Dnr GU 2022/1697

Ä9 ITFS 2023-05-31
Inkom ITF kansli 2023-03-27

Utbildningsutvärdering med extern bedömning
vid Göteborgs universitet

Bedömarutlåtande för Datavetenskapligt program (N1COS) vid IT-fakulteten

March 27, 2023

Kort bakgrund

IT-fakulteten vid Göteborgs universitet utsåg 9 juni 2022 en extern bedömargrupp för bedömning av det datavetenskapliga kandidatprogrammet (DV) vid Göteborgs universitet. Följande fyra personer utsågs:

- Johan Jeuring, professor, Universiteit Utrecht, Nederländarna.
- Dana Dannélls, docent, Göteborgs Universitet.
- Tjark Weber, universitetslektor, Uppsala Universitet.
- Karol Ostrovsky, arbetslivsrepresentant.

Johan Jeuring har varit ordförande för gruppen. Bedömargruppen höll ett tretal förberedande möten (via Zoom) och gjorde 21 och 22 november 2022 ett platsbesök på IT-fakulteten (agendan bifogas).

Bedömargruppen har därefter med utgångspunkt i underlag och platsbesöksintervjuer via (Zoom) möten och ett delat dokument gemensamt utarbetat sitt bedömarutlåtande.

Resten av utlåtandet är på engelska enligt bedömargruppens uppdrag (Dnr GU 2022/1697).

Summary

We think the DV program is a good, interesting, and relevant program. The students in the program appreciate the ability to make their own choice for a relatively large part of their curriculum. The quality of the final theses is good for a bachelor program in computer science. Students easily find jobs after the program, sometimes after taking a master program, at interesting work environments. The students and teachers are generally enthusiastic. The program leader is easy to approach.

In this report, the assessment committee gives its assessment of the program. The report is structured according to the eight assessment criteria set out in *Policy for quality assurance and quality development of education at the University of Gothenburg*:

1. the actual study results correspond to the learning goals and end terms;
2. the teaching in the program focuses on students' learning;
3. the content and form of the teaching is based on scientific knowledge;
4. the number of teachers is proportional to the size and content of the program and teachers have up-to-date knowledge of their subject, and of university pedagogy computer science didactics;
5. the program is relevant for the students' and society's needs;
6. the students have influence on the planning, implementation and follow-up of the program;
7. the study and learning environment is accessible and suitable for all students;
8. continuous evaluation and development of the program is carried out.

After our assessment based on these criteria, we have collected some other comments about the program.

1 Goal fulfillment

The national examination goals are defined in Annex 2 of the *Higher Education Ordinance* (1993:100). The program-specific examination goals are defined in the program syllabus (Dnr GU 2021/2401), as well as in the document *Lokal Examensbeskrivning* (Dnr GU 2021/2402). The working document *Programbeskrivning för Datavetenskapligt Program vid Göteborgs Universitet* (version March, 2022) contains a "program design matrix" (in Section 4.2) that connects program-specific examination goals with mandatory courses on the program. The examination goals are then reiterated as learning outcomes in each course syllabus.

According to the program design matrix, not all learning goals are addressed in mandatory courses: learning goal 5c, the evaluation of new technologies, is not covered. Otherwise, we consider the selection of mandatory courses and their contents appropriate for the program-specific examination goals. The coverage of national examination goals is less clear, as these are not currently included in the program design matrix. Likewise, it is unclear how elective courses contribute to goal coverage, as these are not currently included in the matrix either.

The course DIT792 *Introduction to Computer Engineering* was made mandatory in 2022/23. This change suggests that a basic understanding of computer architecture could be included in the program-specific examination goals.

The courses on calculus (MMGD30) and linear algebra (MMGD20) appear not strongly connected to the rest of the program. Although mathematical understanding is a learning goal in itself for the program, there are good opportunities to connect these courses to subjects like computer graphics, machine learning, and possibly more, but this does not seem to happen. Doing so would also help answer the questions some students have about why these courses are part of their program.

