

Statement from evaluation of the bachelor program in Software Engineering and Management at Göteborgs Universitet

1. Summary

1.1 Strengths

- The high level of teachers' academic and pedagogic records.
- The high engagement and willingness to cooperate amongst the teachers.
- The high engagement of the program coordinator.
- The topic and focus of the education program are highly relevant for the expanding job market in the IT-related sector, both locally and internationally.

1.2 Development areas

Contents of the program:

- The large amount of project courses makes it hard to follow the progress of the individual students and provide individual examination.
- Progression in management subjects is under-documented in the course plans. Management research amongst teachers is under-critical.
- The required prerequisites of the students are very general, which makes it necessary to start at a low level to make everyone prepared to fulfill their studies.

Management of the program:

- Make use of CDIO-matrices to relate individual courses to the learning goals. Experience shows that compiling all courses into a matrix for the entire study program is a good way to ensure coverage of goals and to identify development areas.
- It takes a long time to establish course plans and the result is often very general. This is partly due to that the systems for GU (Göteborgs Universitet) and Chalmers differ. Too general course plans make it hard for students and teachers to plan the courses. It also makes them less transparent for evaluation and improvement.

1.3 Next step

The evaluation committee recommends the faculty to initiate a discussion of the balance between the relatively many project courses and theory courses. Project courses can be excellent to train the practice of Software Engineering, so the discussion should focus on the volume and role of this training rather than the number of courses. When a conscious strategy is formulated, work in finding learning outcomes and means to follow the progression of the individual students can be initiated.

2 Evaluation criteria

In the directives to the evaluators, GU requested a statement of 8 predefined questions that we have translated into English and answered in the following subsections.

2.1 The actual study results corresponds to the learning outcomes and the higher education ordinance exam objectives

Below we briefly reflect on the program setup, its prerequisites, learning outcomes, and how the syllabuses reflect these. The Higher Education Ordinance states three key competency areas in its Annex-2; Knowledge and understanding, competence and skill, and judgment and approach.

The program addresses the knowledge and understanding criteria with a breadth and some depth in the software engineering subfield. One doubt is if students obtain the required skills in the computer science area, with the current setup with two courses, the mathematical foundation course and a course on algorithms and data structures. The program's major, software engineering, is well covered, that is, the program provides courses that cover the entire software life-cycle at a general level and additionally provides more specialized courses focusing on, for example, specific system types or development techniques.

The competencies and skills described in the Annex-2 include crucial abilities for a practicing software engineer; problem-solving, communication, and information management. Several courses in the program introduce students to best practices and allow them to practice in close to realistic settings. The students practice primarily in a relatively large number of project courses although most courses include activities that also check these competencies and abilities.

We have used two models to evaluate the coverage of the program at the course level. The Software Engineering Body of Knowledge is a community-driven initiative that aims at defining a body of knowledge for practicing software engineers. The ACM/IEEE computing curriculum is the second model we used. It maps knowledge and skills more connected to basic computer

science. Based on this mapping we may confirm that the program covers software engineering knowledge and practices.

Based on the evaluation of syllabuses using the Higher Education Ordinance competency areas, SwEBok, and the ACM/IEEE computing curricula we may say that the program setup meets the expected criteria. However, some potential weaknesses are the frequent use of project-based learning and a lack of computer science training.

Project-based learning poses several challenges on the students and teachers. It is often less clear for students what the expectations are and how the assessment is conducted. Many students also raise concerns regarding teacher biases. From the teacher perspective, similar concerns arise. It is challenging to develop and execute a transparent assessment on an individual basis. That often requires more effort monitoring project teams frequently, often several times a day. If the program manages to control all potential vulnerabilities that come from project-based learning it is an effective way to teach software engineering practice and train abilities and skills. However, there are several pitfalls must be avoided and project-based learning require that teachers, in particular, are on high-alert for the duration of the projects.

