

EXTRA CURRICULUM, CIVIL AND STRUCTURAL ENGINEERING STUDIES AT UNIVERSITY OF AGDER, NORWAY

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ABSTRACT

The Bachelor of Science education in engineering is limited by the Norwegian Ministry of Education and Research (UHR) to 180 points in the European Credit Transfer System (ECTS). A normal study progress is three years consisting of two semesters, totally 6 semesters comprising courses summarising up to 30 ECTS. In 2011 a new framework for engineering educations was introduced by UHR. All institutions offering engineering education had to adjust their curricula according to the new requirements by the fall semester of 2012. When planning these changes, the University of Agder (UiA) decided to retain 60 ECTS fundamental courses in all engineering programmes.

A special Industrial Reference Group (IRG) has been established for supporting the Civil and Structural (C&S) engineering education at UiA. This group consists of stakeholders from all major types of employers for C&S engineers; building clients, consultancies, contractors, producers, and municipalities. The IRG supported the decision on retaining the thorough foundation of fundamental courses. However, the different groups of stakeholders in the IRG deviated strongly from one another, when discussing the content of the remaining 120 ECTS.

Conclusively, the IRG supported UiA's final decision on total content in the C&S education programme. The programme now comprises important subjects for all parts of the industry. However, a long list of topics requested by the different stakeholders had not been included in the programme, due to lack of space. To accommodate the unsatisfied requests from industry, the concept of "Extra Curriculum" was introduced. The idea is that industry and other stakeholders offer courses to the students on topics that are considered vital by stakeholders, but that is not included in the education programme. The university approves the curriculum, assignments and execution plan and organises the courses, while the stakeholder suggests the curriculum and does the lecturing. This service from the industry (or another stakeholder) should be given free of charge to the university and the students.

Multiple Extra Curriculum courses have been offered by members of IRG and even by stakeholders that are not members of the IRG. One unplanned outcome of this activity is that several companies have approached UiA asking if their employees can participate in the courses. Another result is that the members of the reference group now state that students that have participated in Extra Curriculum courses are prioritised in hiring processes.

Keywords: Civil engineering, Extra Curriculum, Interaction University - community

1 INTRODUCTION

In 2011 a new framework for engineering educations was introduced by the Norwegian Association of Higher Education Institutions (UHR). This framework introduced big changes in organisation and execution of education leading to bachelor's degree in engineering. Before this framework was introduced, the norm for programme organisation was through 5- and 10 ECTS-courses. Only the final bachelor's thesis course was scheduled 15 – 20 ECTS.

The framework of 2011 requires a minimum course size of 10 ECTS. The new requirements led to a redesign process at the bachelor programme of the C&S engineering education, on what is taught in the programme – and how. This process included multiple discussions within the university and externally with the Industrial Reference Group (IRG). The IRG's role is solely advisory.

The IRG has members from building clients, engineering consultancies, contractors, municipalities and offshore design producers, and covers both the structural and infrastructure parts of the C&S engineering education. Hence, the group members represent a wide range of future employers of our students. Industry often seems to desire to receive fully specialised expert engineers directly from the university. This is of course not achievable, but the dialogue between the university and the IRG became valuable as it contributed to deepen the understanding on both sides of what is achievable within the education – and what must come in addition. A long list of knowledge and skills required by different groups of the IRG remained unaccommodated by the education programme. This leaves newly educated engineers the responsibility to develop such competence in co-operation with their employer, through early years in working life.

During fall 2011 the new education programme was launched, fulfilling the requirements given by UHR, and simultaneously being supported by the IRG.

2 THEORETICAL INSPIRATION

2.1 Extra Curriculum courses and industry involvement

There seem to be little research scientifically published on the methods and corresponding results for Extra Curriculum courses and the involvement of industry in teaching such. However, some works have been identified and are used for inspiration:

2.1.1 *Extra-curricular activities*

In the book “Developing Student Capability through Modular Courses” [1], Gaskell, G, and Brierly have written a paper on the accreditation of extra-curricular learning at Oxford Brookes University. They state that two-thirds of university students woken hours are devoted to activities other than studying and that former students report that the activities outside the classroom increased their competence and self-assurance. As these are important qualities for an upcoming member of the workforce, the authors got approval for accrediting these activities.

