Methodology and Statistics for the Behavioural, Biomedical, and Social Sciences

Faculty of Social and Behavioural Sciences
Utrecht University

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This report was finalized on May 25, 2016

Report on the research master's programme Methodology and Statistics for the Behavioural, Biomedical, and Social Sciences of Utrecht University

This report takes the NVAO *Assessment framework for limited programme assessments* (19 December 2014) and the NVAO *Guidelines for assessment of research master's programmes* (23 April 2015) as starting points.

Administrative data regarding the programme

Master's programme Methodology and Statistics for the Behavioural, Biomedical, and Social Sciences

Name of the programme:	Methodology and Statistics for the Behavioural, Biomedical, and Social Sciences
CROHO number:	60384
Level of the programme:	research master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	not applicable
Location:	Utrecht
Mode of study:	full time
Language of instruction:	English
Expiration of accreditation:	April 11, 2017

The visit of the assessment panel Methodology and Statistics for the Behavioural, Biomedical, and Social Sciences to the Faculty of Social and Behavioural Sciences of Utrecht University took place on March 15-16, 2106.

Administrative data regarding the institution

Name of the institution:	Utrecht University
Status of the institution:	publicly funded institution
Result institutional quality assurance assessment:	positive

Composition of the assessment panel

The NVAO has approved the composition of the panel on February 29, 2016. The panel that assessed the master's programme Methodology and Statistics for the Behavioural, Biomedical, and Social Sciences consisted of:

- Prof. Gerard van Breukelen (chair), professor in Methodology & Statistics, Maastricht University
- Prof. Francis Tuerlinckx, professor of Quantitative Psychology and Individual Differences, KU Leuven (Belgium)

- Prof. Jelle Goeman, professor in Biostatistics, Leiden University Medical Centre
- Associate prof. Nikos Tzavidis, associate professor in Social Statistics, University of Southampton (UK)
- Elise Crompvoets, BSc, research master student Social and Behavioural Sciences, Tilburg University

The panel was supported by drs. L.C. te Marvelde, who acted as secretary.

Appendix 1 contains the curricula vitae of the panel members.

Working method of the assessment panel

Preparation
In preparation of the site visit, the secretary first checked the quality and completeness of the critical reflection prepared by the programme. After establishing that the report met the demands, it was forwarded to the participating panel members. The panel members read the report and formulated questions and findings on its contents.

The panel also read sixteen theses. The theses were selected by the chair of the panel from a list of graduates who graduated in the last two completed academic years. The panel chair ensured that the selection was more or less proportional to the distribution of marks in the entire list of graduates. In addition, the sampling is composed such that different supervisors and thesis subjects were represented.

Site visit
A preliminary programme of the site visit was made by the panel secretary and finalised after consultation with the representatives of the programme at Utrecht University. The time table for the site visit in Utrecht is included as Appendix 5.

Prior to the site visit, the panel asked the programme to select representative interview partners. During the site visit, meetings were held with panels representing students and teaching staff, programme management, alumni, the Programme Advisory Committee/Educational Committee and the Board of Examiners.

During the site visit, the panel examined material it had requested; an overview of this material is given in Appendix 6. The panel provided students and lecturers with the opportunity – outside the set interviews – to speak informally to the panel during a consultation hour. No requests were received for this option.

The panel used the final part of the visit for an internal meeting to discuss its findings. The visit was concluded with a public oral presentation of the preliminary impressions and general observations by the chair of the panel.

Report
Based on the panel's findings, the secretary prepared a draft report. This report was then presented to the panel members involved in the site visit. After implementing their comments and receiving approval, the draft report was sent to Utrecht University with the request to report any factual inaccuracies. Utrecht University reported no factual inaccuracies. Subsequently, the final report was approved and sent to Utrecht University.

Decision rules
In accordance with the NVAO's Assessment framework for limited programme assessments, the panel used the following definitions for the assessment of both the standards and the programme as a whole.

Generic quality
The quality that can reasonably be expected in an international perspective from a higher education bachelor's or master's programme.

Unsatisfactory
The programme does not meet the current generic quality standards and shows serious shortcomings in several areas.

Satisfactory
The programme meets the current generic quality standards and shows an acceptable level across its entire spectrum.

Good
The programme systematically surpasses the current generic quality standard.

Excellent
The programme systematically well surpasses the current generic quality standard and is regarded as an international example.

Summary judgement

The research master's programme in Methodology and Statistics for the Behavioural, Biomedical and Social Sciences (MSBBSS) is offered by the Faculty of Social and Behavioural Sciences (FSBS) of Utrecht University (UU). The programme is executed by Utrecht University (department of Methodology and Statistics of FSBS, department of Biostatistics of the University Medical Centre Utrecht) in collaboration with the University of Twente (department of Research Methodology, Measurement Methods and Data Analysis of the Faculty Behavioural, Management and Social Sciences).

The research master's programme MSBBSS has positioned itself within its disciplinary domain by choosing an explicit focus on applied statistics rather than on more mathematical statistics. The broad perspective on (applied) methodology and statistics that is established by the commitment of the three contributing departments offers a rich research environment.

The research master's programme MSBBSS is primarily designed to prepare students for entry to a PhD programme. However, the programme also provides training for students who wish to pursue their professional career as a researcher outside of academia.

The programme subscribes to general aims that apply to all research master's programmes at the FSBS in addition to its programme specific aims. MSBBSS graduates are explicitly able to apply methodological and statistical approaches in cooperation with behavioural, biomedical, and social scientists. They are also able to evaluate methodological and statistical approaches that are regularly used in behavioural, biomedical, and social scientific research, and they are able to develop methodological and statistical approaches that are required by new developments in behavioural, biomedical, and social scientific research. In addition, MSBBSS graduates have a strong foundation in the state of the art methodology and statistics of the behavioural, biomedical, and social sciences as the basis for growth throughout the professional career.

MSBBSS is a full-time two-year programme that comprises 120 EC. The content of the programme is closely connected to the research that is executed by the three participating departments of Utrecht University and the University of Twente, which is visible in the content of the curriculum and the possible locations to execute traineeships and theses. The panel has studied the curriuclum and finds that all elements of the programme are good and assist the students in acquiring the intended learning outcomes. The different curriculum elements provide students with a profound basis in applied statistics with a solid theoretical background in their field of specialization. Students are thus enabled to become very capable in the inventive applications of methods.

The panel finds that the coherence of the curriculum could benefit from systematic reflection on alternative ways in which to structure the programme. The first year offers students a broad basis in methodology and statistics. Elements of certain methodological and statistical subjects are scattered throughout this year and reoccur in several courses, such as missing data, statistical modelling, categorical data, and generalised linear modelling frameworks. The panel asks the programme to consider the possible unwanted effects of this scattering and to make sure that the students are enabled to interconnect the elements in order to grasp the full landscape of these important subjects. In addition, the panel asks the programme to remain focused on the sequencing of scattered elements in different courses and to make sure that students experience a logical build up of their knowledge and skills.

The second year is mainly dedicated to the in-depth exploration of a contemporary research topic leading to the thesis. Students develop their own profile by choosing their thesis topic and one elective course, which results in a so-called track. MSBBSS offers a free track and four pre-designed tracks that reflect the expertise of the participating research groups: survey track, educational measurement track, biomedical track, and EMOS track (official statistics). The panel finds that the balance of the curriculum in the second year is somewhat asymmetric since the focus on the thesis (*Research Seminar I (7.5 EC)*, *Preparation for the Thesis (15 EC)*, *Research Seminar II (7.5 EC)*, *Master's Thesis (22.5 EC)*) leads to sparsity in training and acquisition of new substantive knowledge. The panel sees opportunities for the programme to offer training in topics that could be useful for the students in their thesis process, such as missing data, optimization methods, and designing simulation studies.

