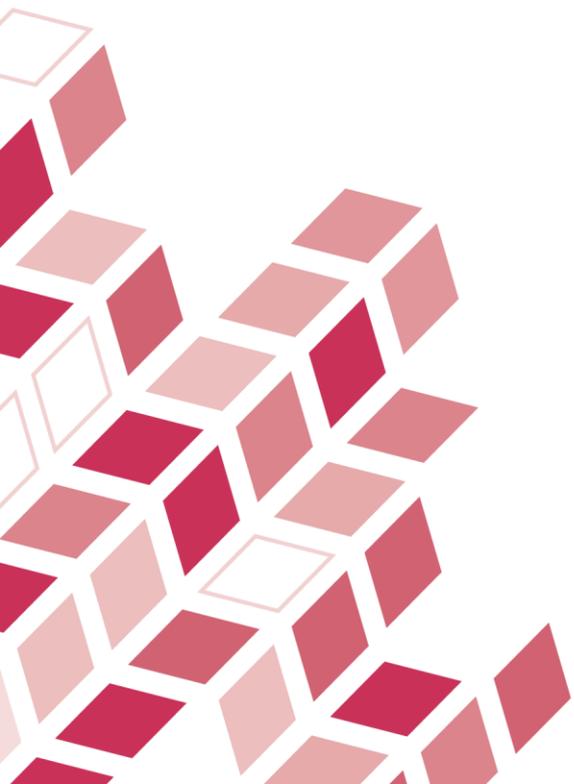


NOKUTS tilsynsrapporter

Applied Computer Science with Specialization in Software Integration

Master degree at The Norwegian School for IT (NITH)
september 2013



Institution:	The Norwegian School for IT (NITH)
Name of educational provision:	Applied Computer Science with Specialization in Software Integration
Degree/Studiepoeng (ECTS):	Master degree. 120 studiepoeng/ECTS.
Date of decision:	19th of September 2013
Expert Committee:	Professor Frode Eika Sandnes, Oslo and Akershus University College of Applied Science (HiOA)
	Associate professor Marianne Graves Petersen, Aarhus University
Archive Number:	13/149

Introduction

The external quality assurance performed by NOKUT consists of evaluating the institution's quality assurance systems, accreditation of new provisions and revision of accredited provisions. Universities and university colleges have different self-accrediting powers. For an institution without self-accrediting powers to establish a provision in a certain cycle an application must be made to NOKUT.

Hereby NOKUT presents the accreditation report of Applied Computer Science with Specialization in Software Integration at The Norwegian School for IT (NITH). The expert evaluation in this report is part of the accreditation process following NITH's application for accreditation of Applied Computer Science with Specialization in Software Integration¹ submitted before the application deadline on 1st of February 2013. This report clearly indicates the extensive evaluation performed to ensure the educational quality of the planned educational provision.

Applied Computer Science with Specialization in Software Integration at NITH fulfils NOKUT's conditions for accreditation and is accredited by resolution of 19th of September 2013.

This decision does not have limited validity in time. NOKUT will however make a subsequent supervision of the educational provision within three years.

Oslo, 19th of September 2013



Terje Mørland
Director General

Information on accreditation of educational provisions (in Norwegian):

<http://www.nokut.no/no/Norsk-utdanning/Universitet-og-hogskole/Akkreditering-av-studietilbod/Korleis-sokje-akkreditering/>

¹ Based on the expert assessment, NITH changed the name of the provision from Applied Computing to Applied Computer Science with Specialization in Software Integration (see part 6).

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1 Information regarding the applicant institution

The Norwegian School of IT (NITH) specializes in bachelor's and master's programmes in the field of IT. At present NITH offers bachelor programmes in areas such as programming, game design, 3D graphics, digital marketing and e-business as well as a master programme in information systems with two specializations: digital business systems and IS management & innovation.

NITH is a university college with accreditation from NOKUT. NITH has the power of self-accreditation for educational provisions in the first cycle, but has to apply to NOKUT for accreditation of educational provisions in all higher cycles.

The following educational provisions at the institution have obtained accreditation from NOKUT:

- Master degree in Information Systems (2011).

The institution's quality assurance system was evaluated and accepted by NOKUT in 2011.

NITH applied for accreditation of master degree in Applied Computing (120 ECTS) within the application deadline 1st of February 2013.

2 Description of procedure

NOKUT makes an administrative assessment to ensure that all basic conditions for accreditation are fulfilled as expressed in the Regulation concerning NOKUT's supervision and control of the quality in Norwegian higher education.² (hereafter referred to as the Quality Assurance Regulation on Higher Education.). For applications that have been approved administratively, NOKUT appoints external experts for the evaluation of the application. The external experts have declared that they are legally competent to perform an independent evaluation, and carry out their assignment in accordance with the mandate for expert assessment passed by NOKUT's board, and in accordance with the requirements for educational quality as determined by the Quality Assurance Regulation on Higher Education.

Following their assessment, the expert committee shall conclude either with a yes or no as to whether the quality of the educational provision complies with the requirements in the Quality Assurance Regulation on Higher Education. NOKUT also requests that the expert committee advise on further improvements of the educational provision. All criteria must be satisfactorily met before NOKUT accredits an educational provision.

If the conclusion reached by the expert committee is negative, the report is sent to the applicant institution, which is then given three weeks to comment. Thereafter NOKUT decides whether the comments should be sent to the committee for additional consideration. The committee is given two

² <http://www.lovddata.no/cgi-wift/ldles?doc=/sf/sf/sf-20110127-0297.html>

weeks to submit the revised assessment. The director general then reaches a final decision about accreditation.

About this report

The current report presents the accreditation process chronologically. As described above, the committee is free to change its conclusion on accreditation in the course of the process, and has in fact done so in this report. The final conclusion is found in part 7.

3 Administrative assessment

Quality Assurance Regulation on Higher Education § 4-1: Basic conditions for accreditation

1. Demands expressed in the Universities and Colleges Act concerning the following arrangements will be assessed:
 - a. Internal regulations and governance
 - b. Appeals Committee
 - c. Learning Environment Committee
 - d. Educational Plan
 - e. Diplomas and Diploma Supplement
 - f. Quality assurance system

NOKUT's assessment

The intention of this article is to make it clear and predictable what regulations in the University and Colleges Act (2002) that NOKUT supervises. NITH offers accredited educational provision. Hence, it is presupposed that the demands expressed in the Universities and Colleges Act are fulfilled. Diploma supplement is evaluated as satisfactory.

