

Aarhus University

Graduate School of Technical Sciences (GSTS)

International Evaluation report 2021

Version 2021-10-26

Evaluation of the Graduate Schools of Aarhus University

Background

According to the Ministerial Order no 960 of 14 August 2014 (concerning the Act on Universities) § 14, 5 the Rector and the head of the Graduate School shall initiate an evaluation of the University's Graduate Schools.

Aarhus University has initiated evaluations of its Graduate Schools. Each evaluation will take the form of an international evaluation based on two elements: a self-evaluation report written by the individual school, and a visit to the school by an international assessment committee.

This is the report from the 2021 evaluation of the Graduate School of Technical Sciences.

Aarhus University will write up the final evaluation and a plan for implementing the recommendations.

The reports will be made public on the graduate schools' websites.

Composition of the international panel

As head of the GSTS PhD school, vice dean for research Brian Vinter at the AU Faculty of Technical Sciences has appointed the following international panel:

- Professor Peter Sestoft, panel chair, head of Computer Science Department, IT University of Copenhagen, Denmark
- Professor Åsa Helena Frostegård, Norwegian University of Life Sciences (NMBU)
- Professor Marc Van Meirvenne, dean of the Faculty of Bioscience Engineering, Ghent University, Belgium

Procedure

The Graduate School of Technical Sciences (GSTS) prepared a self-evaluation report based on existing data. The report and its appendices were sent to the international panel on 13 September 2021.

It should be taken into consideration that this international evaluation occurred right after 18 months of uncertainty and lock-downs caused by the covid-19 pandemic, which have adversely affected most PhD students, particularly with respect to the mobility requirement.

The international panel's site visits took place Monday 11 October to Wednesday 13 October 2021 according to the time schedule below, showing which students, faculty, managers and administrators the panel met (but not showing breaks, meals, intra-panel meetings, etc):

Monday 11 October 2021		
13:30-14:15	Short introduction and discussion with the Graduate School Management	<ul style="list-style-type: none">● Brian Vinter, vice dean, Head of PhD school● Damian Goldberg, Head of division● Maria Fauery Iversen, Head of administrative department
14:30-15:45	Meeting with Heads of PhD programs	Lis Wollesen de Jonge, Agroecology Peter Borgen Sørensen, Ecoscience Alexandre Magno Barbosa Anesio, Environmental Science Carl-Otto Ottosen, Food Science Stefan Hallerstede, Engineering Ole Højbjerg, Animal Science
16:00-17:00	Meeting with PhD committee	<ul style="list-style-type: none">● Lis Wollesen de Jonge, Head of PhD committee● Morten Frederiksen, Senior Researcher● Marianne Hammershøj, Associate Professor● Stefan Hallerstede, Associate Professor● Kasper Heiselberg, Vice-Chair of PhD committee● Mathilde Pauline Coutant, PhD student● Laura Sofie Harbo, PhD student
Tuesday 12 October 2021		
09:00-09:45	Meeting with PhD students	<ul style="list-style-type: none">● Christian Elkjær Høeg, Engineering, CAE● Josephine Baunvig Aagaard, Engineering, BCE● Illia Oleksienko, Engineering, ECE● Thea Lykkegaard Møller, Food Science● Jens Søndervindgab Kvist Jensen, Engineering,

		MPE
10:00-10:30	Tour at department of Food Science	<ul style="list-style-type: none"> • Jette Feveile Young, Associate Professor
10:30-11:15	Meeting with supervisors	<ul style="list-style-type: none"> • Zili Zhang, Engineering, CAE • Edzard Spillner, Engineering, BCE • Alexandros Iosifidis, Engineering, ECE • Ramin Aghababaei, Engineering, MPE • Qian Janice Wang, Food Science
11:15-12:15	Transport to Foulum	
13:15-14:00	Meeting with PhD students	<ul style="list-style-type: none"> • Claudia Nielsen, Agroecology • Peter Lystbæk Weber, Agroecology • Nikolaj Peder Hansen, Animal Science • Egil Gautason, Quantitative Genetics and Genomics
14:15-15:00	Meeting with supervisors	<ul style="list-style-type: none"> • Marie Trydeman Knudsen, Agroecology • Jim Rasmussen, Agroecology • Nuria Canibe, Animal Science • Ole Fredslund Christensen, Quantitative Genetics and Genomics
15:00-15:45	Tour on Campus Foulum	<ul style="list-style-type: none"> • Morten Maigaard Sørensen, PhD student, Animal Science
16:45	Transport to hotel	
Wednesday 13 October 2021		
07:15-10:00	Transport to Campus Roskilde	
10:15-11:00	Meeting with PhD students	<ul style="list-style-type: none"> • Xiuqing Hao, Ecoscience • Ane Paster Rollan, Ecoscience • Ate Hendrik-Jan Jaarsma, Environmental Science • Marie Rønne Aggerbeck, Environmental Science
11:00-12:00	Tour on Campus Roskilde	<ul style="list-style-type: none"> • Anne Winding, PhD supervisor
12:45-13:30	Meeting with supervisors	<ul style="list-style-type: none"> • Jonas Teilmann, Ecoscience • Anne Winding, Environmental Science • Berit Hasler, Environmental Science