The programme recruits and selects students with bachelor's degrees in a variety of disciplines which results in a heterogeneous inflow. Furthermore, the limited mathematical training of students in their bachelor's programmes, and the collaboration between three departments at two universities are challenging factors in designing and executing the programme. Due to the resilience of its staff members, the programme is able to cope with these challenges.

Staff members are all high quality, active researchers and are members of very good to excellent research groups. Based on the reputation and recent track record of the teaching staff and the fact that students perform their final projects at universities and research institutes with a strong reputation, the panel concludes that students are educated within a very good to excellent research environment. The staff-student ratio is favourably low which enables students to have considerable interaction with each other and with lecturers.

The Education Committee (EC) advises the Board of Studies at the level of the graduate school of FSBS. Since 2015 each research master's programme in the graduate school has a Programme Advisory Committee (PAC) that plays a crucial role in the quality assurance of an individual programme. The close relationship of the MSBBSS PAC to the programme on the one hand and the Education Committee on the other contributes to a culture of quality in which problems are quickly and efficiently addressed.

The Board of Examiners (BoE) operates at a faculty level, which creates a distance from the programme. However, MSBBSS has its own assessment committee, which is closely involved with the programme. The panel finds that the programme and the BoE have installed adequate measures to monitor assessment quality. The consistent implementation and execution of assessment guidelines and regulations could benefit from more attention since teaching staff work autonomously in the development and grading of assessments. The BoE and its assessment committee could adopt a more proactive approach to guard the assessment processes. The small scale of the programme and informal contacts between students and staff ensure that any problems regarding assessments are adequately and quickly resolved.

The panel has established that the programme uses diverse assessment methods that are aligned with the learning objectives of each course unit. Safeguarding the quality of final research projects gets sufficient attention from examiners. The panel urges the programme to make sure that there is a strict separation between the roles of the thesis supervisor and co-author of the subsequent publication after graduation. Any impression that a supervisor of a thesis is a co-author of the thesis should be avoided.

After studying multiple theses and the accompanying research archives, the panel finds that students realize the intended learning outcomes of the research master's programme in Methodology and Statistics for the Behavioural, Biomedical and Social Sciences. The achieved level in the theses is generally high; students demonstrate good research qualities in their work. According to the panel, this high quality of the reports and the fact that they often lead to publication in international peer reviewed journals demonstrate the success of the research orientation of the programme.

Based on the performance of alumni the panel concludes that the programme prepares students well for a research career in and outside of academia. The majority of graduates obtain a PhD position. The panel concludes that the programme succeeds in its ambition to prepare students for a strong career in methodology and statistics.

The panel assesses the standards from the *Assessment framework for limited programme assessments* in the following way:

Standard 1: Intended learning outcomes	satisfactory
Standard 2: Teaching-learning environment	good
Standard 3: Assessment	satisfactory
Standard 4: Achieved learning outcomes	good
General conclusion	good

The chair and the secretary of the panel hereby declare that all panel members have studied this report and that they agree with the judgements laid down in the report. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: May 25, 2016

Prof. Gerard van Breukelen
chair

drs. Linda te Marvelde
secretary

Description of the standards from the Assessment framework for limited programme assessments

The research master's programme in Methodology and Statistics for the Behavioural, Biomedical and Social Sciences (MSBBSS) is offered by the Faculty of Social and Behavioural Sciences (FSBS) of Utrecht University (UU). FSBS established a Graduate School of Social and Behavioural Sciences in 2002, which is chaired by the vice-dean who is assisted by the Board of Studies. The Board of Studies comprises the coordinators of FSBS' seven NVAO accredited research master's programmes.

All FSBS' research master's programmes are taught in English, cover two academic years (120 EC), and lead to an MSc degree. The research master's programmes reflect the themes of the most qualified research programmes of the Faculty of Social and Behavioural Sciences and are directly linked to Research Schools (*onderzoeksscholen*) that are (re)accredited by the Royal Netherlands Academy of Arts and Sciences (KNAW), or to national Research Networks (*onderzoeksnetwerken*) in which researchers from the Faculty of Social and Behavioural Sciences cooperate with colleagues from other Dutch universities. The research master's programme MSBBSS is directly linked to the Interuniversity Graduate School of Psychometrics and Sociometrics (IOPS). The research programmes connected to the Graduate School's research masters and PhD programmes are embedded in the Research Institute of Social and Behavioural Sciences and are monitored by a Board of Research that steers the Research Institute.

Utrecht University is the official owner of the MSBBSS programme, but the programme is executed by Utrecht University (department of Methodology and Statistics of FSBS, department of Biostatistics of the University Medical Centre Utrecht) in collaboration with the University of Twente (department of Research Methodology, Measurement Methods and Data Analysis of the Faculty Behavioural, Management and Social Sciences). As a result, students are always enrolled at Utrecht University but are either based in Utrecht or Twente. The collaboration is highly valued by staff and students. The programme has expressed an intention to further formalise the collaboration by creating a joint degree programme based on the current partnership. Changing the legal status of the programme would benefit students and staff at both locations. The programme has invited the panel to consider the strengths and weaknesses of the existing collaboration and the desired change in legal status (i.e. joint degree).

Standard 1: Intended learning outcomes
The intended learning outcomes of the programme have been concretised with regard to content, level and orientation; they meet international requirements.

Explanation:
As for level and orientation (bachelor's or master's; professional or academic), the intended learning outcomes fit into the Dutch qualifications framework. In addition, they tie in with the international perspective of the requirements currently set by the professional field and the discipline with regard to the contents of the programme. Insofar as is applicable, the intended learning outcomes are in accordance with relevant legislation and regulations.

Findings
The Graduate School of Social and Behavioural Sciences has formulated general aims that apply to all its research masters programmes in addition to programme specific aims for each individual programme. All research master's programmes are primarily designed to prepare

students for entry to a PhD programme. However, the programmes also provide training for students who wish to pursue their professional career as a researcher outside of academia.

According to the critical reflection, graduates of a research master's programme have acquired an overview of important theoretical and methodological issues in their field of study. They have expertise and experience in the elaboration of a research project with a clearly formulated research problem that is innovative while building on the state of the art in the field and being well grounded in the literature in this field. Graduates have an understanding of different research designs and methods of data collection, have acquired the expertise and experience in the elaboration of research designs and methods of data collection that are adequate for answering an underlying research question, and they are capable of choosing and applying them in their research. Graduates are able to choose and apply appropriate statistical models. They have expertise and experience in the integration of theory and (quantitative and/or qualitative) empirical research ("theory-guided empirical research") and they have gained experience in the full process of social or behavioural research and in reporting the results of research in a specific field of study.

Graduates of research master's programmes are also trained in academic writing and in presenting for various audiences. They meet the requirements of academic integrity relating to the practice of research, including collecting, storing, processing, and analysing data, leading to a publication. They will have acquired a general work orientation that is required for membership in a research team and in a research network in their own research domain.

In addition to the main aims that apply to all research master's programmes, MSBBSS specifically states that graduates:

- are able to apply methodological and statistical approaches in cooperation with behavioural, biomedical, and social scientists,
- are able to evaluate methodological and statistical approaches that are regularly used in behavioural, biomedical, and social scientific research,
- are able to develop methodological and statistical approaches that are required by new developments in behavioural, biomedical, and social scientific research,
- will have acquired a strong foundation in the state of the art methodology and statistics of the behavioural, biomedical, and social sciences as the basis for growth throughout the professional career.

MSBBSS has formulated 12 programme-specific intended learning outcomes ('qualifications') that are further specified in 34 academic objectives (appendix 3).