The program includes a relatively large amount (67.5 credits) of elective courses. We understand that the program considers the resulting flexibility for students a strength, and that it helps to differentiate the program from other (similar) programs available to students in Gothenburg.

We received and studied a number of bachelor theses, and course information such as exams, rubrics, etc. Our conclusion is that goals, exams, examination forms and progression are generally fine. The quality of the final theses is good for a bachelor program in computer science. We understand there is a very thorough process for assessing the bachelor theses at the end of the program, and we applaud the existence and application of detailed evaluation criteria (*Bedömningskriterier för skriftlig rapport i kandidatarbetet, HISS*). However, this assessment was not very transparent to the alumni that we interviewed. They were unclear about the criteria and the role these criteria play in the individual assessment, and they were not entirely sure why they got the grade they received.

Moreover, there are shortcomings in the individual assessment of thesis projects, which are typically carried out in groups of five to six students. Alumni reported that freeloading was not uncommon. Examiners confirmed that the

available documentation that students submit during the course DIT561 *Kandidatuppsats inom Datavetenskap* is not always sufficient to rule out freeloading. This is a well-known problem with individually assessed group projects in general: 'bright students' are incentivized to contribute more than their fair share, while 'poor students' are incentivized to exaggerate their own contributions.[1] On the thesis course, we believe the relatively large group size and the fairly independent working conditions for students to be factors that exacerbate these issues. The former appears to be the result of resource constraints (rather than primarily pedagogically motivated). To ensure adequate assessment and establish that each student individually meets the course goals, we recommend to significantly reduce the group size.

Recommendations

1. Include the national examination goals (as defined in Annex 2 of the *Higher Education Ordinance*) in the program design matrix, and connect them with courses in the program.

2. Include elective courses in the program design matrix, and connect them with (both national and program-specific) examination goals.

3. Include a basic understanding of computer architecture in the program-specific examination goals.

4. Make the more over-arching learning goals such as ethics, collaboration and presentation skills, evaluation of (new) technologies, explicit, and relate them to the various courses in the program.

5. Ensure that every examination goal is covered by at least one mandatory course. Revise course syllabuses (or impose restrictions on combinations of elective courses) as needed.

6. Connect the mathematical courses more strongly with the rest of the program, for instance by discussing suitable examples/applications from computer science in these courses.

7. On the course DIT561 *Kandidatuppsats inom Datavetenskap*, provide a brief written justification of the individual course grade to each student.

8. Reduce the group size for thesis projects on the course DIT561 *Kandidatuppsats inom Datavetenskap* to (usually) three students.[2] Increase teaching resources for the course accordingly.

[1] M. J. Pitt, *The Application of Games Theory to Group Project Assessment*, `https://doi.org/10.1080/135625100114876`

[2] This should be compliant with the rules for bachelor thesis projects at Chalmers (see *Föreskrift för kandidatarbete på Chalmers - genomförande och examination*), which seem to require groups of three to six students.

2 Student-centered learning

Teaching in the program is rather similar to how computer science is taught at academic institutions over the world. Courses are commonly taught through a combination of traditional (teacher-centered) lectures and more student-centered methods, such as exercise sessions and computer labs. Certain courses, for instance DIT561 *Kandidatuppsats inom Datavetenskap* and the (elective) course DIT257 *Agil projektledning*, make substantial use of group work, project work and other forms of student-centered learning. The program offers a variety of examination forms, and course guides are generally informative.

Feedback to student learning is provided in several ways, where teaching assistants apparently play a prominent role. We got the impression that students do not make extensive use of other forms of feedback on their work, and the program might think about how it can further give feedback on student progress within a course, without further adding to the workload of teachers. This is challenging, but there are successful practices using peer feedback, or early assessment and subsequent assessment of the improvements.

The introductory course taught when students arrive at the program, before the first courses start, gives a good overview of the program and relevant practical information. Quite a few students we talked to were no longer aware of that information. We think it would be good to pay attention again to practical aspects of the program when the program leadership meets with the students in the later years of their study.