The self-evaluation report and the site visits were very well prepared and supported by the PhD school. The panel especially acknowledges the help from Liselotte K. Heller and Brian Vinter in planning, framing, note-taking, procuring additional requested documents and data, transport, and so on.



The panel at one of AU Foulum's modern experimental stables, with PhD student Morten Maigaard Sørensen (left) and several cows. Photo by Liselotte K. Heller.

Origin and organization of the PhD School

The Graduate School of Technical Sciences (GSTS) was created on 1 June 2020 when the former Graduate School of Science and Technology (GSST) was split into a Science PhD school and a Technical Sciences PhD school (namely the GSTS evaluated here), following a corresponding split of the former Faculty of Science and Technology into two.

The GSTS PhD school is organized with a Head of PhD School (the vice dean), a joint PhD Committee (with a chair and co-chair), one local PhD Program per department (each with a Head of Program), a council consisting of the PhD Program Heads, as well as a local PhD Committee for each department (presumably), an Admissions Committee, and a PhD administration, which also comprises PhD Partners who support students. Clearly some PhD students and supervisors were not aware of everybody's role and the available support, despite the generally high information level. **The panel recommends** that a more detailed graphic is made to communicate the structure described above, and possibly that PhD Program Heads share more information about best practices and valuable ideas with each other.

Supervisors and PhD students consider the PhD school administration to be very well-functioning and of high quality. **The panel recommends** to make sure the administration's high quality is preserved.

Initial comments

Due to the legal framework (the ministerial order, "bekendtgørelse om phd-uddannelsen") Danish PhD programs, including GSTS's PhD programs, are strictly time-limited to 3 years, which is short compared to most international programs. Moreover, there are heavy demands on a PhD student, including 30 ECTS coursework, considerable dissemination/teaching requirements and a stay at another academic institution or a relevant industry, preferably abroad, in addition to producing research results, papers and a dissertation. The panel observes that the short duration and the many demands limit the amount of time available for research and exploration, and can be especially challenging in subjects with experimental work depending on growing cycles (e.g. agriculture) or for remote fieldwork (e.g. in Greenland) (eg. environmental science) and the like.

Nevertheless, the panel finds that the GSTS PhD school is highly successful and efficiently organised, securing a high quality and delivering competent PhD graduates to the job markets in academia (approx. 50% of graduates 2018-2020) as well as in the private sector (approx. 35%) and the public sector (approx 15%).

Our general impression is that there is a strong belief in the PhD system among the students and most of the staff, and everybody we spoke to is strongly motivated to obtain the best possible result. The PhD students seem satisfied with their PhD education and say that they appreciate the bounded duration over a project that might drag on for 5-6-7 years, although several PhD students stated that they would like to have more time for research. Most PhD students find that the imposed tasks (courses, teaching, dissemination, mobility, paper writing, ...) add value as an education in academia. A large majority obtain their PhD within the 3-year time frame, and only a few (approx. 10%) drop out of the program entirely. The PhD supervisors seem happy with the quality of PhD students, the organization of the PhD studies and the resulting research and dissertations.

Progress Management and Quality Assurance of the Individual PhD study

The progress of the students is followed up regularly through evaluations every 6 months (although a few students, particularly in Roskilde, were frustrated with the online PhD Planner reporting system and did not feel that their reports in the system were taken much into account). In some cases the students present their results to each other every 6 months, which we find to be a valuable part of the training. The mid-term exam is a very good check-point to evaluate whether the student is on track.

The supervisors are generally satisfied with the program and defend the choices they make within the program. However, they express strong concerns about securing sufficient funding. The recent change from one third faculty co-funding up front at the start, to output funding some time (up to 2 years) after a successful defence, has caused a time interval in which the funding is entirely a responsibility of the supervisor, which was raised as a concern by multiple supervisors (but not PhD students, who fortunately seem shielded from such concerns). **The panel recommends** clearer communication about this change and how negative consequences will be mitigated.