4 Expert Assessment

This chapter is the expert committee's assessment. The term "we" refers to the expert committee as such. The number preceding each heading refers to the corresponding provision in the Quality Assurance Regulation on Higher Education.

Summary of the report

It is our assessment that the Master degree in Applied Computing does not fully satisfy the accreditation criteria in its present form. We are convinced that there is a huge potential for such a Master program as the curriculum is timely and relevant. However, there are several issues that need to be addressed and clarified. In particular there is a need for specifying the learning outcomes according to the National Qualification Framework and for further developing the structure of the provision to ensure progression and variation in the courses and exams.

4.1 Basic conditions for accreditation

4.1.1 Demands expressed in the Universities and Colleges Act.

These demands have been evaluated by NOKUT in the administrative assessment. The expert committee has reviewed the Diploma Supplement and finds that it is sufficient.

4.1.2 Demands expressed in national curriculum frameworks, where such apply, and in relevant Regulations issued by the Ministry of Education and Research must be met.

Assessment

The accreditation application makes a reference to the accompanying document "Admission regulations for Master programmes and Master courses". According to this document this programme falls into the category outlined in paragraph 3 of the master degree regulations issued by the Ministry of Education and Research, that is, a 120 ECTS programme requiring an 80 ECTS specialization in the applicant's bachelor studies. Furthermore, these 80 ECTS should be in a relevant field to the Master's degree, such as IT, programming, software engineering or HCI. This kind of background is suitable for the provision.

NITH has not indicated the length of the independent work under 4.1.2. However, elsewhere it is described that the Master dissertation is of 45 ECTS. This is within the master degree regulations issued by the Ministry of Education and Research.

No national curriculum frameworks apply.

Conclusion

Yes, the condition is fulfilled.

- The institution is advised to clearly indicate that this is a 120 ECTS programme requiring 80 ECTS specialization for applicants in all relevant documentation.

4.1.3 Estimates of student recruitment, as relevant in relation to the establishing of a satisfactory learning environment and stable provision, must be presented.

Assessment

Approximately 100 candidates successfully complete their bachelor studies at NITH every year. These 100 candidates provide a good basis for recruiting students for the programme. However, recently a master programme in Information Systems was accredited. It is a concern regarding recruitment that the two master programmes will compete for students, and the application does not describe how NITH intends to handle the internal competition. There are also positive sides to having two programmes, such as improvement of the learning environment if NITH introduces common academic and social arenas for students enrolled onto the two master programmes.

The master programme has a timely profile that should appear appealing to potential applicants and thus contribute positively towards recruiting students.

The accreditation application also describes an intention to recruit students nationally and internationally. However, no details are given regarding how NITH intend to attract and compete for these students.

The potential of recruiting part-time students is also mentioned in the application. Part-time students with part-time or full-time jobs pose certain challenges, and NITH is therefore advised to identify and implement measures to increase the quality of education for part-time students.

Conclusion

Yes, the institution's estimates are satisfactory.

The institution is advised to:

- identify how students will be recruited nationally and internationally
- devise a strategy for recruiting NITH's own bachelor candidates while preventing unconstructive internal competition with the other master programme in Information Systems
- identify how to ensure quality education for part-time students
- closely monitor the national student recruitment trends in computer science
- stimulate synergies and improved study environment by introducing common academic and social arenas for students enrolled onto the two master programmes

4.1.4 A plan of the students' expected workload must be presented.

Assessment

The plan for the students' expected workload is provided in Table 2 (page 6). This table is not accompanied by any explanatory text and it is thus hard to interpret NITHs intentions.

The plan indicates a yearly workload of 1600 hours, which is within the ECTS norm of 1500-1800 hours. Several activity categories are suggested. Regarding the workload the first year, the plan entails that students will have 591 hours of self-study, 0 hours seminars with presentation/discussion, 0 hours of supervision but 420 hours assessment.

We suggest that these figures need further consideration and explanation. First, one would expect that students need regular supervision throughout the various stages of their studies. Second, 420 hours appears generous for "assessment", as it is natural to associate this category with "assessment of student learning outcomes". An explanation of what assessment actually entails would be helpful in order to judge whether 420 hours is appropriate or not. Regarding the second year, the plan provides for 300 hours industry contact. Again, an explanation of what "industry contact" entails would be helpful in order to establish an impression of what the students will encounter. 300 hours is a significant amount of time.

According to paragraph 6 of the master regulations issued by the Ministry of Education and Research the amount of individual work should be in the range of 30-60 ECTS. It is difficult to assess whether this requirement is satisfied or not from the table. The application should clearly explain how this requirement is met.

Conclusion

No, the institution's presented documentation is not satisfactory.

The institution is required to:

- provide an explanation of the numbers assigned to the various activities and what the various activities entail
- provide evidence that the amount of individual work is in the range of 30-60 ECTS

4.1.5 When part(s) of the provision is taught outside the degree awarding institution formally agreed documents must be in place to regulate issues of importance for the students.

Not applicable.

4.2 Study Plan

1. The educational provision must have an adequate title
2. The provision must be described with reference to learning outcomes
 - a) Learning outcomes must be expressed in terms of a candidate's intended achievements in knowledge, skills and general competence, as related to the National Qualifications Frameworks.
 - b) The provision's relevance for working life and/or continued studies must be clearly expressed.
 - c) Content and design of the provision must be satisfactorily related to the description of learning outcomes.
 - d) Teaching and student work must be suited for the achievement of intended learning outcomes, as expressed in the plan.
 - e) Exams and other means of evaluation must be suited for the assessment of the students' attainment of intended learning outcomes, as expressed in the plan.
3. The provision must have satisfactory links to research and academic and/or artistic development work, adapted to its level, volume and other characteristics.
4. The provision must be attached to student exchange and internationalization arrangements adapted to its level, volume and other characteristics.

4.2.1 The educational provision must have an adequate title.

Assessment

Applied Computing is a vague and broad title and the application does not refer to any formal definitions of applied computing. The term could be used in a number of specific fields besides the orientation specified in the application, such as oil and gas, meteorology and medical computing. In a broad sense "Applied Computing" could refer to all computing subjects that are not pure or theoretical. Since most of modern day computer science is applied, the title appears too broad in light of the modules offered and of what can be realistically covered by an academic staff of eight individuals.

The application further indicates that the programme is a specialization in Technology Integration. Technology is a very broad term that includes various sorts of hardware, and could refer to physical objects, such as pipes (systems of liquids and gas) and building material (technologies in the built environment). It would be more descriptive with a more narrow scope such as Software Integration.