Students perform a research project in a group of five or six students at the end of the program. We had the impression that the step from taking courses to performing a group research project was rather large, but the results of the group projects showed that the students could deal with this. Nevertheless, preparing students for the research project with some education on research methods, such as formulating research questions, selecting appropriate research methods, and analysing results from experiments, might be beneficial.

Recommendations

9. Discuss questions and practical issues related to the program also in the meetings with the students in the program in years 2 and 3.

10. Think about how to give further feedback on student progress within a course, without further adding to the workload of teachers.

11. Teach research methods before students start on their thesis project.

3 Education's scientific and experience base

The content and form of the teaching is based on up-to-date scientific knowledge from computer science, computer science education, and higher education didactics. Almost all courses regularly update their literature. In the majority

of courses the course literature consists of scientific peer-reviewed articles and online course books, usually freely available online. Guest lecturers from industry regularly give invited lectures in some of the (usually elective) courses in the program.

4 Teacher competence and capacity

Most teachers in the program are enthusiastic educators with many years of experience and the required educational skills necessary for the individual courses and the program as a whole. They teach and supervise students at all levels of education. All teachers have at least basic pedagogical training and students are in general satisfied with the pedagogical aspects of the courses. The teachers in the program interviewed by us had the ambition to deliver excellent teaching, and routinely tried to improve it. Some courses in the program involve guest lecturers from industry. These lecturers usually do not have pedagogical training, but we do not consider this to be a problem. Engaging guest lecturers seems to work well both for the teachers and the students.

There are several ways in which the department stimulates good teaching and pedagogical development. Teachers need to take pedagogical courses to be promoted to Docent. Good teaching is rewarded with teaching prizes, and sometimes contributes to salary negotiations. These are measures on the individual level.

The courses in the program often use teaching assistants (TAs) in lab and exercise sessions, to help students, and to give feedback on their work. The quality of this feedback is perceived as good, but from our discussion with the students, not constant, and in some cases teaching assistants had to learn as much as the students themselves.

Recommendations

12. Think about how to reward groups of teachers in addition to individual teachers for good results in teaching.

13. Check that TAs have the required background when assigning them to a course.

5 Relevance for students and society

At least three teachers teaching in the program have active engagement with industry on both national and international levels through (research) collaborations. Guest lectures, project collaborations and thesis projects with societal partners are arranged regularly, but on an ad-hoc basis as far as we could see.

Students generally have no problem finding jobs after they finish the program. Elective courses allow students to choose part of their program based on their interests. These courses can also help students to prepare for a role

in the field or industry of their choice. Some students mentioned that choosing elective courses from other university programs in order to create a more multi-disciplinary individual program was hard.

Many industrial projects are performed in groups. Collaboration skills, such as giving feedback, breaking bad news, or conflict resolution are not or hardly taught and practiced to a level that is expected in industry today. The lack of group-work competency development might also impact the thesis work where students work in groups of five or six, see Section 1.

Recommendations

14. Investigate the possibility to allow a wider selection of elective courses.
15. Teach collaboration skills to prepare students for group work in the thesis project and later in their professional life.

6 Student influence

Students are represented at several levels in the program. At the strategic level, students are represented in the program council/board.

After a course is finished, students are asked to evaluate it. Relatively few students fill out the evaluation form. Students, and to a lesser extent teachers, expressed two concerns in the interviews:

- The evaluation form is rather long, and contains almost always the same standard questions. See Section 8 for a related recommendation.
- Many courses are taken by Chalmers and DV students together. In many cases there are more Chalmers than DV students, which makes it difficult to influence the course by DV students.

Students have informal ad-hoc discussions with the program leader and teachers on social media and in the Monaden student area in the EDIT building.

7 Accessibility and effectiveness of learning environment

The physical environment is generally adequate. We note positively that there are many spaces available for students to work in groups (both with and without prior reservation), and that lecture halls are routinely equipped with AV equipment for streaming/recording. The campus is accessible for students with mobility impairments. Course materials are available online (usually in Canvas, sometimes separately). Students and teachers expressed satisfaction with the learning environment.

There appears to be a lack of lecture halls of sufficient size for some of the larger courses in the program. Sometimes lectures have been streamed into a

second lecture hall to accommodate all students. We consider this solution less than ideal for an on-campus study program.

