

# WORK RELEVANCE IN CIVIL ENGINEERING EDUCATION

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## ABSTRACT

The Norwegian government states in the white paper “Education for restructuring – increased working relevance in higher education” (Meld. St. 16 (2020-2021)) that to prepare students for the jobs of tomorrow educational institutions need to decrease the gap between the academics and the industry. An internship can be difficult to organise for some study programmes as it usually involves a considerable degree of effort and time. Hence, this paper investigates what the students consider to be work relevant in their study, and alternatives to internship for the study programmes to better prepare the students for the industry.

Two surveys were distributed at the beginning of October 2022 to all the bachelor and master students in Civil Engineering at the University of Agder: one for the bachelor students and one for the master students. The Civil Engineering Department at the University of Agder has made various attempts to increase work relevance. Despite this, the students still rate the work relevance relatively low.

The result from the surveys indicates that the students find many of the courses and the design of the lectures to be work relevant. The findings of this study suggest excursions, company presentations, laboratory work, guest lectures and projects to enhance the work relevance in a study programme. This study could help study programmes improve their work relevance without going to the extent of implementing internships.

*Keywords: Work relevance, civil engineering, education, survey*

## 1 INTRODUCTION

To develop the employees for the future we need to address the students of today. According to the World Economic Forum [1] four types of skills are needed for the jobs of tomorrow; problem-solving, self-management, how to work with people, and technology use and development. The Norwegian government states in the white paper “Education for restructuring – increased working relevance in higher education” (Meld. St. 16 (2020-2021)) [2] that to prepare students for the jobs of tomorrow educational institutions need to decrease the gap between the academics and the industry. Consequently, educational institutions need to increase the work relevance of the courses taught in the study programmes. The Civil Engineering Department at the University of Agder (UiA) has made various attempts to increase work relevance, such as a work-relevant curriculum, exercises, software, exams, guest lectures, laboratory work, company presentations and excursions, to name a few. Even so, when looking at the results from the national student survey “Studiebarometeret” [3, 4] the category with the lowest score for the civil engineering students at UiA is the perceived connection to working life. On a scale from 1 to 5, 1 meaning to a small extent and 5 meaning to a large extent, the student’s rate five claims regarding work relevance in their study programme. The results from 2021 show that the bachelor students have an average of 2.8 which is 0.2 below the national average and the master students have an average of 3.1 which is 0.3 below the national average. Out of all the categories on the survey “Studiebarometeret” work relevance is one of the lowest scoring categories. Hence, this is a common challenge for all universities within the civil engineering educations.

The Organisation for Economic Cooperation and Development (OECD) [5] did a study in 2018 to investigate how students managed the transition from student to employee. The study concluded that Norwegian higher education prepared the students for the industry. However, the same report stated that Norwegian higher education lacks work relevance in their study programmes.

The white paper “Education for restructuring – increased working relevance in higher education” (Meld. St. 16 (2020-2021)) [2] solely mentions internship as a way of increasing work relevance in higher education, but also encourage study programmes to find other ways of introducing work relevance. “Internship in Higher Education” [6] points out multiple challenges in implementing internship programmes, such as diverse expectations, the required competencies to establish a professional practice, inadequate resources from universities and students who struggle to secure a suitable internship experience. Knouse et al. [7] identified that the students with higher grades were more likely to gain access to internships, risking neglecting the lower achievers. However, very little is known about alternatives to enhancing work relevance in the study programme. Therefore, this study tries to investigate what the students find work relevant in their study programme, and thus give other study programmes suggestions on how to decrease the gap between academics and the industry.

## 2 METHODOLOGIES

The students participating in this study are studying Civil Engineering at the University of Agder. The students are divided into two groups: bachelor students and master students. The bachelor students are in a three-year programme and the master students are in a two-year programme. Some of the master students have finished the three-year programme at the University of Agder and some of the master students are from other universities. On the 26<sup>th</sup> of February 2023, the study programmes consisted of 244 students in the three-year bachelor’s programme and 90 students in the two-year master’s programme. During the time of this research, internships as part of the study programme were not available to students in civil engineering education. However, this will be available from the autumn of 2023.

The purpose of the study was to find out what the students find to be work relevant in their study programme. To determine this, two surveys were distributed on the 7<sup>th</sup> of October 2022 to all the bachelor and master students in Civil Engineering at the University of Agder: one for the bachelor students and one for the master students. The students had two weeks to answer the surveys.

The surveys were distributed in their learning management system Canvas and were made with the survey programme SurveyXact. First, the students were asked about some background information. Second, the students had the opportunity to write in their own words what they consider to be work relevant to their study programme. Next, a multiple-answer question with a set of answer options regarding what activities they have experienced during their study, see Table 2. The question was formulated: “Which of the following have you experienced during your study?”. The options were normal lectures, guest lectures, excursions, laboratory work, exercises and exams, project work, internship, company presentations, software, small talk with lecturers and small talk with fellow students. Fourth, the students were asked “How work relevant do you find the following?”, and to rate the same set of options from 1 to 5, 1 meaning highly irrelevant and 5 meaning highly relevant. They also had to rate the courses taught in their study overall from 1 to 5 by answering “How work relevant do you find your courses to be?”. Lastly, the students had the opportunity to write one or more suggestions on how to increase the work relevance in their study programme.

## 3 RESULTS AND DISCUSSION

The data regarding the surveys are shown in Table 1. Both surveys were distributed on the 7<sup>th</sup> of October and contained 8 questions. The response rate was 20% for the bachelor students and 22% for the master students. Two sets of surveys were used to see the differences between the bachelor and master students.