Below we briefly reflect on the program setup, its prerequisites, learning outcomes, and how these are reflected in the course syllabuses. We use the Higher Education Ordinance states in Annex-2 for structure

HEO-A2	N1SOF - Bachelor	
Knowledge and understanding	Comments	
<ul style="list-style-type: none"> demonstrate knowledge and understanding in the main field of study, including knowledge of the disciplinary foundation of the field, knowledge of applicable methodologies in the field, specialized study in some 	Questionable: The main field, software engineering is well catered for. However, management and computer science are two areas that could be a larger part of the program	
Competence and skills		
<ul style="list-style-type: none"> demonstrate the ability to search for, gather, evaluate and critically interpret the relevant information for a formulated problem and also discuss phenomena, issues and 	Satisfactory: Mainly covered in the thesis course and project courses. Questionable if the program succeeds in evaluating student individually.	

situations critically		
<ul style="list-style-type: none"> demonstrate the ability to identify, formulate and solve problems autonomously and to complete tasks within predetermined time frames 	Satisfactory: Mainly covered in the thesis course and project courses. Questionable if the program succeeds in evaluating student individually.	
<ul style="list-style-type: none"> demonstrate the ability to present and discuss information, problems, and solutions in speech and writing and in dialogue with different audiences, and 	Satisfactory: Mainly covered in the thesis course and project courses. Questionable if the program succeeds in evaluating student individually.	
<ul style="list-style-type: none"> demonstrate the skills required to work autonomously in the main field of study. 	Satisfactory: Mainly covered in the thesis course and project courses. Questionable if the program succeeds in evaluating student individually. Work in teams yes, however, autonomously is not always in teams.	
Judgement and approach		
<ul style="list-style-type: none"> <i>demonstrate the ability to make assessments in the main field of study informed by relevant disciplinary, social and ethical issues</i> 	Satisfactory: However difficult to assess from the documentation and interviews. Assessment of these abilities is challenging.	
<ul style="list-style-type: none"> <i>demonstrate insight into the role of knowledge in society and the responsibility of the individual for how it is used, and</i> 	Satisfactory: However difficult to assess from the documentation and interviews. Assessment of these abilities is challenging. Mainly covered in project courses. Questionable courses succeed in evaluating students individually on these topics.	
<ul style="list-style-type: none"> <i>demonstrate the ability to identify the need for further knowledge and ongoing learning.</i> 	Questionable: Mainly covered in project courses and the thesis project. Challenging to assess based on the documentation and interviews. Assessment of these abilities is indeed challenging.	

2.2 Teaching puts students' learning in the center

GU has a programme of four courses of five credits concerning pedagogical and educational skills. Section 2.4 provides the overall assessment of the skills of the teachers engaged in the program.

The criteria used for the assessment are unified from GU's pedagogical idea program, from the Swedish Student Union proposal, and from the reports of the national conferences on pedagogy in HE:

- *Criterion 1, University's learning environment:* the physical and virtual space, in the way to promote interaction between teachers and students and between students; teachers' skills and development to visualize, document and disseminate their experiences of teaching, including different forms of feedback, from students, colleagues, management, etc.; supportive organisational structures for teachers and students.
- *Criterion 2, Student's responsibility:* students are expected to take significant responsibility for their own learning process and they are expected to acquire, seek and create knowledge with others.
- *Criterion 3, Students' expectations in HE:* to be able to motivate students to take responsibility; to be able to use the students' views - evaluation and feedback; to be able to meet students' different needs - through varied teaching methods.

Findings:

- The physical space is satisfying. Some limitations refer to the rooms' capacity (max ~100 students), and to limited access to some all-purpose and meeting-type rooms for the GU students compared to Chalmers students.
- The virtual space is satisfying to an average extent. The students find the flipped-classroom method as not successfully applied, and there are complaints on the quality of video recordings of the lectures.
- Teachers' pedagogical skills are in overall satisfying, with the exception, according to the students, of the math course.
- Students' responsibilities should be improved to systematically engage students, in the form of a representative group, in the follow-up of each and every course; currently, this involvement is not systematic. Students additionally ask to be represented in the faculty board.
- Students' expectations are to be more engaged during teaching sessions, in different ways, as well as to have better-functioning contacts with the course teachers for Q&A.