We note the absence of active learning classrooms (at Campus Johanneberg) that would facilitate group work or other forms of student-centered learning. The lecture halls that are available were designed for traditional (teacher-centered) lectures; their layout discourages the use of other pedagogical approaches.

We also note that the classroom equipment that is available in computer lab rooms is not uniform. Some lab rooms are equipped with whiteboards and projectors, while other lab rooms offer neither. Providing such equipment in all lab rooms could facilitate communication between teaching staff and students during computer labs.

The university has an obligation to ensure the accessibility of digital content (cf. *Lag (2018:1937) om tillgänglighet till digital offentlig service*). It is not clear to us that there is a systematic effort to meet these accessibility requirements. Course pages and documents that are not accessible could present challenges especially for students with special needs.

Students with a documented permanent disability can apply for study support from the university, and are welcome to contact the program leader, study advisor or course examiner to discuss their needs. According to *Regler för examination på grundnivå och avancerad nivå vid Göteborgs universitet* (Dnr V 2018/1223), such students may be entitled to individually adapted examinations. As pointed out already in the previous (2016) evaluation of the program, this should be noted in course syllabuses. The university's *Handbok till Regler för examination*[3] suggests the following formulation:

> "Om studenten har ett beslut från [Göteborgs] universitet om särskilt pedagogiskt stöd på grund av funktionsnedsättning har examinatorn rätt att ge ett anpassat prov eller låta studenten genomföra provet på ett alternativt sätt."

Program students have access to a study advisor, both via drop-in and (if desired) by appointment. We note positively that this position was recently filled again (after it had been vacant for some time), and we expect that this will lead to improvements for students who are in need of study advice. We hope that this will also allow to reinstitute an "early warning" routine, where the study advisor (or some other suitable person) actively identifies students that are falling behind in their studies, and contacts them to offer study advice. Identification of such students could perhaps be partially automated (e.g., via a database query that selects students based on recent study results).

There are collaborations with university-wide support structures on specific courses: for instance, the University Library and the Unit for Academic Language assist in teaching the course DIT561 *Kandidatuppsats inom Dataveteskap*. These collaborations are generally perceived as beneficial; students especially consider the University Library to be a great resource.

[3] `https://medarbetarportalen.gu.se/studieadministration/handbok/anpassad-examination/`

Recommendations

16. Estimate the size and type of teaching facilities that will be required (at Campus Johanneberg) in the future, taking into account changing student numbers and pedagogical approaches. Create a plan to meet these needs both in the short and in the long term.

17. Install a whiteboard and (where possible) a projector in all computer lab rooms.

18. Decide how the legal requirements for accessibility of digital content should be implemented. Provide staff training for teachers and others who create digital content.

19. Revise course syllabuses to include a formulation that permits individually adapted examinations for students with a documented disability.

20. Implement an "early warning" routine to identify and offer study advice to students that are falling behind.

8 Continuous evaluation and development of the education program

We note positively that the recommendation of the previous (2016) evaluation to create a program board has been implemented, although it appears that this board has only met once so far. Going forward, we hope that the program board will provide valuable assistance to the program leader, for instance by regularly discussing course evaluation results, course syllabuses, the program curriculum, and other changes and quality issues on the program.

Courses are mainly evaluated through course evaluations. Such course evaluations are required for all courses by law (see *Higher Education Ordinance* (1993:100)), but it appears that they are not regularly conducted for the thesis course DIT561 *Kandidatuppsats inom Datavetenskap*. This should be rectified.

We understood that many teachers in the program meet informally in their department. However, there does not seem to be a structured forum for teachers to discuss how their courses fit together with other courses on the program, could be developed to better address the needs of the program, etc. In particular, communication with teachers outside the Department of Computer Science and Engineering seems to be lacking. Also, there does not seem to be a forum where teachers meet to discuss aspects related to teaching and share best practices. Many teachers develop their teaching by performing innovations or experiments, but there is no good way to share these.