Quite a number of PhD students experienced periods of stress and some even of burn-out requiring professional medical help during their PhD study. This was largely due to the many requirements of the PhD program, sometimes in combination with family duties (small children) or due to communication problems with the supervisor (and also the covid-measures causing more isolation). Although the School provides help to find appropriate psychological health care if needed, it was mentioned several times that a neutral and independent point of contact (an independent 'ombudsperson') to talk to would be a welcome solution. **The panel recommends** that the GSTS PhD school identifies such a person and communicates the existence of such help/service on the School website, guaranteeing confidentiality and impartial advice.

The panel observes that it may be difficult to publish the results in good/acceptable scientific journals within the 3-year period. Our impression is that most students have at least one published paper in their thesis, but often also unpublished manuscripts. More published papers are common in many countries, especially those that allow a longer PhD period. Some students foresee that they will continue to work on these manuscripts together with the supervisors post-defence, maybe during a postdoc period. Some supervisors raised, however, concerns that writing papers after the students have left is a heavy task.

The requirement for 30 ECTs of PhD courses, which is similar to many other countries in Europe, is appreciated by the students.

By contrast, **the panel is concerned** about the "dissemination" requirement of 280 h/year, which we find to be a large part of the 3-year PhD education. Moreover, it is interpreted in different ways within the Faculty. For some programs it means using these hours for teaching at lower-grade courses. The PhD students emphasized that they like teaching and that they learn from it, but the amount of teaching is a heavy load on an already very tight schedule for some

PhD programs, particularly in the Engineering departments where the university apparently is dependent on the PhD students in order to be able to deliver the course portfolio (particularly practical exercises). On the other hand, PhD students in eg. the ENV and ECO have no possibility to teach, which they experience to be a gap in their PhD education.

The panel recommends to decrease the teaching burden in cases where the entire time for “dissemination” is used for teaching, and make sure that the PhD students can take part also in other, relevant “dissemination” tasks and, conversely, to arrange that all students have a chance to get some teaching experience.

The mobility requirement (“stay abroad”) requirement seems to work well in general. Most students find, in collaboration with their supervisors, relevant places to visit, mostly in other academic institutions in Denmark (a possibility which was relaxed during the covid-traveling restrictions) or abroad. These visits are well integrated in their PhD project and the results, in the form of publications, usually become part of the PhD thesis.

Internationalisation of the PhD education

The PhD school has a good balance between Danish and international students, and in aggregate a fair gender balance.

All the PhD students and supervisors we met indicated good international relations and outlook for the projects, and publications in international venues.

Some international students, especially at Campus Roskilde, indicated that some talks and communication and many informal interactions took place in Danish, and felt somewhat excluded for language reasons. **The panel recommends** more awareness of inclusion in research environments where international PhD students are recently introduced.

It seems that there are uneven practices concerning the financing of each PhD student’s travel, conference participation, etc. **The panel recommends** to consider the allocation of an annual bursary (e.g. 10,000 DKK) for each PhD student to use at his or her discretion, to somewhat even out the wide variation otherwise caused by the departments’ and PhD students’ financial resources.

Geographical diversity

The actual PhD programs of the GSTS PhD School are found in multiple locations: Aarhus (the Engineering programs), Skejby near Aarhus (Food Science), Foulum near Viborg (Agroecology, Animal Science, Quantitative Genetics and Genomics, 70 km from Aarhus), and Campus Roskilde (Ecoscience, Environmental Science, 280 km by road from Aarhus).

Quite some heterogeneity exists among the departments with respect to the way they interact with PhD students. At the departments in or near Aarhus, PhD students are intensively included in the educational programs of a department (sometimes to the extent that it is claimed that without PhD students it would be impossible to deliver all teaching duties), while at other departments (in Foulum and Roskilde), students indicate to have very little to even no access to teaching opportunities. A better spreading of the teaching duties among departments would be a way to remediate this situation.

The panel recommends that the PhD school supports the PhD students and their supervisors in making sure that the teaching requirements never go beyond the maximal 280 hours/year and that it does not interfere negatively with the research contents of the PhD studies. In those departments that have little actual teaching to ask the students to do, **the panel recommends** a relaxed interpretation of the mandatory work hour requirements.