2.3 The content and form of teaching and the form stands on a scientific and/or artistic basis and proven experience

The program engages 13 teachers, all having a Ph.D. degree or higher. All of the teachers are actively doing research in the research areas very well-corresponding to their teaching subjects; that is seen from their CV's, as well as from online available research impact metrics. This is a very good pre-condition for providing high quality for the scientific basis of the course. In addition, a few teachers are having real industrial experience, and many have been participating in the projects in the areas belonging to the program.

Findings:

- The literature of the courses is well recognized. Besides the course books, some of the courses also point to “recommended reading” that can be used for students to broaden or go in-depth with their studies. This is a good practice worth to follow. Two project-oriented courses do not state book-type course literature - for DIT092, the relevant and concrete literature sources should be explicitly stated; and for DIT112 the given sources are not complete, i.e. the full references are missing.
- The theoretical foundation on the “non-project” courses is appropriate and progression is in overall good and clearly recognizable.
- The theoretical foundation is not sufficiently provided on the “project” courses, such as core concepts, principles, and methods, and therefore academic progression is not fully satisfactory as appointed by the students; while the practical value is appreciated. A recommendation is to improve these courses by giving core theoretical foundations about the practices being done on the courses.

2.4 Teachers have timely and adequate subject, pedagogical, and educational skills; the number of teachers is in proportion to the scope of training and content

The list of teachers comprises 21 teachers whereof 18 also submitted a short CV. One teacher is not in the list and is borrowed from another department. In terms of research areas the group of teachers involved in the courses of the program (13 persons) covers:

- Requirements engineering
- Software architecture
- System and software design
- Software processes

- Software testing
- Software quality
- Organizational change
- Relevant domains, such as: Automotive, Human aspects, and Web-based systems.

Findings:

- The research areas amongst the teachers correspond very well to the technical courses.
- Only one teacher has research in management, but many teachers have research connected to managing software projects. This is a vulnerability that might be solved with cooperation with teachers that conduct research in management.
- No teacher is a professional mathematician. Students expressed problems with the mathematics course that might be attained with collaboration with the mathematics department.
- When reviewing the courses' PM and course evaluations, four teachers seem not to be involved in any courses in the old or the new program.

As regards pedagogical and educational skills GU has a programme of four courses of five credits each.

Findings for all 18 teachers:

- The median number of credits is 18, which is very satisfying. No teacher lacks pedagogical training.
- In total, the group of teachers has 47 pedagogical publications, which is also very satisfying.

2.5 The training is relevant to the needs of the students and society

We base the assessment primarily on discussions with staff and students. The program is offered at Campus Lindholmen in Göteborg, one of the fastest expanding job markets in northern Europe for IT-related jobs, which is both a strength and a threat to the program. There is a connection to industry in guest lectures and projects that students conduct with a connection to companies. It is clear that the students are attractive on the job market, which indicates that the program is relevant for society and also students, assuming their primary concern is to secure a job after the education.

It seems like a majority of the graduated students start a job in the industry, sometimes even before graduating. A rather small group continues with studies on an advanced level.

2.6 The students have an influence on the planning, implementation, and monitoring of the training

The students of GU, similarly to other Swedish universities, have a number of common rights and obligations stipulated by laws and regulations at the state level (such as Högskolelagen and Högskoleförordningen), while some other are local regulations. On GU, the main documented rules are as following:

- The university must give the students who participate in or have completed a course, the opportunity to present their experiences and views on the course through a course evaluation organized by the university. The University compiles the course evaluations and informs students about the results and any decisions that are due to the course evaluations.
- The head of department or equivalent is responsible for ensuring that students who participate in or have completed a course are given the opportunity to anonymously present experiences and views on the course.