Conclusion

No, the title of the provision is not adequate.

- The institution is required to provide a title for the programme that accurately communicates its contents and scope.

4.2.2 The provision must be described with reference to learning outcomes

a. Learning outcomes must be expressed in terms of a candidate's intended achievements in knowledge, skills and general competence, as related to the National Qualifications Frameworks.

The learning outcomes (from the application):

Knowledge: Candidates will have an advanced knowledge of applied computing as a research field, in terms of theories, knowledge claims, research methods, tools, technologies and professional standards. They will be able to apply this knowledge, and to reflect on how applied computing contributes to close the gap between research findings, business needs and societal aims.

Skills: Candidates will acquire practical skills in analysing complex organizational problems, research issues and technology innovation opportunities. They will be able to design, develop and evaluate solutions. Candidates will also have strong skills in applying research methods, research design and analysis techniques.

Competence: Candidates will take responsibility for solving complex tasks and conducting a research based IT project at a high standard in an organisation. This includes the ability to choose the appropriate research approach to choose and/or develop a solution, to act professionally and ethically, and to evaluate and communicate the results in a systematic way.

Assessment

The accreditation application describes the provision with reference to learning outcomes on page 10 and 11. The knowledge, skills and general competence are described in three short paragraphs, where each paragraph comprises a few sentences each with a list of learning outcomes.

From the rather short description, and with the setup used in the application, it is hard to recognize the generic learning outcomes specified by the National Qualification Framework. Several of the key aspects are covered, but the different generic learning outcomes are combined and mixed, and some of the generic learning outcomes appear to be missing.

The assessment of how the provision relates to the generic learning outcomes outlined in the National Qualification Framework will be much simplified if NITH instead uses a similar setup. That is, for instance the use of a bullet point for each distinct learning outcome listed in the same order. See for instance how they are listed by the Ministry of Education and Research:

<http://www.regjeringen.no/upload/KD/Vedlegg/Internasjonalt/engelskoversettelse.pdf>

The learning outcomes are also described as future goals (future tense). However, the National Qualification Framework emphasizes the description of the state of learning as it will be once the student has successfully completed the programme and has become a candidate (present tense).

The accreditation has only devoted three short paragraphs to explaining the learning outcomes without any elaborate explanations. The description of the learning outcomes is a crucial part of the accreditation and needs to be more thoroughly described.

Conclusion

No, learning outcomes are not satisfactorily described.

- The institution is required to describe learning outcomes according to the National Qualification Framework with distinct and separate bullet points for each learning outcome written in present tense

b. The provision's relevance for working life and/or continued studies must be clearly expressed.

Assessment

The academic profile of the provision signals high relevance and timeliness through the name and the contents of the various courses. The provision as a whole holds potential for providing candidates with a useful start to their professional careers in the software industry. NITH has close ties with relevant companies through projects at both bachelor and master level. The testimonials accompanied by the application confirm the relevance of the provision.

Futuristic topics such as the Internet of Things holds potential for motivating and inspiring students, but may compete with other courses that perhaps could be more directly relevant to candidates' first job.

Conclusion

Yes, the provision's relevance for working life and/or continued studies is clearly expressed.

- The institution is advised to further develop and describe the relevance of the more futuristic courses in the provision such as Internet of Things

c. Content and design of the provision must be satisfactorily related to the description of learning outcomes.

Assessment

Table 3 on page 13 of the application describes the relationship between the learning outcomes at the programme level and the learning outcomes at course level. However, the table only partially accounts for this connection as only one learning outcome in terms of knowledge, skills and general competences are covered for each course. Thus, the table does not provide answers to how the other learning outcomes are covered by the courses that constitute the provision.

We recommend that the description include concrete examples on how the learning outcomes are met by specific courses or activities. In the description of the individual courses (Appendix 8) most of the courses have no articulated prerequisites. Courses at master level should be at a more advanced level than bachelor courses and it should be clear from the course descriptions what students should already know. This is particularly important when recruiting students from other institutions, especially

internationally, as bachelor level course structures vary greatly and consequently it also varies what students bring of prior knowledge, skills and general competences into the study.

The following sections contain brief comments on the various courses:

Systems Development – it is a very ambitious course. It appears to be a mixture of a software engineering course and a research methods course. The committee finds it unusual to cover action research under this title.

Big Data – this is an exciting and timely topic. The academic staff does not have any documented competence to cover this topic, but have provided a recruitment plan to bridge the gap.

Visual Analytics – judging from the course description and its literature this course would probably be more easily recognized with the title “Information Visualization”. “Analytics” often refers to the discovery of patterns through various statistical methods and this does not seem to be a central focus of this course where the focus is on the presentation. Judging from the course description it is unclear what makes this a master level course as opposed to a bachelor level course. According to the learning outcomes this could easily have been an advanced bachelor level course.

Service and Integration Oriented Architecture – this is a timely topic which is highly relevant for many companies and organisations.

Agile Project Management – this is a timely topic, which is highly relevant for companies and organizations.

Mobile Computing – the title “Mobile Computing” can be used in various contexts, for example communications, mobile technology, mobile human computer interaction and mobile architecture. Judging from the course description the course ambitiously attempts to cover all of these. The risk with the current orientation is that it may become too superficial, not covering any of the subtopics in sufficient depth to merit being at an advanced (master) level. As reference, there are master courses offered at various institutions around the world that for instance focus exclusively on mobile communication in depth (protocols and networking).

Internet of Things – this is a timely, inspiring and futuristic topic that may provide students with inspiration and motivate their studies. However, the course description refers to “reading list” and “research articles”. What is the difference between the two?

Interactive Enterprise Technologies – this is an unusual title for a course. A simple google search for these three words gave only four hits. The title appears ambiguous, as it is unclear whether the focus is on interactivity or enterprise. According to the course description the course is actually concerned with “interactive technologies”. It is hard to see how “enterprise” fits into this course. The topic of enterprise computing usually have a quite different focus addressing the overall picture within the world of business (server side perspective), while interactivity usually is concerned with users and their interaction with machines (client side perspective).

Consulting and Leadership - it is hard to determine if this is a master level course. One may question whether students should have a separate course such as this or whether this should be an integral part of a project or other courses. Undoubtedly, consulting and leadership will be useful for candidates

completing this provision, but it is questionable whether 7.5 ECTS is sufficient to go into adequate depth for the course to be practically useful.

