheid (eindterm 1 t/m 3).
   - Eindtermen die betrekking hebben op meer algemene aspecten van professioneel handelen ten dienste van die kern van het beroep: te weten samenwerking met collega's en de omgeving van de school en met reflectie en persoonlijke en professionele ontwikkeling (eindterm 4 t/m 5).

   De opleiding draagt er zorg voor dat de afgestudeerde Leraar VHO in ieder geval:
   1. aantoonbaar beschikt over vakinhoudelijke kennis en vaardigheden die het wo-bachelorniveau overstijgen dan wel verdiepen. Dat wil zeggen dat de afgestudeerde Leraar VHO:
      a. de inhoud van vak beheerst / boven de leerstof staat;
      b. daardoor de leerstof, voor het schooltype waarin de leraar werkzaam is, zo kan samenstellen, kiezen of bewerken dat de leerlingen die kunnen leren;
      c. vanuit vakinhoudelijke expertise verbanden kan leggen met het dagelijks leven, met werk en met wetenschap en het onderwijs betekenisvol kan maken voor de leerlingen;
      d. daarmee kan bijdragen aan de algemene vorming van de leerlingen.
   2. aantoonbaar beschikt over vakdidactische kennis en vaardigheden. Dat wil zeggen dat de afgestudeerde Leraar VHO:
      a. de vakinhoud weet te vertalen in leerplannen of leertrajecten en dat doet op een professionele, ontwikkelingsgerichte werkwijze;
      b. de vakinhoud leerbaar maakt voor en afstemt op het niveau en kenmerken van de leerlingen, daarbij doelmatig gebruikmakend van (digitale) beschikbare leermiddelen;
      c. het onderwijs kan ontwikkelen en evalueren;
      d. het onderwijs doelmatig kan uitvoeren en het leren van leerlingen kan organiseren;
      e. de vak inhoud/didactiek afstemt met de collega's op school en laat aansluiten bij de visie en missie van de school.
   3. aantoonbaar beschikt over pedagogische kennis en vaardigheden. Dat wil zeggen dat de afgestudeerde Leraar VHO:
      a. de ontwikkeling van leerlingen volgt in hun leren en gedrag en daarop het handelen afstemt;
      b. bijdraagt aan de sociaal-emotionele en morele ontwikkeling van de leerlingen;
      c. bijdraagt aan de burgerschapsvorming en de ontwikkeling van de leerling tot een zelfstandige en verantwoordelijke volwassene;
      d. met een professionele, ontwikkelingsgerichte werkwijze en in samenwerking met collega's een veilig, ondersteunend en stimulerend leerklimaat voor leerlingen kan realiseren;
      e. in staat is om oordelen te formuleren, rekening houdend met de sociaal-maatschappelijke en ethische verantwoordelijkheden die horen bij het beroep.
   4. aantoonbaar reflecteert ten behoeve van persoonlijke en professionele ontwikkeling. Dat wil zeggen dat de afgestudeerde Leraar VHO:
      a. in staat is kritisch te reflecteren op alle aspecten die met zijn/haar persoonlijkheid, motivatie, attitudes, verwachtingen en cognities te maken hebben (die onder meer tot uiting komen in het pedagogisch handelen) en feedback hieromtrent ter harte te nemen
      b. op onderzoeksmatige wijze de (eigen) onderwijspraktijk verbetert en blijft ontwikkelen;
      c. in staat is (vak)kennis en -kunde actueel te houden;

d. in staat is een eigen positie te bepalen ten aanzien van de missie en visie van de school/instelling en bereid is een constructieve bijdrage te leveren aan de ontwikkeling van het vak/het onderwijs in de school.

5. aantoonbaar samenwerkt en communiceert met collega's en omgeving. Dat wil zeggen dat de afgestudeerde Leraar VHO:
    a. het pedagogisch handelen kan afstemmen met collega's en met anderen die voor de ontwikkeling van de leerling verantwoordelijk zijn;
    b. de ontwikkeling van het vak/curriculum in de school kan afstemmen met collega's en met anderen die voor de ontwikkeling van de leerling verantwoordelijk zijn.