The situation of non-centrally located departments (at Foulum and especially at Roskilde) requires special attention. These groups sometimes experience a strong feeling of detachment from the core university activities in Aarhus. Initiatives to strengthen their bond to the Aarhus campus would be strongly welcomed. Some students at Campus Roskilde expressed frustration that the schedules of courses held in Aarhus were not adapted to them (they have to leave from home at 04:00). Also, they do not feel well included in the PhD school. **The panel recommends** to provide help with overnight accommodation for PhD students travelling to Aarhus for mandatory courses, and also other adaptations such as social gatherings in the evenings so that PhD students from different campuses get better acquainted with each other.

Also in more general terms, the situation at Campus Roskilde seems peculiar, showing a certain feeling of isolation and exclusion from “big AU” in the Aarhus region. The research groups located at this campus indicate that they have little teaching possibilities and fewer opportunities to meet the other obligations, yet they belong to a university whose main task is to provide education. As a consequence their research activities do not filter into the teaching to BSc and MSc students, and they cannot profit from getting to know students prior to selection procedures for e.g. a PhD position. The lack of teaching opportunities also means that the PhD students at this campus have few possibilities to develop teaching competences. While this problem complex is probably neither particular to the PhD school nor easily solved, it does appear to be an acute problem for the PhD students. **The panel recommends** taking some initiatives to mitigate the general problem of “feeling isolated”, eg (a) make sure that there is at least one co-supervisor at a university campus (AU Aarhus, DTU, CBS, KU, RUC, ...) to create an additional scientific environment for the Campus Roskilde PhD students, helping them finding their way into the AU system and supporting them to obtain the required skills; (b) allocate a pool of funds for arranging shorter (2-14 days) PhD courses at Campus Roskilde to attract other PhD students there (c) make sure PhD Partners and other PhD school administrative staff visit Campus Roskilde regularly - as appears to have happened in the past; (d) improve the local networking for PhD students at Campus Roskilde across ENV5 and ECOS.

Questions from the PhD School self-evaluation

The self-evaluation report page 42 lists several specific questions that the panel answers as follows:

In comparison with international standards,

- *Do we perform well on recruitment in connection with recruiting top talented Danish students and students from top universities to the PhD study at GSTS?*
The panel finds that the numbers and geographical distribution of applicants are impressive, and most supervisors stated that they found that it was possible to recruit very able PhD students, although some supervisors in Foulum and Roskilde found that it was sometimes difficult to recruit good applicants, and that it might perhaps be especially difficult to attract Danish applicants due to the somewhat remote locations.
- *Do we at the same time perform well in recruiting bright international students immediately after they obtain their Bachelor's degree?*
The panel finds that only a rather modest number of PhD students follow the "flexible" model, and furthermore that this proportion is decreasing over the years, from 11% in 2015 to 5% in 2020 (self-evaluation Table 3). This indicates that some efforts need to be made to "market" this model if indeed it is a goal to attract international students right after their BSc degree.
- *Do we ensure the possibility for PhD students with e.g. family obligations to go on extended research visits abroad? Do we do it well?*
The panel lacks detailed information on this point, but anecdotally it seems that PhD students with family do find ways to arrange such stays, that some financial support is available from the PhD school, from private foundations and possibly local departments, but that more systematic support might be valuable.
- *Do the departments in connection with the PhD studies secure a representative gender balance?*
The panel finds that in aggregate across PhD programs, there is a good gender balance (self-evaluation Table 4), but that apparently this is not so in all the individual programs.
- *Do we perform well by our drop-out rates?*
The panel finds that the drop-out rates and failure rates are admirably low, considering the many demands and constraints on the PhD studies.
- *Do we have a proper level of supervision?*
The panel finds that the supervisors are highly engaged in the planning and supervision of the PhD studies, which indeed is necessary given the short duration and many demands. To quote one supervisor, "there is pressure right from the start".

- *Do we perform well in integrating our PhD students in the relevant research environments, particularly international PhD students?*

The panel finds that PhD students are well integrated in the research environments, with the exception of some students at Campus Roskilde who felt somewhat isolated.

Conclusions

Overall, the GSTS PhD school performs very well given the many constraints on Danish PhD programs, and most PhD students and supervisors we met found it possible to conduct meaningful PhD projects leading to international peer-reviewed publications and good PhD dissertations within this framework. The PhD graduates from the School seem to be in high demand in academia as well as in industry.

Signed

Professor Peter Sestoft
Professor Åsa Helena Frostegård
Professor Marc Van Meirvenne