Research Methods – this is a crucial topic at master level and the key to a successful master project. The course description appears somewhat superficial and at the same time ambitious. The intentions are to cover both qualitative and quantitative methods, but how much quantitative and qualitative methods are realistic? In particular, what methods and techniques will the students be acquainted with? These details should be better documented through the learning outcomes.

Conclusion

No, the provision's content and design is not satisfactorily related to the description of learning outcomes.

The institution is required to:

- describe how the learning outcomes at programme level are connected to the learning outcomes at course level. The description must demonstrate that all the learning outcomes are covered by the courses that collectively comprise the provision.
- review prerequisite descriptions for each course to ensure that students have prior knowledge, skills and general competences to start the various courses
- narrow the scope of the course Mobile Computing
- rename the course Interactive Enterprise Technologies simply Interactive Technologies
- provide a more detailed description of the learning outcomes for the course Research Methods and sharpen its focus.

d. Teaching and student work must be suited for the achievement of intended learning outcomes, as expressed in the plan.

Assessment

The accreditation application provides a convincing description of how NITH intends to run the master programme. The application states that the provision will be achieved through lectures, seminars, group work, project work, reading of research articles, technical demonstration, presentations, written work and supervision. However, one gets the impression that the courses that makes up the provision all have a very similar structure, which suggest that the teaching and student work is not sufficiently varied. For example, most courses are structured in blocks of four weeks where the first two weeks are combinations of lectures and presentations in class and the two last weeks are for self-study and essay writing. It is not clear why essay writing is a good way to comply with learning outcomes within the different learning domains.

The application does not describe the expected progress of the students at the various stages of the programme and the internal relationship between the various modules is not clear. For half the courses there are no prerequisites and thus it is not clear how the courses progress to become increasingly challenging and build upon what the students already have learned in previous courses. It is problematic if half the courses are introductory without any prerequisites.

Moreover, the final master project starts after all the courses are completed. Perhaps by introducing a more varied structure could contribute to stimulating students' learning processes? NITH has strong links with relevant companies and these companies could be brought in to serve as case studies for both the curriculum and course work. The provision is highly relevant to industry and this connection to industry holds great potential for making the curriculum even more relevant and engaging.

It would be beneficial to students if the study plan contained more detailed descriptions of the various elements. Some examples include:

- the forms of teaching
- the coursework students are expected to conduct and the extent of the work
- the length of written work (number of words)
- what "technical solution" actually entails
- whether students are to work in groups or individually
- if the "literature" is mandatory or optional reading.

There are several 2nd cycle learning outcomes in the National Qualification Framework that are not clearly described in the application (see section 4.2.2a). Consequently, the application does not account for how the teaching and student work relate to these learning outcomes. Examples include "reflect", "work independently" and "contribute to new thinking and innovation".

Conclusion

No, the teaching and student work is not suited for the achievement of intended learning outcomes, as expressed in the plan.

The institution is required to

- describe the expected progress of the students and the internal relationship between the courses
- introduce more variation in the means used for teaching and student work
- revise the teaching and student work descriptions in the study plan to reflect changes in the learning outcome descriptions

e. Exams and other means of evaluation must be suited for the assessment of the students' attainment of intended learning outcomes, as expressed in the plan.

Assessment

Table 5 on page 15 describes which means of evaluation and examinations that will be used to evaluate the attainment of the intended learning outcomes. The table provides a somewhat superficial description of how knowledge, skills and general competence will be assessed in general terms. There are no details regarding the specific learning outcomes.

Moreover, the course descriptions provide few details regarding the evaluations and what are expected from the students. For instance, in several courses, the assessment is of type “Hand in”. It is not clear what this covers. Moreover, it is not obvious if written work is to be submitted as group work or as individual work. The length of written work (essays) and what aids students are allowed to use during exams is not specified, and the role of the products/applications developed by the students as part of the courses is not clear. Finally, it is not specified how a student can issue complaints in case of an unsatisfactory examination.

Conclusion

No, exams and other means of evaluation are not suited for the assessment of the students’ attainment of intended learning outcomes, as expressed in the plan.

The institution is required to:

- specify details regarding how the learning outcomes are evaluated and provide a justification of why the specific means of evaluation are chosen
- provide specific details regarding the evaluation in the study plan to avoid ambiguities

4.2.3 The provision must have satisfactory links to research and academic and/or artistic development work, adapted to its level, volume and other characteristics.

Assessment

The description of the provision shows strong links to research. The course material and curriculum in large parts contain research papers. Moreover, the course descriptions demonstrate that some of the academic staff members base their teaching on their own research when relevant. Students will also be included as active participants in ongoing research activities and thereby will gain first-hand research experience.

The research conducted by the academic staff has reasonably good links to the content of the provision.

The MoTeL laboratory is a laudable initiative, which holds great potential for motivating students to participate in ongoing research projects. Moreover, MoTeL could serve as an academic meeting point for active researchers and students.

Two of the courses in the study plan are indicated as providing students with relevant research method learning outcomes, namely Systems Development and Research Methods. It is an interesting idea to view Systems Development as a research methods course. The research methods course is ambitious with wide scope. One may argue that a more narrow scope will allow students to gain deeper learning outcomes instead of a superficial overview. Moreover, one may argue that introducing the research methods course earlier would give students the tools that allow them to better respond to the other courses that are research-based.

Another consideration is to run the same research methods courses for the two master provisions to achieve a student environment with critical mass allowing students to appreciate the breath of research through the other students.

Conclusion

Yes, the provision has satisfactory links to research and academic and/or artistic development work, adapted to its level, volume and other characteristics.

The institution is advised to:

- maintain a continuous focus on actively involving students in ongoing research activities. The students should be considered a beneficial research resource.
- consider including students as co-authors on publications where students have contributed significantly through their work. Student co-authorship can be developed as an indicator measuring the degree of research-based education.
- consider combining the students from both master provisions into single research methods classes.

4.2.4 The provision must be attached to student exchange and internationalisation arrangements adapted to its level, volume and other characteristics.

Assessment

The master programme will in its entirety be taught in English and thereby provide a promising platform for internationalisation at home. NITH is planning to recruit international students and the presence of international students on campus will contribute to the international experience for all the students enrolled into the programme. Moreover, NITH have recruited staff internationally, which also will be important for the internationalisation at home experience.

NITH has established a distinct, concentrated and mature portfolio of agreements with foreign higher education institutions. Although the number of institutions is small, each agreement is actively used. Brunel University in the United Kingdom is one of the institutions with which NITH has a long lasting relationship and documented results. The content of the master programme has an international orientation and student mobility is therefore a realistic goal.