The programme has made a comparison with other (two-year) research master's programmes in the Netherlands, Belgium, Denmark and Switzerland. On a dimension ranging from mathematical statistics to applied statistics, the master's programme in Utrecht focuses explicitly on applied statistics, whereas the other programmes are slightly more focused on mathematical statistics. The Netherlands only offers two research master's programmes in the field of methodology and statistics. There are, however, regular (one-year) master's programmes in methodology and statistics and research master's programmes in behavioural and social sciences that offer tracks in methodology and statistics. According to the critical reflection, the programme in Utrecht distinguishes itself from these by offering a more comprehensive, thorough and focussed programme in methodology and statistics.

Considerations

The panel established that the intended learning outcomes (qualifications) and objectives of the research master's programme MSBBSS clearly demonstrate the scientific orientation and master's level of the programme. The learning outcomes describe all aspects of functioning as independent researchers. The panel has observed that the programme has positioned itself within its disciplinary domain. The broad perspective on (applied) methodology and statistics that is established by the commitment of three contributing departments offers a rich research environment. According to the panel, the profile and the ambitions to deliver researchers are adequately expressed in the intended learning outcomes. The panel concludes that the learning outcomes are fitting and generally accepted.

Conclusion

Master's programme Methodology and Statistics for the Behavioural, Biomedical, and Social Sciences: the panel assesses Standard 1 as 'satisfactory'.

Standard 2: Teaching-learning environment

The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

Explanation:

The contents and structure of the curriculum enable the students admitted to achieve the intended learning outcomes. The quality of the staff and of the programme-specific services and facilities is essential to that end. Curriculum, staff, services and facilities constitute a coherent teaching-learning environment for the students.

Findings

The panel has studied the curriculum of the research master's programme MSBBSS. The panel has read course materials, reports of relevant committees and (study) information on the digital learning environment Blackboard. This standard starts with the findings concerning the content and structure of the curriculum. Next, a short description of the teaching methods of the programme is presented. Special attention is given to the academic context in which students function. Finally, some findings on the feasibility, staff, quality assurance and facilities of the programmes are described.

Programme

MSBBSS is a two-year programme that comprises 120 EC. Appendix 4 shows a schematic overview of the curriculum.

The content of the programme is closely connected to the research that is executed by the three participating departments of Utrecht University and the University of Twente, which is visible in the content of the curriculum and the possible locations to execute traineeships and theses. The main research themes of the Utrecht Department of Methods and Statistics (MS) are Bayesian statistics, official statistics, survey research, randomized response and population size estimation, multilevel and multivariate analyses. The main research themes of the Utrecht Department of Biostatistics (BS) are clinical trials, interim and meta analysis, survival analysis, prediction and high dimensional data. The main research themes of the Twente Department of Research Methodology, Measurement Methods and Data Analysis (OMD) are measurement models, test design, Bayesian psychometric methods and computerized assessment.

The first year of the programme offers a broad basis in methodology and statistics with courses in *Advanced survey methodology, Multivariate statistics, Fundamentals of statistics,* and

Computational inference with R in the first semester. In the second semester students follow *Psychometrics, Introduction to multilevel and structural equation modelling, Bayesian statistics,* and *Clinical research designs.* All courses run in parallel for the full length of a semester and have been specifically and exclusively developed for the MSBBSS programme. PhD students from Utrecht and Twente may be eligible to participate in the courses if circumstances allow it.
First year courses provide a broad basis, among other by addressing both observational and experimental research. Students are provided with a theoretical basis in mathematical and Bayesian statistics. Statistical programming in the R package is implemented throughout the first year in several courses. Students learn to understand, compare, and criticise the frequentist and Bayesian approaches to statistics. Furthermore, students encounter and apply multivariate statistics, psychometric modelling, clinical research designs, multilevel modelling, and structural equation modelling. Throughout the first year four components are continuously addressed: methodological/statistical theory, putting the theory to work (e.g., designing an experiment or writing an R programme), applications of existing software (e.g., Mplus) for the analysis of empirical data from the behavioural, biomedical, and social sciences, and critical reflections on what is done. The programme uses several different teaching methods, from lectures to problem-solving computer practicals. The panel finds that the course manual does not do justice to the interactive nature of the actual teaching methods by suggesting that some courses mainly consists of lectures, and advises the programme to reconsider the manner in which this information is presented.

As a result of the collaboration between Utrecht and Twente, first-year students who are based in Twente travel to Utrecht twice every three weeks. Students based in Utrecht travel to Twente once every three weeks. In the second year travel between locations will occur approximately three times per semester. When needed, a video link between Utrecht and Twente is established which allows students and lecturers to actively interact with each other. Students and staff report that this inventive, novel technology works well. The benefits of the collaboration far outweighs the practical challenges of travel and video links since the contribution of the University of Twente significantly strengthens the programme by offering Twente's internationally recognized expertise on psychometrics.

The second year is mainly dedicated to the in-depth exploration of a contemporary research topic by means of the courses *Preparation for the thesis* (15 EC), *Research seminar I & II* (7,5 EC each) and the *master's thesis* (22,5 EC). The master's thesis is a scientific paper in the form of a journal article that can be submitted to an international peer reviewed journal on methodology and statistics. Students may choose their thesis topic from an existing list with options, or suggest their own. Some students become involved with their supervisor's research project.

While writing their thesis, students are coached on scientific writing and presenting, working in a group, and scientific integrity in conducting, archiving, and reporting research. Additionally, the students are trained in methodological/statistical consultation by means of advising bachelor and master students in the behavioural, biomedical, and social sciences on the methods and statistics they use in their theses, and by each contributing to a staff member's consultation session.

Students develop their own profile in the second year by choosing their thesis topic and one elective course, which results in a so-called track. MSBBSS offers a free track and four pre-designed tracks that reflect the research groups: survey track, educational measurement track, biomedical track, and EMOS track (official statistics). Appendix 4 provides an elaboration on the content of the tracks.

The panel appreciates that the tracks offer students a distinct profile. The social and behavioural statistics are broadly represented and clearly recognizable. In contrast, the panel finds that the biomedical track is rather limited. Students will only have followed one biomedical course in their first year (*clinical research design*) and one biomedical elective in the second year. Further, students who want to specialise in methodology and statistics for the behavioural sciences have to choose the free track and design their own behavioural track. The panel had expected a pre-designed behavioural track given the name of the programme. In addition, the panel finds that the choice for merely one elective (7,5 EC) is rather limited. The students that the panel spoke with concurred with this finding and expressed their desire for the option of choosing more than one elective. This would allow them to expand their knowledge on subjects for which there is currently limited time in the programme or to undertake a more extensive internship.

The panel discussed the content and coherence of the curriculum, and the added value of the collaboration between Utrecht and Twente in the content and execution of the programme. The panel's general conclusion is that the curriculum allows students to acquire the intended learning outcomes. All aspects of methodology and statistics that are to be expected are present in the curriculum. The content is of a high level and encourages inventive applications of methods. The course materials are of high quality and display a diversity in applied and mathematical statistics and methods.

The courses *Fundamentals of statistics, Bayesian statistics and Computational inference with* R are very much appreciated and are suitable for use in all tracks, as is the course *Multivariate statistics.* However, the panel finds that this latter course might benefit from more algebra and an attempt to reach a higher level in the course. Elements of certain methodological and statistical subjects are scattered throughout the first year and reoccur in several courses, such as missing data, statistical modelling, categorical data, and generalised linear modelling frameworks. The panel asks the programme to consider the possible unwanted effects of this scattering and to make sure that the students are enabled to interconnect the elements in order to grasp the full landscape of these important subjects. In addition, the panel asks the programme to remain focused on the sequencing of scattered elements in different courses and to make sure that students experience a logical build up of their knowledge and skills.