2.1.2 *Securing educational gaining*

Jorgensen et al. [2] worked with industry collaborative capstone design projects. The article concludes that “involving industry in the project activity raises the interest and performance of the students” and that “the real-life experience they [students] gain through the interaction with the industrial client is extremely valuable (...)”.

2.1.3 *Extra-curricular activities and career*

Guy Tchibozo published in January of 2007 an article in Higher Education Quarterly called “Extra-Curricular Activity and the Transition from Higher Education to Work: A Survey of Graduated in the United Kingdom” [3]. In this article, he states that students that have been involved in extra-curricular activities have an advantage at the beginning of their careers when it comes to status. Compared to graduates that did not participate these activities. Those who participated in extra-curricular activities were 3 times more likely to start as managers.

3 METHODS

After having successfully introduced the new formal education programme during fall 2011, we returned to the list of surplus requirements from the reference group. This consisted of multiple requests from the stakeholders in the IRG, which were left out of the education programme not because of lack of relevance, but because of lack of space. Through the discussion in the IRG, there was a consensus that the aim is to educate skilled engineers, having thorough basic education in the fields of C&S engineering. However, the IRG members desired more specialised competence within multiple topics.

Conclusively, we came up with the idea of introducing additional courses to the students, on relevant topics that are not included in the education programme. These courses should be offered in addition to the main curriculum, at odd hours.

Our hope was that if industry requested new engineers having this competence, they would also be willing to contribute by teaching these subjects for free. The reference group adopted the idea. These courses were given the name “Extra Curriculum”, having a two-folded inspiration: Firstly, the name is

an adaptation from extra-curricular activities which is very normal in the US for high school students to include in their applications for college. Secondly, as the name states, participating students have been active and interested in learning more than just the regular curriculum of the education.

The organisation of the Extra Curriculum courses is handled by the university; however, the “industrial” stakeholder is responsible for lecturing and execution of students’ assignments. The aim is to offer one course every semester, but up to now, that has not always been possible. The restriction is normally the university’s capacity to organise – not lack of industrial stakeholders.

The first course was taught in the spring of 2013. From this beginning to today, eight courses have been arranged. One of the courses was even found so attractive that it was included as a mandatory course for students in another engineering programme than the C&S education (renewable energy). These students participated parallel to the voluntary students from the C&S programme.

As the popularity of Extra Curriculum courses raised, we organised that four of these courses could substitute a 10 ECTS elective in the formal programme. Though popular when announced, no student has so far applied this solution. It seems that students who are willing to “walk the extra mile” also desire the signal effect towards employers – that their Extra Curriculum efforts really are additional to the education.

The design of an Extra Curriculum course follows the template for courses given as ordinary university courses, reduced to the size 2.5 ECTS: An Extra Curriculum course consists of 24 hours of scheduled teaching. This is usually 12 hours of lectures and 12 hours of mentoring. In addition to lectures and mentoring, the students are expected to put in a minimum of 40 hours independent work. This is often linked to a problem the students have to address in groups. The end of the course is usually an oral exam. It is possible to assess the students in different ways, but there has to be an assessment to evaluate whether the students meet the criteria for passing the course. Each course is graded as passed/failed.

4 RESULTS AND DISCUSSION

4.1 Status

Several Extra Curriculum courses have been offered by members of the IRG. However, the initiative has grown more widespread, and several courses have been initiated and executed also by non-IRG members. There are no practical differences between courses given by these two stakeholder groups; however, it is interesting to witness that the initiative has become popular also for “industrial” stakeholders who have not been a part of the process initially fostering the idea in the IRG. Up to now, the following eight courses have been given:

Table 1. Extra Curriculum courses that have been given

Topic	Semester	«Industrial» stakeholder responsible	Number of participating students Passed/total
Applications of facade systems	Spring 2013	The Norwegian association for producers of glass and building facade elements	32/35
Hydropower plant design	Fall 2013	SWECO	21/27
Management, Operation and Maintenance (MOM) of roads	Fall 2014	The Norwegian Public Roads Administration (NPRA)	44/48
Tekla Structures BIM-software	Fall 2015	EDR Medeso	23/27
Management, Operation and Maintenance (MOM)	Fall 2016	The Norwegian Public Roads Administration (NPRA)	21/26

of roads			
Applications of facade systems	Spring 2017	The Norwegian association for producers of glass and building facade elements	17/22
Strategies for reducing warranty claims on construction projects	Fall 2017	The collaboration of contractor (AF Gruppen) and Building client for the erection of Grimstad municipal library	13/13
Collaboration models and contract strategies in Building and Construction industry	Spring 2018	The collaboration of contractor (AF Gruppen) and Building client for the erection of Grimstad municipal library	13/14

4.2 Why does industry engage in organising Extra Curriculum courses?

One reason for the industrial stakeholders to put effort into offering Extra Curriculum might be Corporate Societal Responsibility (CSR). However, according to our dialogue with these stakeholders, the industry is rather looking upon this as an investment they want to benefit from. One reason seems to be the possibility to get in contact with high performing students and to observe them during a period of intensive efforts. This is considered an arena for recruiting the best students for future employment.

Another possible reason is less direct; some stakeholders are striving to elevate the engineering skills in the market, within their particular field. This applies to the Norwegian Public Road Administration (NPRA). Being a public building client, NPRA is depending on contractors and consultancies to having relevant competence for executing works on building and maintaining roads. Hence, NPRA is investing through Extra Curriculum to elevate competence amongst engineers, without necessarily aiming at hiring the participating students. This aim also calls for rearranging the corresponding course every second year, as visualised in table 1.

A corresponding incentive is valid for The “Norwegian association for producers of glass and building facade elements”. This organisation holds just a small administration without the potential for hiring multiple students. However, they represent an industry frequently experiencing lack of competence amongst consultancies and entrepreneurs. Again, it is visual from table 1, that they utilise the opportunity to reach new students every second year.

Lastly, stakeholders like the consultancy SWECO who is frequently hiring newly educated engineers are expected to involve in Extra Curriculum to get in early contact with the best students. These stakeholders can follow up later by engaging selected students in capstone courses, internships, etc.

For all of the above, there might also be an element of CSR; helping the university to create a society better fit to contribute to meeting tomorrow’s challenges.

4.3 Why do the students engage in passing Extra Curriculum courses?

It is also interesting to investigate what students are willing to invest extra time and efforts in curricula activities additional to the study programme – and why they are doing it. Extra Curriculum courses are available to all C&S engineering students. However, the main interest group is students in the second and third year, as first-year students are not expected to have the relevant background for benefitting from participation. Hence, any course is expected to have new relevance every second year, as the students in the second and third year will not have had the opportunity to follow this course before.

Normally, each course is announced for a restricted number of participants. However, we always strive to accommodate requests from all students who actively search participation. As students consider the standard curriculum of the education programme to be challenging, the number of students interested in Extra Curriculum courses is limited.

One expected reason for taking on Extra Curriculum courses might be that clever students want the extra attractiveness in the labour market, gained from demonstrating capacity by doing an extra effort on building competence in addition to doing well in the ordinary curriculum. Another possible explanation with quite the opposite origin would be lower performing students looking for an easy way to substitute weak performance in the ordinary study programme, by engaging in extra activities. The latter might be based on an expectation that the threshold to pass an Extra Curriculum course is lower than for an ordinary course.

Students in all groups are expected to find it attractive to relate to working life throughout the education. This is in accordance with both Gaskell and Brierly [1] who reports that “former students report that the activities outside the classroom increased their competence and self-assurance” and Jorgensen et al. [2] who found that “involving industry in the project activity raises the interest and performance of the students”.

One reason why the university has claimed the right (and duty) to approve and organise all Extra Curriculum courses, is to make sure that the quality is kept at the same level as for the ordinary courses. Hence, even though an expectation on “low hanging fruit” might be present from weaker students, this should not be met by reality. Weaker students are advised not to participate in Extra Curriculum courses when asking e.g. the programme coordinator if it is wise to participate. This is to avoid tricking students to take on extra work when having enough challenges completing the regular curriculum.