The accreditation application does not describe how the international students will be recruited and how the international students will be accommodated and socially integrated.

Conclusion

Yes, the provision has systems for student exchange and internationalisation arrangements adapted to its level, volume and other characteristics.

The institution is advised to:

- devise a plan for how international students are to be recruited
- devise a plan for accommodating the inbound international students so that they become an integral part of the student environment at NITH

4.3 Discipline community/-ies attached to the provision

4.3.1 The composition, size and collective competence of the relevant discipline community/-ies must be adapted to the provision as the plan describes it and adequate for the conduct of relevant research and development work.

Assessment

The academic staff allotted to the provision is small, but satisfies the minimum requirements outlined in the regulations. The academic profile is closely tied to a small group of individuals and the programme is thus vulnerable to sudden changes in the group.

There is a satisfactory match between the academic profile of the academic staff and the academic profile of the master programme. This is especially visible in the course descriptions where the staffs' own research is represented in the curriculum.

None of the academic staff cover the area of Big Data and the committee's conclusion must therefore be negative, but NITH documents initiatives to recruit a new associate professor that will be able to cover this topic. When NITH can show an agreement of employment of an associate professor with academic profile described in the application, this demand is fulfilled.

The publication lists suggest that the academic staff collaborates and publishes research together. This is a laudable practice and contributes to the robustness of the group, and to stimulating the exchange of competence and experience between senior and junior researchers.

The academic staff documents many years of experience teaching at master level, especially through its collaboration with Brunel University, and through one year of running their own master programme in Information Systems.

Conclusion

No, the composition, size and collective competence of the discipline community/-ies is not adapted to the provision as the plan describes it, and is adequate for the conduct of relevant research and development work.

The institution is required to:

- employ an associate professor in Big Data with the academic profile described in the application

The institution is advised to:

- actively strive to strengthen the robustness of the academic staff allotted to the provision to achieve critical mass
- encourage the academic staff allotted to the provision to collaborate on the taught modules and research activities

4.3.2 At least 50 per cent of the academic FTEs allotted to the provision must be members of the institution's own academic staff. Of these, professors (full or associate) must be represented among those who teach the core elements of the provision.

b. For second cycle provisions, at least 10 per cent of the relevant discipline community/-ies must be full professors, and an additional 40 per cent associate professors.

Assessment

The academic FTEs allotted to the provision comprise eight academic staff which contribute 3.52 full-time equivalents (FTEs) into the programme. Two of the academic staff are full professors contributing 1 (FTE) which equates to 28.4% of the total academic effort. This ratio exceeds the minimum requirements of 10% full professors. Totally, seven of the academic staff are at associate level or above. This equates to 88% of the total effort, which is well above the minimum requirement of 50%.

One of the professors is assigned 20% to the provision and another is assigned to the provision full-time. Although this per definition is sufficient to satisfy the minimum accreditation requirements NITH should have short-term and long-term plans in place to handle long term sick-leave, death or notice of leave. What will NITH do in the case that NITH loses its core professor assigned to the provision? Where will NITH recruit short term professor qualified stand-ins, and how long will it take to replace a full time professor?

Conclusion

Yes, the criteria and the demands specific to the cycle of the present educational provision are fulfilled.

- The institution is advised to undertake a risk analysis and establish a plan to ensure a critical mass in its academic staff over time. The academic staff allotted satisfies the minimum requirements, but the group is highly vulnerable, especially in terms of professors.

4.3.3 The discipline community/-ies must be active in research and/or development work.

b. For the second cycle, documented results at a high level of quality.

Assessment

NITH has over the last decade demonstrated an impressive growth in the number of scientific publications from nearly no publication activity to an acceptable level considering the size of the group. According to the statistics presented in the application the publication output appears to have converged on approximately 12 publication points per year. The group published three level-2 articles in 2011, which is a convincing indication that the research conducted is at a high level of quality.

However, it is unclear from the application whether all these publication points represent the faculty members involved in the master programme only, or whether these represents the publication output of the entire NITH. Assuming the publication output listed correctly represents the faculty members involved in the master programme only, the group achieves 1.5 publication points per faculty member, which is average in the sector and indeed high for a small private university college.

Conclusion

No, the criteria and the demands specific to the cycle of the present educational provision are not fulfilled.

- The institution is required to confirm that the publication output in terms of publication points listed in the application actually cover the faculty members listed for the provision only. If this is not the case, NITH must provide correct publications statistics for the faculty members listed for the provision.

4.3.4 The discipline community/-ies must participate actively in relevant national and international networks and collaborative arrangements/projects.

Assessment

NITH participates in several formal and informal networks, nationally and internationally. Nationally, the academic staff allotted to the provision is actively involved in the NOKOBIT and NIK conferences, which constitute the main national academic meeting points for Norwegian computer science researchers. NITH is also an active member of the national council for information sciences. NITH also refers to several Scandinavian networks, including IRIS and the NORDPLUS mobility network.

NITH also participates in an EU framework 7 programme in collaboration with Brunel University in the UK.

The academic staff allotted to the provision at NITH are actively involved in editorial work and peer-review for various international conferences and journals relevant to the master programme. Some of these are considered prestigious such as the ACM CHI conference.

Conclusion

Yes, the composition, size and collective competence of the discipline community/-ies is adapted to the provision as described in the plan, and is adequate for the conduct of relevant research and development work.

The institution is advised to:

- continue to encourage the academic staff allotted to the provision to participate in national and international networks, and exploit the opportunities in attracting faculty members and international students
- continue to encourage the academic staff allotted to the provision to devote time and effort to editorial and peer-review duties in conjunction with conferences and journals

4.3.5 For provision with vocational practice/internship arrangements, the discipline community/-ies and the practice supervisors must have relevant experience from the practice field.

Not applicable.

4.4 Support functions and infrastructure

4.4.1 The institution must have rooms, library services, administrative and technical services, ICT resources and working conditions for their students that are satisfactory and adapted to the provision as described in the study plan and the number of enrolled students.

Assessment

NITH occupies modern premises in a central and attractive part of the capital. The application states that 200 m² are reserved for the master programme. It is not certain whether this space will be shared by the two master programmes, that is 100 m² per programme. However, it is beneficial if the two study environments are combined.

The MoTel-laboratory is a very positive and exciting initiative.