The panel finds that the balance of the curriculum in the second year is somewhat asymmetric. The focus on the thesis (*Research Seminar I (7.5 EC), Preparation for the Thesis (15 EC), Research Seminar II (7.5 EC), Master's Thesis (22.5 EC))* leads to sparsity in training and acquiring new substantive knowledge. The panel sees opportunities for the programme to offer training in topics that could be useful for the students in their thesis process, such as missing data, optimization methods, designing simulation studies etc. In order to create time for such activities, *Research Seminars I* and *II* could be condensed as there seems to be some overlap in content between the courses. Students also reported that the workload of the thesis very much depends on the chosen subject which allows some students to take on extra courses in the second year already.

Admission, study guidance and feasibility

MSBBSS aims at enrolling 20 new students per year and has a selective admission policy. Students can apply with a cv, a letter of motivation, reference letters, proof of English language proficiency and a transcript of their grades from a bachelor's degree in behavioural, biomedical, or social sciences. Excellent students with a bachelor's degree in (applied) mathematics, information sciences, and economics, are also eligible to apply for admission to the programme. The programme has an increasing number of applicants each year (60 in

2015), which is attributed to the participation of UMCU and the University of Twente in recent years. The high number of applications allows the programme to select and admit the best students.

The programme enjoys a diverse inflow from different bachelor's programmes, but the majority of students have a social sciences background. Furthermore, MSBBSS has attracted students from many different countries (USA, South Korea, Ireland, Greece, Israel, Spain, Estonia, Slovenia, Belgium, and Germany). The inflow of students from abroad is steadily increasing from approximately 15% in 2013 to approximately 30% in 2015. The heterogeneous composition of cohorts and the lack of previous elaborate mathematical training mean that the programme has to dedicate a significant part of the programme to fundamental training.

Students who enter the programme stay together as a group throughout the first year and during the research seminars in the second year. The programme actively encourages a common learning experience characterized by ample interaction and cooperation between students. The courses in the first year run parallel, which challenges students but also helps them to study in a high tempo. The panel emphasizes that this format means that many new concepts are introduced in a short space of time. In addition, the connection between the courses' elements might be difficult for students to grasp. However, courses that are considered difficult by the students, such as *Fundamentals of statistics*, do not threaten the feasibility of the programme. The small scale of the programme makes for an active and supportive learning community in which students and staff easily find each other and help each other to study and process large quantities of new information.

The panel finds that the selection process works well, evidenced by low dropout rates and the fact that most students tend to graduate within two years. The panel does have one point of care with regards to the selection process. Not many students with a biomedical background are admitted to the programme. The panel wonders if this could be due to the nature of their biomedical bachelor's degree that might not contain the 20 EC in methodology and statistics that are required for entry to the programme. The panel advises the programme to ensure that students with a biomedical background are not too easily selected out, despite options to follow a deficiency programme.

Staff and academic context
All members of the MSBBSS teaching staff are active scientists in one of the relevant research areas. Lecturers and supervisors of MS and OMD are members of the Interuniversity Research School for Psychometrics and Sociometrics (IOPS) that provides graduate training at the PhD level. Lecturers and supervisors of BS are members of the Utrecht Life Sciences Graduate School.

The three research programmes that contribute to MSBBSS were all recently assessed by international committees of senior scholars according to the guidelines of the *Standard Evaluation Protocol 2009-2015 for Public Research Organizations* (SEP). OMD is a part of the Educational Design and Evaluation programme of the University of Twente and was evaluated in the Research Assessment Pedagogics and Education Science in 2013. BS was assessed as part of the 2014 Research Assessment of the University Medical Center Utrecht. MS was evaluated in the Research Review Psychology in 2012. All programmes received scores ranging from (very) good to excellent. This reputation of the groups is endorsed by the panel.

Course coordinators and supervisors of MSBBSS are tenured faculty members at the assistant, associate and full professor level. The main supervisor of the master's thesis is always an assistant, associate, or full professor, or a senior staff member of a non-academic organisation with a PhD in the area of methodology and statistics.

Lecturers are required to have teaching and research qualifications. All MSBBSS course coordinators have at least a junior qualification in teaching and research. A third of course coordinators have both a senior qualification in teaching and in research. Another third has one of the senior qualifications. They are experienced researchers who are experienced in speaking and writing scientific English, have highly visible publication records, and have considerable experience in supervising doctoral dissertations. The research groups and their staff make for an academic environment in which students can pursue virtually any research interest they may have in the area of methodology and statistics. The contribution of Twente staff has clearly expanded the broad scope of the programme even further, which provides students with more options and access to excellent researchers and research groups. Furthermore, all courses have a favourable staff-student ratio (1:11) which allows for individual and personal attention, face-to-face contact, high visibility of staff, and staff-student interaction.

The programme and its lecturers are well connected to non-academic organisations that contribute to several tracks in the second year and/or provide opportunities for students to execute their (preparation for the) thesis. Among these organisations are Statistics Netherlands, MOA, RIVM, TNO, CITO, RCEC, CBG-MEB, Julius-Clinical, Medisch Spectrum Twente, MSD, CenterData, the municipality of Amsterdam, and LSAC. According to the panel, the involvement of these organisations provides significant added value to the programme and ensures that students have a great opportunity to learn about the possibilities and challenges of performing advanced methodological and statistical research outside of academia.

Staff members show much commitment and enthusiasm for working with MSBBSS students. This became clear from the conversations the panel had with lecturers, students and alumni. The small scale of the programme ensures the interactive character of lectures and the direct contact between students and lecturers. The panel has studied the curricula vitae of the staff members involved in the programme and concluded that they are all prominent and active researchers in one of the programme's specializations. It is clear to the panel that students are part of a high quality, driven and committed research environment. The reputation and recent track record of the teaching staff is very good to excellent.

Specific teaching facilities and quality assurance
The panel met with the chair of the Education Committee (EC) and members of the Programme Advisory Committee (PAC). The Educational Committee consists of representatives from all the programmes of the graduate school and is appointed by the dean of the faculty. The EC advises the Board of Studies about (the content of) all research master's programmes belonging to the graduate school, the Education and Examination Regulations (EER), quality assurance, and other educational affairs.

Since 2015 each research master's programme in the graduate school has a Programme Advisory Committee. The PAC executes course evaluations, evaluates the EER of its programme, reviews and discusses course materials, and assesses a variety of issues and problems regarding the content or execution of their programme curriculum, including the optimalisation of the programme structure and the option of offering more electives. The

PAC is able to address and solve problems in the programme in an informal fashion, which is aided by the short lines between students and staff. The EC regularly receives specific input from the each PAC and is kept informed via their annual reports. As a result the EC is able to focus on overarching issues that apply to most or all research master's programmes in the graduate school.

The panel concludes that the PAC for MSBBSS has a dedicated attitude towards the quality of the programme and that the programme has realized a spirit of ongoing improvement with the aid of students and staff. The PAC ensures that issues are addressed swiftly and efficiently which results in a quality culture that guarantees continuing development of and adjustments to the programme.

Considerations

The panel has established that the learning environment of the master's programme MSBBSS offers students great opportunities to develop themselves as independent researchers. The research orientation of the curriculum is beyond dispute. The different curriculum elements provide students with a profound basis in applied statistics with a solid theoretical background in their field of specialization. Students are thus enabled to become very capable in the inventive applications of methods.

The panel finds that the coherence of the curriculum could benefit from systematic reflection by the programme management and teaching staff on alternative ways in which to structure the programme. The panel understands that the heterogeneous inflow, the limited mathematical training of students in the bachelor's programme, and the collaboration between three departments are challenging factors in designing and executing the programme. The panel stresses that all elements of the programme are good and necessary, but the way the elements are organized causes discussion and calls for reflection (see e.g. page 13 of this report). The panel praises the strong connection to the world outside of academia which enables students to prepare for an alternative career if they decide not to pursue a PhD position.