Findings:

- The course evaluation, individually and anonymously performed by the students, is the main means used for influencing the planning and implementation of the courses included in the program.
- A majority of the courses do have individual evaluation reports, 2 are missing.
- The incentives for performing evaluations are missing, according to the students.
- It is the program director who, with students representatives, course teachers, and the student counselor, review the quality of the courses individually, upon their completion; this is done based on students' course evaluation. This is well organized and owing to a good engagement for the program's director.
- In a majority of the courses, the student course representatives can make contact and convey feedback during the course, i.e. not only on completion. This should be ensured as a functioning mechanism for all the courses.
- The final reviews/proposed changes are not systematically presented to next-year students, i.e. some teachers inform about them, and some not. This should be ensured for all the courses.

A suggestion for the future would be that the student union organizes the course evaluations for a set of related study programs. It's probably better if course representatives are elected by their fellow students and meet a few times per year to share their impressions and develop the feedback to GU together. This way the students can follow-up on the input they give and the students will be more motivated to contribute to the long-term development of the program.

2.7 An appropriate study and learning environment is available for all students

The physical learning environment seems adequate; it's not brought up as a large problem during interviews. The size of the classrooms set the maximum students admitted to the courses and the programme.

There are different IT-platforms for GU and Chalmers which complicates the access of information and communication for the students. IT resources in general, such as network, computer labs are not brought up as a problem during interviews.

International students require much help in the beginning, both with practical things and the study environment. There is an information day at the beginning of the education. The study counselor invites students to a drop-in cafe if they have questions about their studies.

The study counselor is the first contact for students with problems and refers them to appropriate helpers. For students with permanent disabilities, there is a University-level organization at GU that handles pedagogic support to give all students equal opportunities to complete the studies.

2.8 There is a continuous follow-up and development of the study program

There is a well-defined process for changes in the program, where the program coordinator prepares suggestions together with the department. Changes are decided by the education board and finally the dean of the faculty. It normally takes a year to make a change operational.

The role of the program coordinator is well understood, but not formally described. The program coordinator has de facto a large personal responsibility in following up the results of the program and initiating changes. Both support personnel, teachers and students testify that Richard Bertsson-Svensson is a very engaged program coordinator.

A formal description of the program coordinator role and having a deputy program coordinator is recommended.

Course evaluations with student representatives are performed each time the course has been given.

Teachers testified that they discuss teaching across courses informally, in regular meetings, and in workshops.

The faculty and the department develop a three-year operational plan each year including actions raised from improvement suggestions found by evaluating the present way of working.

At GU level there is a quality policy. There are basically three processes for quality assurance:

1. Local, continuous development and follow up. This is specially focussed on the compliance with national rules and the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG). This work is done both on faculty as well as the department level.
2. External evaluations, such as the one reported here are performed in six-year intervals if the study programme is not evaluated in the six-year cycle per request from the UKÄ. These evaluations are initiated by the faculty education board.
3. The rector of GU makes an annual follow-up of the quality work by the faculties and the quality policy itself. Workshops for education development, sharing of experience among the different faculties, and benchmarking are offered to all faculties.

These procedures are ambitious and are in line with other successful universities. The faculty-initiated external evaluations in item 2 are very ambitious.

About the evaluation

The evaluation group had the following members:

Kristian Sandahl, professor, Linköpings universitet. Chairman.

Jelena Zdravkovic, professor, Stockholms universitet

Jesper Andersson, docent, Linnéuniversitetet

Viktor Elliot, universitetslektor, Göteborgs universitet

Kim Van Loo, student representative, Göteborgs universitet

The group have received an initial set of documentation about both the old and the new programs and made an on-site visit with interviews with management, teachers, students, and support personnel 2018-11-14.

Additional documentation have been requested and delivered without any problems.