2. Onverminderd het bepaalde in lid 1 heeft de afgestudeerde van afstudeerrichting Biologie een gedegen vakinhoudelijke kennis van en inzicht in het vakgebied en de vakdidactiek van Biologie en kan op basis daarvan aantrekkelijke, effectieve en efficiënte leeractiviteiten ontwerpen, uitvoeren, begeleiden en evalueren voor het schoolvak Biologie in de onderbouw en/of bovenbouw.
3. Onverminderd het bepaalde in lid 1 heeft de afgestudeerde van afstudeerrichting Natuurkunde een gedegen vakinhoudelijke kennis van en inzicht in het vakgebied en de vakdidactiek van Natuurkunde en kan op basis daarvan aantrekkelijke, effectieve en efficiënte leeractiviteiten ontwerpen, uitvoeren, begeleiden en evalueren voor het schoolvak Natuurkunde in de onderbouw en/of bovenbouw.
4. Onverminderd het bepaalde in lid 1 heeft de afgestudeerde van afstudeerrichting Scheikunde een gedegen vakinhoudelijke kennis van en inzicht in het vakgebied en de vakdidactiek van Scheikunde en kan op basis daarvan aantrekkelijke, effectieve en efficiënte leeractiviteiten ontwerpen, uitvoeren, begeleiden en evalueren voor het schoolvak Scheikunde in de onderbouw en/of bovenbouw.
5. Onverminderd het bepaalde in lid 1 heeft de afgestudeerde van afstudeerrichting Wiskunde een gedegen vakinhoudelijke kennis van en inzicht in het vakgebied en de vakdidactiek van Wiskunde en kan op basis daarvan aantrekkelijke, effectieve en efficiënte leeractiviteiten ontwerpen, uitvoeren, begeleiden en evalueren voor het schoolvak Wiskunde in de onderbouw en/of bovenbouw.
6. Onverminderd het bepaalde in lid 1 heeft de afgestudeerde van afstudeerrichting Aardrijkskunde een gedegen vakinhoudelijke kennis van en inzicht in het vakgebied en de vakdidactiek van Aardrijkskunde en kan op basis daarvan aantrekkelijke, effectieve en efficiënte leeractiviteiten ontwerpen, uitvoeren, begeleiden en evalueren voor het schoolvak Aardrijkskunde in de onderbouw en/of bovenbouw.

D. Final attainment levels of the minor Science & Sustainability

After conclusion of the Minor *Science for Sustainability*, students:

- Are aware of the interdependence of the global natural system, the social system and the human system as well as of the importance of the coherence that is required between them to produce effective, science-based sustainable solutions.
- Have developed a view on complex sustainability issues while maintaining a clear focus on one specific disciplinary domain, in which they develop further scientific knowledge and expertise.
- Have learned how sustainable solutions can be realized via system innovations and transition management.
- Have become acquainted with an interdisciplinary approach in developing sustainable, science-based solutions for urgent societal challenges, including the economic and policy aspects related to these issues.
- Have learnt to work collaboratively in an interdisciplinary student project.

E. Learning objectives of the minor Tesla

By completing the Tesla Minor the graduate is fit to start a career in demanding environments which require abilities to utilize the disciplinary science background in research, corporate, civil society, governmental and advisory work environments.
All learning objectives fall into at least one of the following categories:

1. Information processing;
2. Teamwork;
3. Project Work;
4. Communication;
5. Self-reflection.

Further information about the minor Tesla can be found in the study guide: http://www.teslaminor.nl .

F. Final attainment levels of the minor Educatie

De bekwaamheidseisen Leraar Voorbereidend Hoger Onderwijs zijn, naast de voor alle wo-bacheloropleidingen geldende Dublin-descriptoren en algemene wettelijke eisen, richtinggevend voor de doelstellingen en eindtermen van de minor Educatie en Educatieve module. Deze bekwaamheidseisen zijn vastgelegd in de Wet op het voortgezet onderwijs (artikel 36 e.v.) en het Besluit bekwaamheidseisen onderwijspersoneel (zie 'Besluit bekwaamheidseisen onderwijspersoneel' (http://wetten.overheid.nl/BWBR0018692/2017-08-01) en 'Besluit van 16 maart 2017 tot wijziging van het Besluit bekwaamheidseisen onderwijspersoneel en het Besluit bekwaamheidseisen onderwijspersoneel BES in verband met de herijking van de bekwaamheidseisen voor leraren en docenten' (https://zoek.officielebekendmakingen.nl/stb-2017-148.html)). De eindtermen zijn toegespitst op de onderwijssector waarvoor de minor Educatie of Educatieve module opleidt en waarop de bevoegdheid die er sinds 2009 aan verbonden is betrekking heeft: de theoretische leerweg in het vmbo en de eerste drie klassen van havo en vwo.