According to the accreditation application the NITH infrastructure includes a library that subscribes to the ACM digital library. This is a high quality source of highly relevant material and research that covers large parts of the research literature relevant to the master programme. To complete the collection, NITH could consider an institutional subscription to IEEE eXplore, which would complement ACM and probably cover some 80-90% of all relevant and updated research literature.

The accreditation application describes a satisfactory ICT infrastructure, LMS (Learning Management System) and other administrative services.

Conclusion

Yes, the institution has adequate support functions and infrastructure.

The institution is advised to:

- maintain focus on the suitability of the real-estate allocated to the students
- consider an institutional subscription to IEEE eXplore digital library
- actively promote the use of, and train students in the use of ACM-digital library as a resource in their studies
- continue the development of MoTel as a resource for students and faculty members, and actively use MoTel for marketing the programme in terms of potential students and society at large

5 Conclusion

On the basis of the written application with attached documentation, the expert committee concludes the following:

The committee does not recommend accreditation of the Master of Applied Computing at Norwegian School of Information Technology.

The expert assessment states which demands the institution is required to meet in order to achieve accreditation. In addition, the committee has provided advice for the further development of this educational provision.

The following demands are not met:

4.1.4 A plan of the students' expected workload must be presented.

4.2.1 The educational provision must have an adequate title

4.2.2a. Learning outcomes must be expressed in terms of a candidate's intended achievements in knowledge, skills and general competence, as related to the National Qualifications Frameworks.

4.2.2c. Content and design of the provision must be satisfactorily related to the description of learning outcomes.

4.2.2d. Teaching and student work must be suited for the achievement of intended learning outcomes, as expressed in the plan.

4.2.2e. Exams and other means of evaluation must be suited for the assessment of the students' attainment of intended learning outcomes, as expressed in the plan.

4.3.1 The composition, size and collective competence of the relevant discipline community/-ies must be adapted to the provision as the plan describes it and adequate for the conduct of relevant research and development work.

4.3.3 The discipline community/-ies must be active in research and/or development work.

The following demands must be met in order to achieve accreditation:

The institution is required to:

4.1.4 A plan of the students' expected workload must be presented.

- provide an explanation of the numbers assigned to the various activities and what the various activities entail
- provide evidence that the amount of individual work is in the range of 30-60 ECTS

4.2.1 The educational provision must have an adequate title

- provide a title for the programme that accurately communicates its contents and scope.

4.2.2a. Learning outcomes must be expressed in terms of a candidate's intended achievements in knowledge, skills and general competence, as related to the National Qualifications Frameworks.

- describe learning outcomes according to the National Qualification Framework with distinct and separate bullet points for each learning outcome written in present tense.

4.2.2c. Content and design of the provision must be satisfactorily related to the description of learning outcomes.

- describe how the learning outcomes at programme level are connected to the learning outcomes at course level. The description must demonstrate that all the learning outcomes are covered by the courses that collectively comprise the provision.
- review prerequisite descriptions for each course to ensure that students have prior knowledge, skills and general competences to start the various courses
- narrow the scope of the course Mobile Computing
- rename the course Interactive Enterprise Technologies simply Interactive Technologies
- provide a more detailed description of the learning outcomes for the course Research Methods and sharpen its focus.

4.2.2d. Teaching and student work must be suited for the achievement of intended learning outcomes, as expressed in the plan.

- describe the expected progress of the students and the internal relationship between the courses
- introduce more variation in the means used for teaching and student work
- revise the teaching and student work descriptions in the study plan to reflect changes in the learning outcome descriptions

4.2.2e. Exams and other means of evaluation must be suited for the assessment of the students' attainment of intended learning outcomes, as expressed in the plan.

- specify details regarding how the learning outcomes are evaluated and provide a justification of why the specific means of evaluation are chosen
- provide specific details regarding the evaluation in the study plan to avoid ambiguities

4.3.1 The composition, size and collective competence of the relevant discipline community/-ies must be adapted to the provision as the plan describes it and adequate for the conduct of relevant research and development work.

- employ an associate professor in Big Data with the academic profile described in the application

4.3.3 The discipline community/-ies must be active in research and/or development work.

- confirm that the publication output in terms of publication points listed in the application actually cover the faculty members listed for the provision only. If this is not the case, NITH must provide correct publications statistics for the faculty members listed for the provision.

The committee offers the following advice to develop this educational provision further:

The institution is advised to:

- clearly indicate that this is a 120 ECTS programme requiring 80 ECTS specialization for applicants in all relevant documentation
- identify how students will be recruited nationally and internationally
- devise a strategy for recruiting NITH's own bachelor candidates while preventing unconstructive internal competition with the other master programme in Information Systems
- identify how to ensure quality education for part-time students
- closely monitor the national student recruitment trends in computer science
- stimulate synergies and improved study environment by introducing common academic and social arenas for students enrolled onto the two master programmes
- further develop and describe the relevance of the more futuristic courses in the provision such as Internet of Things.
- maintain a continuous focus on actively involving students in ongoing research activities. The students should be considered a beneficial research resource.

- consider including students as co-authors on publications where students have contributed significantly through their work. Student co-authorship can be developed as an indicator measuring the degree of research-based education.
- consider combining the students from both master provisions into single research methods classes.
- devise a plan for how international students are to be recruited
- devise a plan for accommodating the inbound international students so that they become an integral part of the student environment at NITH
- actively strive to strengthen the robustness of the academic staff allotted to the provision to achieve critical mass
- encourage the academic staff allotted to the provision to collaborate on the taught modules and research activities
- undertake a risk analysis and establish a plan to ensure a critical mass in its academic staff over time. The academic staff allotted satisfies the minimum requirements, but the group is highly vulnerable, especially in terms of professors.
- continue to encourage the academic staff allotted to the provision to participate in national and international networks, and exploit the opportunities in attracting faculty members and international students
- continue to encourage the academic staff allotted to the provision to devote time and effort to editorial and peer-review duties in conjunction with conferences and journals
- maintain focus on the suitability of the real-estate allocated to the students
- consider an institutional subscription to IEEE eXplore digital library
- actively promote the use of, and train students in the use of ACM-digital library as a resource in their studies
- continue the development of MoTel as a resource for students and faculty members, and actively use MoTel for marketing the programme in terms of potential students and society at large

6 Commentary from the institution

Following is the detailed response to each of the demands stated as ‘not met’ by the committee in the expert assessment report of 5th of July 2013. All changes to documents that were part of the initial application are marked in yellow. Revised documents are attached as appendices to this response letter. For other documents referenced in application document, we refer to appendices submitted with the initial application.