Staff members are all high quality, active researchers and are members of very good to excellent research groups. Based on the reputation and recent track record of the teaching staff and the fact that students perform their final projects at universities and research institutes with a strong reputation, the panel concludes that students are educated within an excellent research environment. The panel wishes to stress that the staff from the University of Twente make an excellent contribution to the programme and provide evident added value. The ambitious and small-scale character of the programme adds to the motivation of the teaching staff to work with MSBBSS students. The staff-student ratio is favourably low; students have considerable interaction with each other and with lecturers.

The Programme Advisory Committee plays an important role in the quality assurance of the programme. Their close relationship to the programme on the one hand and the Education Committee on the other contributes to a culture of quality in which problems are quickly and efficiently addressed.

Conclusion

Master's programme Methodology and Statistics for the Behavioural, Biomedical, and Social Sciences: the panel assesses Standard 2 as 'good'.

Standard 3: Assessment
The programme has an adequate assessment system in place.

Explanation:
The tests and assessments are valid, reliable and transparent to the students. The programme's examining board safeguards the quality of the interim and final tests administered.

Findings

Utrecht University requires all its degree programmes to provide detailed assessment plans in an effort to ensure and improve the match between student assessments to its learning outcomes. The assessment plan of the MSBBSS programme is included in the appendices of the critical reflection. This plan defines (among other issues) the aims and objectives of the programme, and the relationship between curriculum components, the intended learning outcomes and the corresponding assessment modes, and quality assurance of assessments.

MSBBSS uses multiple forms of assessment: written examinations (exams), exercises, class participation, research papers, presentations, consultations, and the masters' thesis. Lecturers operate independently and individually when developing and grading course assessments without the presence of specific guidelines to assist or direct them. Due to the autonomy of lecturers, they do not always share information before or after the assessment (no four eyes principle in place). However, marking schemes have to be available for all course assessments. Contrary to what the self-evaluation report appears to suggest, a resit is provided for students who failed an exam with a grade of at least 4.0 without rounding up.

The reliability of the assessments increases in the second year during the research seminars and the master's thesis when two (research seminars) to five/six (thesis) lecturers are involved in assessing and grading students' work. Assessments in this phase are based on criteria concerning originality, scientific quality, written presentation, general comments, and independent work. The thesis is publicly defended during a meeting of the Thesis Examination Committee. During the defence students respond to questions raised by independent examiners from the MSBBSS programme and from one other research master's programme of the Graduate School. The final decision on the grade for the thesis is made by the Thesis Examination Committee after the defence, and is based on a proposed grade by the supervisor, the independent examiners, and the MSBBSS coordinator. Students present their most important research findings to an audience of fellow students and staff members at a poster fair before graduation.

The panel is impressed by the thorough procedure surrounding the assessment of the thesis. The average grade is 8 and 40% of students graduate with a cum laude distinction. The programme refers to the selection process as an important reason for the high grades with which students graduate. The panel advises the programme to ensure that the thesis supervisor can act independently and does not encounter a conflict of interest when assessing a thesis. The panel has reviewed multiple theses that have led to publications that credit the supervisor as co-author. The panel urges the programme to make sure that there is a strict separation between the roles of the thesis supervisor and co-author of the subsequent publication after graduation. Any impression that a supervisor of a thesis is a co-author of the thesis should be avoided. A possible solution for this issue could be to have one of the examiners act as a second thesis supervisor who cannot be a co-author of the publication afterwards.

The Board of Examiners (BoE) is responsible for guarding the procedures on assessments. The BoE relies on an assessment committee to assure the quality of individual assessments and exams. The assessment committee periodically reviews assessments (at random), and is not (yet) involved in formulating guidelines for the development and grading of assessments. The assessment committee uses a thematic approach. The committee concentrates on certain themes (e.g., thesis assessments, assessment plans etc.) and takes samples to review the state of affairs. At present, no systematic plagiarism check is performed on the theses and this is not deemed necessary by the BoE and assessment committee because they expect any plagiarism in thesis writing to be recognized by the thesis supervisor.

The panel finds that an adequate assessment plan for MSBBSS is available that contains assessment procedures and regulations. The BoE operates at a faculty level and therefore seems to have limited direct contact or involvement with specific issues relating to the MSBBSS programme. The small scale and intensive contacts between lecturers and students of the MSBBSS programme ensure that any possible issues regarding assessments are adequately addressed. Despite the aforementioned issues, the panel has little cause for concern on the system of assessment as a whole. The assessments it has reviewed show that they are of a sufficient level, validity and transparency.

Considerations

The panel has checked whether the programme has adopted an adequate assessment system. The panel has established that the programme uses diverse assessment methods that are aligned with the learning objectives of each course unit. Safeguarding the quality of final research projects gets sufficient attention from examiners. However, the panel expresses some concern on the strict separation of the different roles (supervisor versus co-author) of the supervisor(s) of theses. The course assessments are developed and graded by teaching staff who work independently.

The panel finds that the programme and the Board of Examiners (BoE) have installed adequate measures to monitor assessment quality. The BoE and its assessment committee have adopted a reactive approach on guarding assessment processes. The BoE operate at a faculty level which creates a distance from the MSBBSS programme. The assessment committee is closely involved with the programme, but has not (yet) set a clear agenda for its activities in the future. The small scale of the programme and informal contacts between students and staff ensure that any problems regarding assessments are adequately and quickly resolved.

The panel concludes that the programme has an effective system of assessment in place which is evidenced by the level, validity and transparency of the assessments. The consistent implementation and execution of assessment guidelines and regulations could benefit from more attention since teaching staff work autonomously.

Conclusion

Master's programme Methodology and Statistics for the Behavioural, Biomedical, and Social Sciences: the panel assesses Standard 3 as 'satisfactory'.

Standard 4: Achieved learning outcomes
The programme demonstrates that the intended learning outcomes are achieved.

Explanation:
The level achieved is demonstrated by interim and final tests, final projects and the performance of graduates in actual practice or in post-graduate programmes.

Findings

The thesis illustrates the level achieved in the master's programmed. Prior to the site visit, the assessment panel has selected and studied sixteen theses. The selection procedure is described in the paragraph 'Working method of the assessment panel', on page 6 in this report.

The thesis is set up and written as a publishable article. It has to contain a research problem that is embedded in the state of the art of the chosen research field, a methodologically/statistically sound approach to address the research problem, and results that are based on solid data collections, simulation studies, and/or derivations. The panel appreciated the wide range of topics that students chose that reflect and are geared towards the different (backgrounds of) students in the programme. The thesis elements that particularly impressed the panel were the good mathematical and programming level, the writing skills, and the careful design and implementation of projects. The thesis has to be accompanied by a research archive that can be used to reproduce all the results obtained in the thesis and are an important aspect of the theses with regards to academic integrity. The panel finds that the research archives it reviewed showed that the documentation of codes and data are executed well.

The panel has observed that the final products generally demonstrate a high level and in some cases even an excellent level. In their reports, students show that they reach a level of performing scientific research to be expected in a high-quality research environment, preparing them well to start a PhD. One out of three students publishes their thesis in an international peer reviewed journal. Two out of three students continue their studies in a PhD programme, mainly in methodology and statistics. The programme points out that the majority of students obtain a PhD position (after selection) or other job even before graduating. According to the panel, this shows the programme's good performance in terms of achieved learning outcomes.

During the site visit, the panel had a conversation with alumni, who reported that they were very satisfied with their education, and felt well prepared for a job as a researcher. They point out that they have benefited from the strong mathematical basis that the programme has given them and which allows them to keep learning in the broad field of methodology and statistics. The panel and the alumni are very positive about the programme's strong focus on career prospects and career paths outside of academia. The panel strongly encourages this focus on employability and concludes that the master's programme provides a good preparation for a research career in and outside of academia.