De eindtermen zijn geordend in twee categorieën:

- Eindtermen die rechtstreeks te maken hebben met de kern van het beroep: het onderwijsleerproces en het leren van leerlingen, te weten de vakinhoudelijke, vakdidactische en pedagogische bekwaamheid (eindterm 1 t/m 3).
- Eindtermen die betrekking hebben op meer algemene aspecten van professioneel handelen ten dienste van die kern van het beroep: te weten samenwerking met collega's en de omgeving van de school en met reflectie en persoonlijke en professionele ontwikkeling (eindterm 4 t/m 5).

De opleiding draagt er zorg voor dat de afgestudeerde Leraar VHO met een beperkte tweedegraads bevoegdheid in ieder geval:

1. aantoonbaar beschikt over vakinhoudelijke kennis en vaardigheden die verondersteld mogen worden op wo-bachelorniveau. Dat wil zeggen dat de afgestudeerde leraar met de beperkte tweedegraads bevoegdheid:
    a. de inhoud van het schoolvak in de onderbouw beheerst

   b. daardoor de leerstof, voor het schooltype waarin de leraar werkzaam is, zo kan samenstellen, kiezen of bewerken dat de leerlingen die kunnen leren;
   c. vanuit vakinhoudelijke expertise verbanden kan leggen met het dagelijks leven, en het onderwijs betekenisvol kan maken voor de leerlingen;
   d. daarmee kan bijdragen aan de algemene vorming van de leerlingen.
2. aantoonbaar beschikt over vakdidactische kennis en vaardigheden. Dat wil zeggen dat de afgestudeerde Leraar VHO met een beperkte tweedegraads bevoegdheid:
   a. de vakinhoud weet te vertalen in lessenreeksen en dat doet op een ontwikkelingsgerichte werkwijze;
   b. de vakinhoud leerbaar maakt voor de leerlingen, daarbij doelmatig gebruikmakend van (digitale) beschikbare leermiddelen;
   c. het onderwijs kan ontwikkelen en evalueren;
   d. het onderwijs doelmatig kan uitvoeren ;
   e. de vak inhoud/didactiek afstemt met collega's.
3. aantoonbaar beschikt over pedagogische kennis en vaardigheden. Dat wil zeggen dat de afgestudeerde Leraar VHO met een beperkte tweedegraads bevoegdheid:
   a. het handelen af kan stemmen op de leerlingen;
   b. zicht heeft op de sociaal-emotionele en morele ontwikkeling van de leerlingen;
   c. bijdraagt aan burgerschapsvorming
   d. in samenwerking met collega's een veilig, ondersteunend en stimulerend leerklimaat voor leerlingen kan realiseren;
4. aantoonbaar reflecteert ten behoeve van persoonlijke en professionele ontwikkeling. Dat wil zeggen dat de afgestudeerde Leraar VHO met een beperkte tweedegraads bevoegdheid:
   a. in staat is kritisch te reflecteren op alle aspecten die met zijn/haar persoonlijkheid, motivatie, attitudes, verwachtingen en cognities te maken hebben (die onder meer tot uiting komen in het pedagogisch handelen) en feedback hieromtrent ter harte te nemen
   b. de (eigen) onderwijspraktijk verbetert en blijft ontwikkelen;
   c. (vak)kennis en -kunde actueel kan houden;
5. aantoonbaar samenwerkt en communiceert met collega's en omgeving. Dat wil zeggen dat de afgestudeerde Leraar VHO met een beperkte tweedegraads bevoegdheid:
   a. het pedagogisch handelen kan bespreken met collega's en met anderen die voor de ontwikkeling van de leerling verantwoordelijk zijn;
   b. de ontwikkeling van het vak/curriculum in de school kan bespreken met collega's en met anderen die voor de ontwikkeling van de leerling verantwoordelijk zijn.

Appendix 2. Description of the content and study load of the components

Format: L: lectures and/or tutorials; PR: presentation.; Lit: literature study; PROJ: Project