We have not yet executed a survey or other investigation amongst students participating in Extra Curriculum courses. However, it is a clear impression amongst staff that most students participating Extra Curriculum courses are well performing in the ordinary study programme. The share of students passing the Extra Curriculum courses is 87% on average for all courses – spanning from 78% to 100%. The share of students passing the C&S engineering programme on the schedule is just below 70%. Hence, statistics confirm the clear impression from staff, that mainly well-performing students participate in Extra Curriculum activities. Another indication confirming this is the fact that no student so far has utilised the possibility to substitute an elective in the ordinary programme by four Extra Curriculum courses. By doing so, they would lose the signal effect of performing the extra effort

Confirming the expected value from students of engaging in Extra Curriculum courses: It is a common response between industrial stakeholders to state that when hiring newly educated engineers, those who have engaged in Extra Curriculum activities will be prioritised. This is stated not primarily because of the extra competence, however because of the extra efforts and capacity demonstrated. It is also well in accordance with Tchibozo [3], who concluded that “... students that have been involved in extra-curricular activities have an advantage in the beginning of their careers ...”

4.4 Is there something more?

The idea of getting industry involved in vocational efforts at campus creates a secondary value: students and industry get a common arena to meet each other. The students get used to the social terms of working life and get to learn about the companies as a bonus, and the companies get to know some of the students that might, later on, apply for work in that company. The companies also have the opportunity to connect with selected students, through capstone courses, internships etc.

Yet another aspect that was not planned is the reputation the Extra Curriculum courses receive in industry. UiA is often contacted by companies asking if their employees can participate in the courses. These requests are appreciated by UiA, as continuing education is part of the mandate of any university. We also expect that employees having a positive experience through participating Extra Curriculum as students might take interest and advocate their own management to offer courses as Extra Curriculum at UiA.

A yet unexploited idea is to offer Extra Curriculum courses to improve the practical insights and skills that are important for engineers. Some years ago, the mix of students had a more varied background. Some students had been craftsmen before starting their engineering education, and other came straight from high school. This allowed for students with a theoretical background in need for help to understand e.g. a blueprint, former craftsmen could help. It also applied the opposite way, when it e.g. came to problems in mathematics.

Today most of our students have a theoretical background and cannot get help from their fellow students to understand the practical problems. Therefore, the idea of offering courses that educate students to a better understanding of the practical sides of engineering seems relevant. This can

include visiting worksites and study the blueprints as one sees the construction in real life. Site visits are also relevant for combining with calculating a detail and modeling the detail in a Building Information Model-software. This idea is under development. One challenge is organising the responsibility for visits at worksites etc. Another is that resources from the university are probably requested, in the form of staff, access to laboratories etc. This means that the initial idea of Extra Curriculum being taught without cost for the university would not be valid anymore.

5 CONCLUSIONS

- The introduction of Extra Curriculum courses at the civil engineering studies at UiA is very successful. These courses are on topics that are not taught in the regular civil engineering studies at UiA.
- The members of the Industrial Reference Group for the civil and structural engineering studies are very supportive towards the Extra Curriculum activities.
- Since the beginning in 2013, eight courses have been given, taught by six different stakeholders from industry – free of charge for the university and the students.
- All courses are subject to the same quality control, as the courses in the regular engineering education. The university approves and organises, the industry suggest and execute – without cost for university or students.
- Statistics from exams support the staff's impression that the major part of students participating Extra Curriculum courses is also well performing in the ordinary education programme. On average 87% of the participants have passed the Extra Curriculum exams, while just below 70% pass the engineering program at the schedule.
- Indications are strong that participating students are driven by the desire for extra attractivity in the labour market, gained from demonstrating capacity by doing an extra effort on building competence in addition to doing well in the ordinary curriculum.
- Weaker students are advised not to participate in Extra Curriculum courses.
- Industry express that when hiring, students having participated in Extra Curriculum courses are prioritised.
- Participation in Extra Curriculum courses is also requested by employees from industry.
- A yet unexploited idea is to offer Extra Curriculum courses to improve the practical insights and skills that are important for engineers, to make up for engineering students often lacking practical skills and experience.

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