Considerations

After studying multiple theses and the accompanying research archives, the panel established that students realize the intended learning outcomes of the research master's programme in Methodology and Statistics for the Behavioural, Biomedical and Social Sciences. The achieved level in the theses is generally high; students demonstrate good research qualities in their work. According to the panel, this high quality of the reports and the fact that they often lead

to publication in international peer reviewed journals demonstrate the success of the research orientation of the programme.

Based on the performance of alumni the panel concludes that the programme prepares students well for a research career in and outside of academia. The majority of graduates obtain a PhD position. The panel concludes that the programme succeeds in its ambition to prepare students for a strong career in methodology and statistics.

Conclusion
Master's programme Methodology and Statistics for the Behavioural, Biomedical, and Social Sciences: the panel assesses Standard 4 as 'good'

General conclusion

The panel concludes that students in the master's programme MSBBSS are trained in a good, small-scale research environment. The curriculum addresses all important elements and is geared towards students with different backgrounds and limited prior mathematical training. The panel finds that the curriculum could benefit from a reflection on the coherence of the curriculum in the first year (scattering of elements) and the second year (overlap in Research seminars, and limited options for electives). Nevertheless, the programme is responsible for graduates that produce good final research reports, a high percentage of successful PhD students and numerous publications in international peer reviewed journals. The programme is ambitious and succeeds in realizing its aims. The committed staff has a very good to excellent reputation and the programme is executed in a very good to excellent research environment.

Students and staff are a close-knit community and are dedicated to contributing to the programme quality. As adequate assessment system is in place, but not yet fully executed by the teaching staff. In line with the NVAO decision rules, the panel concludes that the learning environment and the realized final level justify the conclusion that the programme is good.

Collaboration with the University of Twente
The programme has invited the panel to consider the strengths and weaknesses of the existing collaboration between Utrecht University and the University of Twente.

During the site visit, the panel has frequently addressed the collaboration with the University of Twente. The collaboration between Utrecht University and the University of Twente has led to an increase of applicants to the programme which allows MSBBSS to select the best students. The expertise that the University of Twente adds to the programme (in psychometrics and educational measurement) is undisputably of high quality and adds significantly to the programme. MSBBSS students are introduced to extra research groups in Twente, which offers them more opportunities to broaden their scope and research interests. Twente offers an excellent research environment and facilities for MSBBSS students. The use of video links and travel reimbursements for students help to overcome practical challenges in the execution of the programme.

It is due to the resilience of staff members that the collaboration is successful. The current legal status of the collaboration creates issues that could be solved by starting a joint degree programme. A joint degree would lead to a recognition of the roles of both parties and acknowledge the important contribution that Twente makes to the programme. Furthermore,

it would allow students who are based in Twente to enroll at that university and use all of Twente's facilities.

The panel finds that the collaboration between Utrecht and Twente beyond dispute results in a true strengthening of the MSBBS programme. The panel advises the programme to explore all possibilities to change its legal status to a joint degree programme.

Conclusion

The panel assesses the *Master's programme Methodology and Statistics for the Behavioural, Biomedical, and Social Sciences* as 'good'.

Appendices

Appendix 1: Curricula Vitae of the members of the assessment panel

Gerard van Breukelen obtained his MSc in 1984 and his PhD in 1989 at the Radboud University Nijmegen, with a thesis on psychometric models for response times. He was appointed as assistant professor at the dept. of Methodology and Statistics of Maastricht University in 1991, where he is now full professor and dept. chair, with 50:50 appointment in two faculties: Health, Medicine & Life Sciences, and Psychology & Neuroscience. His research is on optimal design and sample sizes for multilevel settings. His second topic is causal inference, notably Lord's ANCOVA paradox. His teaching ranges from logistic regression and factor analysis to multilevel regression and structural equations modeling.

Francis Tuerlinckx is Professor of Quantitative Psychology at the KU Leuven, University of Leuven in Belgium. He received the Master degree in psychology (1996) and a Ph.D. in psychology (2000) from the KU Leuven. He was a postdoc at the Department of Statistics of Columbia University (New York). His research deals with the mathematical modeling of various aspects of human behavior. More specifically, he works on item response theory, reaction time modeling, and dynamical systems modeling of cognition and emotion. He serves as an associate editor for the Journal of Mathematical Psychology and is currently member of the Board of Trustees of the Psychometric Society.

Jelle Goeman is Professor of Biostatistics at Leiden University Medical Center and Radboud University Medical Center with specialization in multiple testing and high-dimensional data. He studied mathematics and history at Leiden University and obtained his PhD on statistical methods for microarray gene expression data from the same university in 2006. He is known for his work on global tests and penalized regression in high dimensions, for which he has been awarded a VENI grant in 2007. He is currently pursuing research on quantifying uncertainty in league tables and rankings, supported by a VIDI grant.

Nikos Tzavidis is Associate Professor of Statistics (PhD 2004, University of Southampton), Head of the Department of Social Statistics and Demography, member of the Senate of the University of Southampton and Deputy Director of the Southampton Statistical Sciences Research Institute. He has previously held posts at University of London and the University of Manchester. He has published research papers in the Journal of the Royal Statistical Society Series A and B, and Biometrika and his research is supported by the British Academy, ESRC and the EU Framework Programmes. He is fellow of the Royal Statistical Society, elected member of the International Statistical Institute, assessor for the UK Civil Service Fast Stream Scheme and the external examiner for the MSc in Social Research Methods and Statistics at the University of Manchester.

Elise Crompvoets is a second-year student of the Research Master in Social and Behavioral Sciences with the minor Methodology and Statistics at Tilburg University. She obtained her bachelor's degree in Psychology and Health at the same university. Crompvoets aims to enroll in a PhD programme after her graduation in 2016. She expresses a special interest in psychometrics, but also shows affinity with other research fields within methodology, statistics, and psychology.

Appendix 2: Domain-specific framework of reference

The programme Methodology and Statistics for the Behavioural, Biomedical and Social Sciences (MSBBSS) currently has one counterpart in the Netherlands: the two-year research master Statistical Science for the Life and Behavioural Sciences based at Leiden University. In the neighbouring countries, the University of Hasselt hosts a two-year Master of Statistics with a focus on the biomedical sciences, The KU Leuven offers a two-year MSc in Statistics in collaboration with Hasselt, there is a two-year Master in Statistics at the University of Copenhagen, and a one-and-a-half year Master in Statistics at the Eidgenössische Technische Hochschule in Zurich. On a dimension with endpoints mathematical statistics and applied statistics, the masters elsewhere are more at the mathematical side whereas MSBBSS is more on the applied side. Furthermore, there are one-year masters both in the Netherlands (Leiden) and abroad and, in the Netherlands, two-year research masters in the area of the behavioural and social sciences that offer a track in methodology and statistics (Amsterdam, Tilburg, Groningen). Compared to these masters MSBBSS offers a more comprehensive, thorough and focussed programme in methodology and statistics.

Appendix 3: Intended learning outcomes

The following reference framework consists of general subject-specific aims and learning outcomes that apply to the Research Master programme Methodology and Statistics of the Behavioural, Biomedical and Social Sciences (MSBBSS).

1. Aim of all research master's programmes of the Faculty of Social and Behavioural Sciences, Utrecht University

The programmes are designed as preparation for a PhD study. The programmes similarly provide training for students who do not wish to enter a PhD training program after graduation, but who wish to pursue their professional career as a researcher outside of the university.