Assessment: E: written and/or oral exam; P: presentation; R: report						
Course	**code UvA**	**code VU**	**EC**	**period**	**Format**	**Ass.**
Restricted-choice elective courses						
Additive Combinatorics	5334ADCO8Y		8	4, 5	L	E
Advanced Algebraic Geometry:			8	1, 2	L	E
Advanced Combinatorics: zeros of graph polynomials, Markov chains and algorithms			6	1,2		
Advanced Linear Programming	53348ALP6Y		6	4, 5	L	E
Advanced Machine Learning	53348ADM6Y	VU	6	1, 2	L	E
Advanced Topics in Stochastic Analysis	5334ATIS6Y		6	1, 2	L	E
Algebraic Geometry 1	53341ALG8Y		8	1, 2	L	E
Algebraic Geometry 2	53342ALG8Y		8	4, 5	L	E
Algebraic Number Theory	53348ANT8Y		8	1, 2	L	E
Algebraic Topology 1			8	1, 2	L	E
Algebraic Topology 2	53342ALT8Y		8	4, 5	L	E
Applied Finite Elements	53348AFE6Y		6	4, 5	L	E
Applied Stochastic Modelling	53348APS6Y	VU	6	1, 2	L	E
Asymptotic Statistics	5374ASST8Y		8	1, 2	L	E
Blowing Ups and Deformations: an Introduction to the Theory of Singularities			6	4,5		
Calculus of Variations			8	4,5		
Category Theory and Topos Theory			8	1,2		
Coding and Cryptography	53348CCR6Y	VU	6	4, 5	L	E
Commutative Algebra	53348COA8Y		8	1, 2	L	E
Complex dynamical systems			6	4,5	L	
Complex Networks	5374CONE8Y		8	4,5		
Computational Complexity	5314COCO6Y		6	4	L	E
Continuous Optimization	53348COP6Y		6	1, 2	L	E
Cryptology	5334CRYP5Y		5	1, 2	L	E

Data-driven Decision Making in Operations Research	5334DDDM6Y		6	4, 5	L	E
Differential Geometry	53348DIG8Y		8	1, 2	L	E
Diophantine Approximation			8	1,2		
Discrete Optimization	53348DOP6Y		6	1,2		
Dynamical Systems	53348DYS8Y		8	1, 2	L	E
Elliptic Curves	53348ELC8Y		8	4, 5	L	E
Forensic Probability and Statistics	5334FOPS8Y		8	1, 2	L	E
Functional Analysis	53348FUA8Y		8	1, 2	L	E
Interest Rate Models	5374INRM6Y		6	1, 2	L	E
Introduction to Numerical Bifurcation Analysis of ODEs and Maps			8	4,5		
Inverse Problems in Imaging			6	4,5		
Lie Algebras			8	4,5		
Lie Groups			8	1,2		
Machine Learning Theory	5334MALT8Y		8	1, 2	L	E
Mathematical Biology	53348MAB8Y		8	1,2		
Mathematical Optimisation		VU	6	2		
Measure Theoretic Probability	5374METP8Y		8	1, 2	L	E
Model Theory	5314MOTH8Y		8	4, 5	L	E
Modular Forms	5334MOFO8Y		8	4,5		
Nonparametric statistics			6	4,5		
Numerical Linear Algebra	53348NLA8Y		8	1, 2	L	E
Numerical Methods for Stationary PDEs			6	1,2	L	E
Operator Algebras	53348OPA8Y		8	4, 5	L	E
Optimisation of Business Processes	53348OPB6Y	VU	6	4, 5	L	E
Parallel Algorithms	53348PAA8Y		8	1, 2	L	E
Partial Differential Equations	53348PAD8Y		8	1, 2	L	E
Percolation: from Introduction to Frontiers of Current Research	5334PITF8Y		8	4,5		
Poisson Geometry	5334POGE8Y		8	1,2		
Portfolio Theory	5374POTS6Y		6	1, 2	L	E
Probabilistic and Extremal Combinatorics	53348PRE8Y		8	1, 2	L	E

Quantum Computing	5334QUCO8Y		8	4, 5	L	E
Quantum in Business and Society	5354QIBS3Y		3	6		
Quantum Field Theory	5354QUFT6Y		6	2		
Quantum Information Theory	5334QUIT8Y		8	4, 5	L	E
Queueing Theory	53748QUT6Y		6	4, 5	L	E
Queues and Levy Fluctuation Theory	5334QLFT6Y		6	4, 5	L	E
Quivers	5334QUIV6Y		6	1, 2	L	E
Random Walks			8	1,2		
Reading course			3	1-6	PR, Lit	E, P
Reading course Mathematics	5334RECM6Y		6	1-6	PR, Lit	E, P
Riemann Surfaces	53348RIS8Y		8	4, 5	L	E
Scheduling	53748SCH6Y		6	4, 5	L	E
Selected Areas in Cryptology	5334SAIC8Y		8	4, 5	L	E
Semidefinite Optimization	53348SEO8Y		8	4,5		
Seminar Algebra		VU	6	4,5		
Set Theory	53348SET8Y		8	1, 2	L	E
Simulation Methods in Statistics	5374SIMS6Y		6	1, 2	L	E
Statistical Models	53348STM6Y	VU	6	1, 2	L	E
Statistical Physics and Condensed Matter Theory I	53541SPC6Y		6	1		
Statistics for life sciences		VU	6	4,5		
Statistical Theory for High-and Infinite-Dimensional Systems		VU	6	4,5		
Statistics for Stochastic Processes			8	4,5		
Stochastic Integration	5374STIN8Y		8	4, 5	L	E
Stochastic Networks	5334STNE6Y		6	1, 2	L	E
Stochastic Optimization	53748SOP6Y	VU	6	1,2	L	E
Stochastic Processes	53748STP8Y		8	4, 5	L	E
Stochastic Processes for Finance	53748SPF6Y	VU	6	1, 2	L	E
Stochastic Simulation	5334STSI6Y		6	1, 2	L	E
String Theory	5354STTH6Y		6	5		
Symplectic Geometry	53248SYG8Y		8	4, 5	L	E