Course evaluations are conducted as anonymous surveys. A standard template with over 30 questions is available for this purpose. Teachers can add course-specific questions. Students have expressed a preference for shorter feedback forms and think that these would lead to better response rates on course evaluations.

Course evaluation results are discussed in a course committee meeting between (at least) the program leader, the course teacher and student representatives. We applaud the existence of these meetings, which we think are an excellent way to follow up on course evaluation results and to improve individual courses. However, it appears that students are not systematically informed about changes made to courses in response to these results.

As part of the documents we received, we got an overview of the "genomströmning" of the program. These numbers look very low. For example, from the 62 people that started HT2016, 6 received their degree until March 2021. We asked several of the people involved in the program if they recognised these numbers, or if they had an explanation for them, but we did not receive a clear answer.

The program is reasonably popular: since 2020, there have been more than 100 first-choice applicants each year for its (usually) 70 places. The required merit value (BI) for admission in the second selection round was 16.61 in 2022. In terms of admission merit, this places the program in a good mid-range when compared to other bachelor programs in computer science in Sweden.

In 2022, about 24% of all applicants and 16% of admitted students were female. This ratio is not unusual for bachelor programs in computer science in Sweden. The percentage of female applicants has increased since 2016.

Recommendations

21. Look more closely at when students finish, or where students go during their studies. Perhaps discuss with other study advisors about how to keep track of students.

22. Evaluate all courses (including *DIT561*) through course evaluations.

23. Institute a regular forum for all teachers on the program to meet and discuss course and program development, and to share best practices (perhaps together with the other teachers in the department).

24. Review the course evaluation template to find a good balance between level of detail and number of questions. Focus on relevant questions that will provide actionable feedback.

25. Systematically (e.g., in the course guide and/or in the introduction lecture of each course) inform students about changes that were made to a course since the last course evaluation.

9 Other issues

Gender balance

None of the obligatory courses in the program is taught by a female teacher. We think female role models are important to try to retain and increase the

amount of female students in the program.

Some teachers try to explicitly include literature from female authors in their course, which we applaud.

Practical issues

Students sometimes find it hard to find information about the program, the facilities, and which sets of elective courses they can choose. We understand that the program is working on providing information to the students in a more structured way and applaud that.

There are situations where course entry requirements (prerequisites) are not applied strictly, e.g., during the first year of the program or when a required course/exam immediately precedes the course that requires it. This practice leads to confusion among students about their eligibility for courses. It is problematic also from the perspective of legal fairness. Since there are typically good reasons for these exceptions (for instance, *Regler för examination på grundnivå och avancerad nivå vid Göteborgs universitet*, Dnr V 2018/1223, allows for at least 15 workdays to report exam results), we do not suggest to abolish them, but rather to make them explicit in the formulation of course entry requirements. For instance, a formulation like "genomgången kurs X" (or similar) could be used to indicate that students must have taken the course X (and are expected to be familiar with its contents) but need not have formally passed it when the admission decision is made.

Moreover, it appears that course entry requirements are interpreted differently depending on which university admits students to a course. This is problematic since many courses on the program are also (jointly) taken by students from Chalmers University of Technology, and the differences in admission practice lead to differences in students' prior knowledge. This affects students negatively, especially on courses that utilize group work.

The administrative process to change a course syllabus can take very long. In particular, for courses given in the autumn, it is not always possible to effect a change in time for the next course instance (in the autumn of the following academic year). Therefore, clear shortcomings in the way a course is delivered sometimes cannot be rectified in a timely manner; or teachers deliberately ignore the course syllabus to improve course quality. Clearly, neither of these outcomes is ideal. For courses that are taught annually, it should be possible to change the syllabus between successive course instances.

Recommendations

26. Involve female teachers (lecturers, guest lecturers, TAs) in the program.

27. Create a visual representation of the dependencies between (both mandatory and elective) courses on the program, to aid students in their course selection.

28. Formulate course entry requirements in a way that agrees with actual admission practice, and ensure their consistent application to all students.

29. Review and if possible shorten the process for syllabus changes, particularly for courses given in the autumn. Consider introducing multiple deadlines per year.