Theoretical attitudes and insights, research skills

Graduates of the programme:

- have an overview of important theoretical and methodological issues in their field of study. They have expertise and experience in the elaboration of a research project with a clearly formulated research problem that is innovative while building on the state of the art in the field and being well grounded in the literature in this field;
- have an understanding of different research designs and methods of data collection, have acquired the expertise and experience in the elaboration of research designs and methods of data collection that are adequate for answering an underlying research question and are capable of choosing and applying them in their research;
- are able to choose and apply appropriate statistical models (not applicable to the CASTOR programme);
- have expertise and experience in the integration of theory and (quantitative and/or qualitative) empirical research ("theory-guided empirical research") and they have gained experience in the full process of social or behavioural research and in reporting the results of research in a specific field of study. These qualifications are reflected in a master's thesis, which should have the form of a publishable research paper;
- are capable, based upon a research proposal, of independently carrying out research towards acquiring a PhD.

General academic skills

Graduates of the programmes are trained in academic writing, in presenting for various audiences, and in data analysing, documentation and archiving.

General work orientation

Graduates of the programmes have acquired a general work orientation that is required for membership in a research team and in a research network in their own research domain.

2. Aim of Methodology and Statistics for the Behavioural, Biomedical and Social Sciences (MSBBSS)

The intended final qualifications and competencies of the MSc degree in Methodology and Statistics in the Behavioural, Biomedical and Social Sciences are based on requirements made by behavioural and social science, follow international academic standards, and are relevant to the professional practices in this field. They are comparable to the requirements made by colleagues in the Netherlands and abroad, and correspond to the internationally accepted Dublin descriptors. The qualifications of each of the following five Dublin descriptors will be related to clear academic objectives.

Knowledge and understanding

Qualifications
1. Being able to demonstrate, understand and develop methodological and statistical scientific knowledge in original ways, and in particular being proficient in the relevant scientific literature on methodology and statistics beyond the competence associated with the undergraduate level.

2. Being capable of formulating and designing an original methodological and/or statistical research project from a biomedical, behavioural and/or social scientific perspective.

Academic objectives
Ad 1. At the end of the master programme, students are capable of:
- following and understanding recent theoretical discussions
- identifying the principal scientific debates in the study of methodology and statistics
- critically appraising an academic argument

Ad 2. At the end of the master programme, students are capable of:
- identifying a coherent research problem, and formulating it in relation to a current methodological and/or statistical debate
- determining the most effective research methods to gather and analyze data necessary to address a research problem, and justifying the choices made
- mastering the principles and practicalities of quantitative analyses

Applying knowledge and understanding

Qualifications
1. Formulating research questions about new and unfamiliar areas of methodology and statistics in the social, biomedical and behavioural sciences.
2. Being able to design studies and analyze data in the area of the biomedical, behavioural and social sciences.
3. Being able to use and develop new software that can be used for data collection and statistical analysis.

Academic objectives
Ad 1. At the end of the master programme, students are capable of:
- contributing to international discussions in their area of specialization
- generating new knowledge about methodology and statistics in the social and behavioural sciences

Ad 2. At the end of the master programme, students are capable of:

- operationalizing a research problem into a hypothesis
- skilfully employing quantitative empirical methods to generate and analyze data necessary to examine and answer the hypothesis or research questions

Ad 3. At the end of the master programme, students are capable of:

- using existing software for data collection and statistical analysis of data
- writing new software for data collection and statistical analysis of data

Making judgements

Qualifications

1. Using scientific judgements to address questions on methodology and statistics in the social and behavioural and biomedical sciences.
2. Being aware of the professional ethics of a methodologist/statistician in a societal, academic and empirical context.

Academic objectives

Ad 1. At the end of the master programme, students are capable of:

- making scientifically informed judgements about the methodology and statistics in the social, behavioural and biomedical sciences employed in research
- responding to academic and public critique in a scholarly way

Ad 2. At the end of the master programme, students are capable of:

- assessing the ethical implications of social, biomedical and/or behavioural scientific research and research methods
- understanding the ethical implications on research subjects, and the ethical obligation to avoid any harm or wrong in the pursuit of knowledge
- carrying the responsibility for the integrity and reputation of the social sciences
- understanding the responsibility to the public, and the social and political implications of the dissemination of research results

Communication

Qualifications

1. Working with other researchers in methodology and statistics in the biomedical, social and behavioural sciences, as well as with researchers in substantive fields of the biomedical, social and behavioural sciences, at an up-to-date academic level.
2. Communicating in English at an academic level.
3. Translating research findings and methodological and statistical findings for a non-scholarly audience.

Academic objectives

Ad 1. At the end of the master programme, students are capable of:

- working with fellow scholars within methodology and statistics in the biomedical, social and behavioural sciences, as well as in other fields of the biomedical, social and behavioural sciences
- sharing their knowledge and experience within an international team of methodologists/statisticians in the social, behavioural and biomedical sciences, as well as

other biomedical, behavioural and social scientists, and applying relevant knowledge and experience to their own ongoing research
- applying relevant methodological and statistical knowledge and experience shared in such international collaboration to the development of joint projects

Ad 2. At the end of the master programme, students are capable of:
- debating with fellow methodologists/statisticians, as well as with behavioural, biomedical and social scientists, on methodology and statistics in English
- writing a MSc thesis in English
- producing publications up to the standards of international peer-reviewed journals in their field
- giving an oral presentation in English on research findings and insights to audiences of specialists and non-specialists

Ad 3. At the end of the master programme, students are capable of:
- explaining research findings and theoretical insights on methodology and statistics in a non-specialist vocabulary
- contributing a methodological/statistical perspective to current affairs in an oral public discussion

Learning skills

Qualifications
1. In possession of the methodological/statistical skills to pursue a PhD.
2. Being capable of autonomous scholarly self-development.

Academic objectives
Ad 1. At the end of the master programme, students are capable of:
- understanding current theories and debates in methodology and statistics in the biomedical, social and behavioural sciences
- employing advanced research methods

Ad 2. At the end of the master programme, students are capable of:
- independently keeping track of international academic developments in their field of study
- critically reassessing their own views in light of the latest developments in the field
- finding and selecting relevant scientific sources in libraries and on the internet
- using ICT technologies, such as computers, text processing programmes, and search machines
- giving proof of being a responsible and scholarly professional
- reflecting on and independently taking action within the scope of career development

Appendix 4: Overview of the curriculum

First year			Second year		
First semester		Hours	First semester		Hours
MSBBSS01	Survey Data Analysis	28	MSBBSS09	Elective Course	Depending on the Elective chosen
MSBBSS02	Multivariate Statistics	42	MSBBSS10	Preparation Research Master's Thesis	14 (dependent on student's need for coaching)
MSBBSS03	Fundamentals of Statistics	56	MSBBSS11	Research Seminar I	36
MSBBSS04	Computational Inference with R	42			
Subtotal		168			50 + Elective
Second semester			Second semester		
MSBBSS05	Psychometrics	26	MSBBSS12	Research Seminar II	36
MSBBSS06	Introduction Multilevel and Structural Equation Modelling	42	MSBBSS13	Master's Thesis	14 (dependent on student's need for coaching)
MSBBSS07	Bayesian Statistics	42			
MSBBSS08	Clinical Research Designs	45			
Subtotal		155			50
Year total		**323**			**100 + Elective**

Second year tracks

In the *free track* students can choose an elective and write and prepare their thesis. They choose their own elective and research topic within the framework of the programme and in consultation with the coordinator of the research master's programme.

The *survey track* consists of the course *Survey elective* which brings together people working in science (university, scientific research institutes), government (national and local, Statistics Netherlands, Netherlands Institute for Social Research), and market research agencies. The track invites guest lecturers from the municipality of Amsterdam, CentERdata, Statistics Netherlands, the Netherlands Institute for Social Research, and Market Research Association. Students are familiarised with different viewpoints on survey methodology, areas of innovation, and challenges that these different types of institutes and their employees face. Students are allowed to write their thesis for a survey organization in science, government or market research.