Systems and Control	53348SYC6Y		6	1, 2	L	E
Topological Data Analysis			8	4,5		
Topology in Physics	5354TOIP6Y		6	4, 5	L	E
Topology of algebraic varieties			6	4,5		
Topos Theory	5334TOTH8Y		8	4,5	L	E
Uncertainty Quantification and Data Assimilation	5334UQDA6Y		6	1, 2	L	E
Master Seminar (6EC required)						
Master Seminar in Algebra, Geometry and Mathematical Physics	5334MSIA6Y		6	1, 2, 4, 5	L, PR	P
Master Seminar in Analysis and Dynamical Systems	5334MSIA6Y		6	1, 2, 4, 5	L, PR	P
Master Seminar in Stochastics	5334MSIS6Y		6	1, 2, 4, 5	L, PR	P
Master Project (36 EC required; 24 EC in case of major or minor)						
Master Project Mathematics	5334MPM36Y		24-36	1-6	PROJ	R
Master Project Mathematics and Theoretical Physics (double master programme)	5334MPM72Y		72	1-6	PROJ	R
Master Project Econometrics and Mathematics (double master programme)			36	1-6	PROJ	R

Course components of the Major Science in Society

Master's graduate with a specialization Science in Society combines an academic approach with the skills and competences that will allow him or her to perform scientific research at the interface of the biomedical sciences and society. The specialization aims to develop strategies that contribute to an understanding of complex societal problems and strategies to solve complex societal problems through interdisciplinary research. In addition, the programme analyses the social, economic and ethical aspects of new developments in the biomedical sciences, so as to assess their implications for society. Master's graduates have the necessary skills to collaborate and communicate with researchers from various scientific disciplines (including but not limited to those in the life sciences) and societal actors, and the ability to use these academic insights.

More information of the majors and minors can be found on:

https://student.uva.nl/math/shared/studentensites/fnwi/ew-gedeelde-content/en/az/majors-and minors/majors-and-minors.html?origin=nzksw95RSfC%2BUP7U7NCF5w

Course components of the Major Science Communication

Communication about science takes place between academic peers and between scientists and the general public. This makes the Communication specialization a complex and dynamic field of research and practice, for example on patient participation in health research, the use and effects of media metaphors and hype, and public understanding of emergent technologies. The Master's gradu-

ate with this specialization has a theoretical understanding of the complex problems that arise during such communication processes and has developed the necessary skills to act professionally at this interface to enhance communication and the outcomes of communication between scientific actors and society.

More information of the majors and minors can be found on:

https://student.uva.nl/math/shared/studentensites/fnwi/ew-gedeelde-content/en/az/majors-and-minors/majors-and-minors.html?origin=nzksw95RSfC%2BUP7U7NCF5w

Course components of the Major Teaching

Courses are taught in Dutch.

Met de opleiding wordt beoogd studenten op te leiden tot Leraar Voorbereidend Hoger Onderwijs. De opleiding combineert het ambachtelijke met het academische: studenten ontwikkelen een stevige kennisbasis en een onderzoekende houding in het vak en beroep, en staan tegelijkertijd met twee benen in de praktijk waar ze het 'ambacht' leren. Studenten worden opgeleid tot teamwerkers die initiatief nemen en draagvlak zoeken, en die zichzelf én een rolmodel voor leerlingen durven te zijn. Zij zijn gericht op innovatie en dragen actief bij aan het creëren van nieuwe kennis en aan schoolvak- en onderwijsontwikkeling.

More information of the majors and minors can be found on:

https://student.uva.nl/math/shared/studentensites/fnwi/ew-gedeelde-content/en/az/majors-and-minors/majors-and-minors.html?origin=nzksw95RSfC%2BUP7U7NCF5w