4.1.4 A plan of the students’ expected workload must be presented

All course descriptions have been revised and the following fields have been added to further detail the various course specific activities: Teaching methods, coursework requirements, form of examination, use of examiners and examination support materials. An Excel sheet (See appendix 2) has been created to highlight the amount of time students spend on different activities in the courses. This adds clarity and detail to the course internal activities. To provide evidence of the amount of individual work in this master programme, section 1.4 in the application document has been revisited and a new table, detailing amount of individual ECTS for all courses, has been added. The amount of individual ECTS required are within the recommendation from the Ministry of Education and Research.

4.2.1 The educational provision must have an adequate title

We do acknowledge the committees recommendations of Applied Computing being a possible vague and broad title. We welcome this discussion and we have followed the committees’ recommendation to be more specific and therefor narrowed the master programme title to Master of Applied Computer Science. By doing this we stay in accordance with the practice from similar programmes in USA, Europe and Nordic such as; Master of Applied Computer Science (Univ. of Leuven, Belgium), The Institute for Applied Computational Science (Harvard Univ., USA), Msc in Applied Computer Science (Univ. of Memphis, USA) and Master of Applied Computer Science (HIG, Norway). Furthermore, this change removes the possible ambiguity for prospective students and the structure and description of the master programme should be easily recognizable for international students. We agree with the committee recommendation regarding the programme specialization and have subsequently changed the specialization title to Software Integration.

4.2.2a. Learning outcomes must be expressed in terms of a candidate’s intended achievements in knowledge, skills and general competence, as related to the National Qualifications Frameworks, 4.2.2c. Content and design of the provision must be satisfactorily related to the description of learning outcomes & 4.2.2d. Teaching and student work must be suited for the achievement of intended learning outcomes, as expressed in the plan.

We agree that the mapping between learning outcomes at programme level and learning outcomes at course level were only partially covered in the table in section 2.2.c. This table has been removed to avoid confusion. The overall learning outcomes at programme level have been detailed and follow the

language and set-up suggested by the qualification framework. The learning outcomes description in section 2.2a has been revisited and rewritten. Bullet points, following the convention from the National Qualification Framework, now describe each category of learning outcomes and in addition the written text describing each learning outcomes category has been extended and now provide a more thorough description. The learning outcomes of each of the courses have also been revisited (See appendix 3) and each bullet point has been reassessed in order to follow the national qualification framework and express the desired learning outcome. With this effort, the learning outcomes from course level are aligned with the learning outcomes at programme level, and the mappings between the two levels are easy to see given the use of amalgamated vocabulary.

The course descriptions in the study plan have been revised to show the expected progress of the students throughout the master programme. Each course description has been revisited and internal relationship (if required) has been indicated as a part of prerequisites. This should ensure both a clearer relationship between associated courses in the programme, as well as highlight required prerequisite knowledge from prospective students. The course descriptions have also been given more details in relation to teaching, student assessment, coursework requirements and examination details. The course descriptions and the study plan have added depth and show clearer how the courses are thought, the variety of methods used, how the students work and how the students are evaluated. The academic breadth and depth are described in section 2.2.c of the application. Here both the progression of the programme is described, and a new table with accompanying text illustrates how the learning outcomes at programme level are mapped to the individual modules. We thank the committee for their valuable suggestions in this matter.

The course description of Mobile computing has been revisited and narrowed to have the intended focus of applied mobile computing. The course now concentrates the focus on application development, user interface and mobile application software architectures. Please see the course description document, appendix 3.

The learning outcomes of the course Research methods has been detailed further. The focus of the module and its activities has also been revisited and a more thorough description added. Please see the course description document, appendix 3.

Interactive Enterprise Technologies has been renamed Interactive Technologies, following the committee's recommendation. Please see the course description document.

4.2.2e. Exams and other means of evaluation must be suited for the assessment of the students' attainment of intended learning outcomes, as expressed in the plan.

The learning outcomes of the proposed Master programme aimed towards the acquisition and application of research-based domain knowledge, general and specific problem solving skills, professional preparedness and market readiness with advanced software craft, and development of general competencies including reflective practice with an awareness for and adherence to professional ethics. The rationale for the chosen examination forms have been further detailed in section 2.2.e of the application document.

4.3.1 The composition, size and collective competence of the relevant discipline community/-ies must be adapted to the provision as the plan describes it and adequate for the conduct of relevant research and development work.

After submission of the original application in FEB 2013, we have employed two new members of faculty.

- Per Lauvås (CV in appendix 5) has background as a practitioner from the field of computer science and holds a certification in SQL server. He has worked as a consultant within the field of business intelligence. In the Big Data course Lauvås will contribute to the theoretical and practical aspects.
- Lars Sydnes (CV in appendix 4) holds a PhD in Mathematics and will contribute to the mathematical and algorithmic part of the course.

With this composition of faculty, we plan to run the Big Data module as a joint module shared between these two lecturers and Prof Vatrapu. Accordingly, we have updated the table in section 3.2 as well as Table 3 from Chapter 5.

4.3.3 The discipline community/-ies must be active in research and/or development work.

We confirm that the publication points listed in the application actually cover the faculty members of NITH. We have now also included a separate table showing the publication output in terms of publication points for only the faculty members listed for the provision. Please refer to the updated section 3.3

Appendices to Response Letter	Appendix nr.
Updated Application for Accreditation document	1
Spread sheet highlighting activities in the courses	2
Revised plan of programme (course descriptions)	3
CV Lars Sydnes	4
CV Per Lauvås	5

7 Expert committee's additional evaluation

The committee has studied the revised application with its supplementary documentation and is impressed with the effort and dedication NITH has put into the revision to enhance the quality. The committee concludes that the program can be accredited in light of the changes made.

4.1.4 A plan of the students' expected workload must be presented

NITH has provided an explanation of the numbers assigned to the various activities and elaborated on what the various activities entail. NITH has provided a table showing that the amount of individual work is in the range of 30-60 ECTS.

Conclusion: NITHs account is convincing.

4.2.1 The educational provision must have an adequate title

NITH has modified the title of the provision from Applied Computing to Applied Computer Science with Specialization in Software Integration. However, the specialization is not mentioned on the front page of the application and thus leaves some ambiguity about whether Software Integration is actually part of the title or not. It is important to accurately communicate the content of the provision when communicating with external stakeholders for instance when recruiting students such that the actual contents match the students' expectations. The title of the educational provision is thus adequate provided the specialization in Software Integration is explicitly mentioned together with Applied Computer Science.