The *educational measurement track* focuses on applied statistics the area of designing and evaluating educational tests. Educational measurement has a significant societal impact and is challenging due to the use of large datasets, dynamic assessment, and computer based testing. Students follow an elective, which taught mainly by specialists from CITO (Dutch national institute of measurement) and the University of Twente. They spend a period at CITO or at another leading institute of educational measurement abroad, and prepare and write their

thesis under the supervision researchers affiliated with either CITO or the University of Twente.

The *biomedical track* combines a (preparation for the) thesis with a supervisor from the biostatistics department of the University Medical Centre Utrecht with a selection of five one week courses from the master's programme Epidemiology of Utrecht University. This track focuses on methodology and statistics that are relevant in biomedical and epidemiological research.

The *EMOS track* in Official Statistics focuses on statistics that is carried out at organisations as Statistics Netherlands and planning bureaus. EMOS (European Master of Official Statistics) is an initiative of the statistical office of the European Union (Eurostat). Students follow an extended elective course taught mainly by Statistics Netherlands, and they prepare and write their thesis under the supervision of SN employees.

Appendix 5: Programme of the site visit

Date: March 15 and 16, 2016
Location: Faculty room, E3.14, Martinus J. Langeveld Building. Heidelberglaan 1, 3584 CS Utrecht, the Netherlands

Tuesday March 15 2016

12.30 - 15.30 Preparatory meeting (including critical reflection + theses), reading additional documentation, lunch

15.30 – 15.45 Break

15.45 – 16.45 Interview with programme management

- Prof. Herbert Hoijtink (programme coordinator MSBBSS, Faculty of Social and Behavioural Sciences, Utrecht University)
- Prof. Jean Paul Fox (programme coordinator MSBBSS, Department of Research Methodology, Measurement and Data Analysis, University of Twente)
- Prof. René Eijkemans (programme coordinator MSBBSS, Julius Centre, Utrecht Medical Centre)
- Prof. Werner Raub (Dean Faculty of Social and Behavioural Sciences, Utrecht University)
- Prof. Marcel van Aken (Vice dean, Faculty of Social and Behavioural Sciences, Utrecht University)

16.45 – 17.00 Break

17.00- 17.30 Interview with alumni

- Kimberley Lek (MSc, Dutch) (PhD candidate at M&S, Faculty of Social and Behavioural Sciences, Utrecht University)
- Fayette Klaassen (MSc, Dutch) (PhD candidate at M&S, Faculty of Social and Behavioural Sciences, Utrecht University)
- Oisin Ryan (MSc, Irish) (PhD candidate at M&S, Faculty of Social and Behavioural Sciences, Utrecht University)
- Karel Kroeze (MSc, Dutch) (PhD candidate at the Department of Research Methodology, Measurement and Data Analysis, University of Twente)
- Roline Kamphuis (MSc, Dutch) (PhD candidate at M&S, Faculty of Social and Behavioural Sciences, Tilburg University)
- Rob Kessels (MSc, Dutch) (statistician at Emotional Brain, Almere)

Wednesday March 16 2016

09.00 – 09.15 Internal meeting panel

09.15 – 10.00 Interview with students

- Rune Poortvliet (BSc, Dutch), (1st year MSBBSS student, combines MSBBSS with Social and Health Psychology)
- Jolien Ketelaar (BSc, Dutch), (1st year MSBBSS student, combines MSBBSS with Educational Sciences: Learning in Interaction)
- Benjamin Rosche (BSc, German), (1st year MSBBSS student, combines MSBBSS with Sociology and Social Research)
- Niek de Schipper (BSc, Dutch), (2nd year MSBBSS student)
- Inbal Shofty (BSc, Israeli/Austrian), (2nd year MSBBSS student)
- Militza Kroonenberg (BSc, Dutch), (2nd year MSBBSS student, combines MSBBSS with Educational Sciences: Learning in Interaction)
- Duco Veen (BSc, Dutch), (2nd year MSBBSS student)

10.00 – 10.45 Interview with lecturers

- Assistant prof. Rebecca Stellato (staff MSBBSS, Julius Centre, Utrecht Medical Centre)
- Prof. Bernard Veldkamp (staff MSBBSS, Department of Research Methodology, Measurement and Data Analysis, University of Twente)
- Prof. Irene Klugkist (staff MSBBSS, Faculty of Social and Behavioural Sciences, Utrecht University)
- Prof. Peter van der Heijden (staff MSBBSS, Faculty of Social and Behavioural Sciences, Utrecht University)
- Associate prof. Mirjam Moerbeek (staff MSBBSS, Faculty of Social and Behavioural Sciences, Utrecht University)
- Prof. Jean Paul Fox (staff MSBBSS, Department of Research Methodology, Measurement and Data Analysis, University of Twente)

10.45 – 11.00 Break

11.00 – 11.30 Interview with Programme Advisory Committee and Educational Committee Graduate School

- Assistant prof. Gerko Vink (Chair Programme Advisory Committee MSBBSS, Faculty of Social and Behavioural Sciences, Utrecht University)
- Rune Poortvliet, BSc (1st year student member Programme Advisory Committee MSBBSS, Faculty of Social and Behavioural Sciences, Utrecht University)
- Niek de Schipper, BSc (2nd year student member Programme Advisory Committee MSBBSS, Faculty of Social and Behavioural Sciences, Utrecht University)
- Associate prof. Bill Hale (Chair Educational Committee Graduate School, Faculty of Social and Behavioural Sciences, Utrecht University)

11.30 – 12.30 Interview with assessment/exam committee

- Associate prof. Herman van Boxtel (Chair Assessment Committee, Faculty of Social and Behavioural Sciences, Utrecht University)
- Assistant prof. Dave Hessen (M&S Member Assessment Committee, Faculty of Social and Behavioural Sciences, Utrecht University)
- Prof. Susan Branje (Chair Exam committee Research Master's Programmes, Faculty of Social and Behavioural Sciences, Utrecht University)
- Prof. Herbert Hoijtink (substitute assessment coordinator MSBBSS, Faculty of Social and Behavioural Sciences, Utrecht University)

12.30 – 13.30 Open office hour (12.30-13.00hrs), lunch, internal meeting panel

13.30 – 14.30 Interview with programme management

- Prof. Herbert Hoijtink (programme coordinator MSBBSS, Faculty of Social and Behavioural Sciences, Utrecht University)
- Prof. Jean Paul Fox (programme coordinator MSBBSS, Department of Research Methodology, Measurement and Data Analysis, University of Twente)
- Prof. René Eijkemans (programme coordinator MSBBSS, Julius Centre, Utrecht Medical Centre)
- Prof. Werner Raub (Dean Faculty of Social and Behavioural Sciences, Utrecht University)
- Prof. Marcel van Aken (Vice dean, Faculty of Social and Behavioural Sciences, Utrecht University)

14.30 – 16.00 Internal meeting panel

16.00 – 16.15 Presentation of preliminary findings

Appendix 6: Theses and documents studied by the panel

Prior to the site visit, the panel studied the theses of the students with the following student numbers:

3340074	4073363	4066731
3463230	4092465	3392279
3270882	4126750	3773736
3547884	3506738	3472825
3931404	4183614	4085760
3366499		

During the site visit, the panel studied, among other things, the following documents (partly as hard copies, partly via the institute's electronic learning environment):

- The annual report by the examining board and the reports by the programme committee (if a programme committee is required);
- Test questions with relevant assessment criteria and mark system (answer models);
- A representative selection of reference books and other study materials.