Conclusion: NITHs account is convincing.

4.2.2 The provision must be described with reference to learning outcomes

a. Learning outcomes must be expressed in terms of a candidate's intended achievements in knowledge, skills and general competence, as related to the National Qualifications Frameworks.

The study plan has been revised according to the National Qualifications Frameworks. Each learning outcome is listed as a separate bullet point making it easier to make reference to NQF. The learning outcomes are correctly written in present tense.

Conclusion: NITHs account is convincing.

c. Content and design of the provision must be satisfactorily related to the description of learning outcomes.

NITH has done an impressive job reworking the study plan according to the National Qualifications Frameworks. A table is added to the application showing the connections between the learning outcomes at program level and the learning outcomes at the course level. However, this table is not matching the actual study plan as it indicates more connections than there seems to be. For instance, learning outcome K (relating to innovation) could only be found in the course Interactive Technologies, while the table suggests that this learning outcome is related to a total of 8 courses out of the 11 courses. The course description for Interactive Technologies is convincing in terms of leading to learning outcome K related to innovation.

It is hard to see a clear connection between some of the other learning outcomes at program and course level. For example, in Systems Development it is not obvious which program level learning outcome “can select the appropriate models, theories, and frameworks for technology integration oriented information system development” is connected with. Other examples include “can examine memory resident databases and streaming technologies which allow analysis of data on the flight” in Big Data. NITH should work on streamlining and clarifying the learning outcomes and make the connection between program and course level learning outcomes obvious to the reader. Moreover, some of the subtle learning outcomes in the National Qualifications Frameworks could be more obvious and explicitly stated at course level such as “independent work” in learning outcome N or “communicate with practitioners” in learning outcome O.

The same is the case for the other generic learning outcomes. The committee’s reason for approving the application despite these flaws is that all learning outcomes seems to be represented in the course plan such that students are exposed to all of these generic learning outcomes. The fact that the application is technically incorrect is thus given less emphasis. NITH is however encouraged to devote attention to the relationship between learning outcomes at program and course level to ensure that the master provision is adhering to national standards.

A prerequisite section has been added to each course. This gives some indication of what students is expected to know a priori. NITH is encouraged to continue to develop the course description so that also prerequisites are referring to learning outcomes.

The scope of the course Mobile Computing is narrowed to fit applied computing with a focus on application development, user interfaces and architecture.

The course Interactive Enterprise Technologies has been renamed to Interactive Technologies as suggested by the committee.

The revised course description of Research Method is now much improved with more specific and focused. The learning outcomes seem well suited for a master program in applied computer science.

Conclusion: NITHs account is convincing.

d. Teaching and student work must be suited for the achievement of intended learning outcomes, as expressed in the plan.

The study plan has been revised according to the National Qualification Frameworks and the student work is sufficiently related to the learning outcomes. The plan now more clearly expresses the expected progress of the students and the intended relationship between the courses. Each course description has a prerequisite section specifying which other topics students must know before taking the course. NITH is encouraged to further develop the prerequisite sections in terms of learning outcomes instead of topics as stated previously. The revised plan expresses sufficient variation in work description. NITH is encouraged to continue to work on improving the student work in order to maximize learning.

Conclusion: NITHs account is convincing.

e. Exams and other means of evaluation must be suited for the assessment of the students' attainment of intended learning outcomes, as expressed in the plan.

The study plan has been clarified to include vital details regarding exams and evaluation forms and what is expected from the student, such as length of written work. The revised application justifies the choice of exams and evaluation forms and these are related to learning outcomes. NITH has chosen to employ group work in programming related courses and individual essays in the other courses. Matching exams and evaluation forms with learning outcomes is challenging. NITH is therefore encouraged to continue to search for, experiment with and try different forms of examination and evaluation forms to find forms that directly relates to, and suitable for, the specific learning outcomes.

Conclusion: NITHs account is convincing.

4.3.1 The composition, size and collective competence of the relevant discipline community/-ies must be adapted to the provision as the plan describes it and adequate for the conduct of relevant research and development work.

NITH has since the original application was submitted recruited two individuals who have the competence to cover the subject Big Data.

Conclusion: NITHs account is convincing.

4.3.3 The discipline community/-ies must be active in research and/or development work.

NITH has confirmed that the statistics provided in the original application included the full research output of NITH at institutional level and thus were misleading. NITH has provided a convincing revised statistics for the research output for the individuals listed for the provision. The level of the research output shows that the collective group is active in research and development.

Conclusion: NITHs account is convincing.

8 Decision³

Vi viser til Norges informasjonsteknologiske høgskoles søknad til fristen 1. februar 2013 om akkreditering av mastergradsstudium i Applied Computer Science with Specialization in Software Integration (120 studiepoeng). De sakkyndige avga sin uttalelse i rapport datert 5. juli 2013 med tilleggsvurdering av 17. september 2013.

Vi vurderer at vilkårene i NOKUTs forskrift om tilsyn med utdanningskvaliteten i høyere utdanning av 28. februar 2013 nå er fylt, og har dermed truffet følgende vedtak:

Mastergradsstudium i Applied Computer Science with Specialization in Software Integration ved Norges informasjonsteknologiske høgskole akkrediteres. Akkrediteringen er gyldig fra vedtaksdato.

NOKUT forutsetter at Norges informasjonsteknologiske høgskole fyller de til enhver tid gjeldende krav for akkreditering. I tillegg forventes at Norges informasjonsteknologiske høgskole vurderer de sakkyndiges merknader og anbefalinger i det videre arbeidet med utvikling av studiet.

For mastergradsstudier som NOKUT akkrediterer, må institusjonen selv søke Kunnskapsdepartementet om rett til å etablere studiet.

9 Documentation⁴

13/149-3 Supplering av søknad - akkreditering av Master Programme in Applied Computing

13/149-13 Tilsvarende sakkyndig rapport - Norges informasjonsteknologiske høgskole - søknad om akkreditering av Master Programme in Applied Computing

³ The decision is not translated into English, but in the letter informing the applicant of the decision, we write the following: "It is NOKUT's assessment that the conditions in NOKUT's Regulations concerning NOKUT's supervision and control of the quality of Norwegian higher education of 28.02.2013 now are met, and the master degree program in Applied Computer Science with Specialization in Software Integration (120 credits/ECTS) at The Norwegian School for IT is accredited. The accreditation is valid from the date of the decision."

⁴ The titles of the documents are in Norwegian, but most of the documentation is written in English.