*Table 1. Data about the surveys*

Educational degree	Distribution date	No. of questions	No. of respondents	Response rate
BSc	7-oct-22	8	49	20%
MSc	7-oct-22	8	20	22%

Figure 1 illustrates what the students answered on the free text question regarding what they consider to be work relevant in their study programme. On this question, 56% of the answers were specific academic courses taught in the Civil Engineering study at UiA.

The next section of the survey was concerned with rating a set of measures and activities concerning work relevance. Table 2 shows how the students rated the work relevance of various measures in their

study, that is normal lectures, guest lectures, excursions, laboratory work, exercises and exams, project work, internship, company presentations, software, small talk with lecturers and small talk with fellow students. Predictably, the highest-rated activity is internships. Normal lectures, exercises and exams and small talk are rated lowest. Assuming that this is typically how an academic course is structured, this outcome is contrary to the previous findings shown in Figure 1. However, the students could have meant specific academic courses consisting of project work, laboratory work, excursions, or guest lectures when giving their response to the first free text question.



Figure 1. Word frequency query results on which activities and measures students consider to be work relevant

As stated before, internship was the highest-scored activity but also scored most ratings of 5 (60%). A closer inspection of the results from the bachelor students shows that internship scored 78% when combining 4 (relevant) and 5 (highly relevant). The bachelor students find excursions (88%), laboratory work (81%) and project work (81%) more work relevant than internships. This observation may provide other universities with effective alternatives to internships. As Chu [6] mentions there are several obstacles to overcome before implementing internship programmes. Hence, excursions, laboratory work and projects do not necessarily require competencies or expectations and could require fewer resources to implement. Furthermore, excursions, laboratory work and projects can be organized by academic staff avoiding the possible pitfall of students struggling to secure a suitable internship experience.

The bachelor students rated the work relevancy of guest lectures to be 3.94 and the master students 4.09. According to Metrejean [8], students also find the use of guest lectures to be beneficial. In a survey in 2010, the average rating was 4.06 on a scale from 0 to 5, 0 meaning no benefit and 5 meaning extreme benefit. Hence, the students seem to assess guest lectures as being work relevant and beneficial in their course of study. Inviting guest lecturers should thus be an easy way of implementing work relevance in the study programme.

The students ranked excursions as the second most work-relevant activity with 4.38 and 4.36 from the bachelor and master students respectively. Alas, only 17% of the bachelor students and 36% of the master students reported having had excursions during their bachelors' degree. Payne et al. [9] found that excursions have a motivational factor and can increase the students' interest in a subject. In "The use of industrial networks to strengthen civil and structural engineering education; a survey-based investigation" [10] 66% ranked the motivational outcome as high or very high when asked about the motivational outcome from participating in an industrial network with excursions. These findings show that implementing more work-relevant activities in the curriculum could have several beneficial effects, both as a motivational factor and in reducing the perceived gap between academics and the industry.

Project work can be an activity to develop the skills mentioned by World Economic Forum [1] such as problem-solving, self-management, how to work with people, and technology use and development. The students found project work to be work relevant with an average score of 3.97. Comparing the results from the bachelor students and the master students, amongst the bachelor students 81% found project work to be relevant or highly relevant while only 64% reported this amongst the master students. In "Various forms of executing peer reviews in civil engineering education" [11] the master students showed a much higher independency compared to the bachelor students. Gatfield [12] found that students with prior work experience were less satisfied with group projects than students with no previous work experience. It is possible, therefore, to hypothesise that these conditions contribute to the observed differences.

Table 2. Average results from the surveys with standard deviation in parenthesis

	BSc	MSc	Average
Internship	4.41 (0.84)	4.55 (0.52)	4.48 (0.68)
Excursions	4.38 (0.71)	4.36 (0.81)	4.37 (0.76)
Company presentation	4.09 (0.82)	4.18 (0.75)	4.14 (0.78)
Laboratory work	4.22 (0.75)	4.00 (0.63)	4.11 (0.69)
Guest Lectures	3.94 (0.93)	4.09 (0.94)	4.02 (0.94)
Project work	4.03 (0.90)	3.91 (1.04)	3.97 (0.97)
Software	3.91 (0.82)	4.00 (1.10)	3.95 (0.96)
Normal lectures	3.73 (0.98)	3.55 (0.93)	3.64 (0.96)
Small talk with fellow students	3.63 (0.87)	3.55 (0.82)	3.59 (0.85)
Small talk with lecturers	3.34 (0.65)	3.64 (0.81)	3.49 (0.73)
Exercises and exams	3.75 (0.95)	3.09 (1.22)	3.42 (1.09)

The national student survey “Studiebarometeret” [3, 4] is sent to more than 70 000 students each autumn and is an important indicator regarding educational quality. Still, the civil engineering students from the UiA rated the connection to working life 2.8 and 3.3. The results represented in Table 2 are contrary to the findings in “Studiebarometeret”. Apart from the master students’ evaluation on exercises and exams, all the other activities score higher than “Studiebarometeret”. One could argue that civil engineering students do not receive or participate in these activities during their study but would value the activities as work relevant. However, Figure 2 illustrates which activities the civil engineering students at UiA report that they have taken part in or been exposed to during their bachelor studies. It can be seen from the data in Figure 2 that a significant amount of the students have experienced project work, guest lectures and laboratory work. This observation may support the hypothesis that the students do not have the required information to understand what work relevance is. This could explain the findings in the study by The Organisation for Economic Cooperation and Development (OECD) [5]; the students in Norway are prepared for the industry, but higher education lacks work relevance in their study programmes. If the work relevance in higher education is solely measured by the students’ opinions, this could give a misleading truth. As the results of this study indicate, the students find many of the

offered activities to be work-relevant but still rate the work relevance in their study programme low. Exercises and exams have the lowest score but still have an average of 3.75 from the bachelor students and 3.09 from the master students. Looking back at the results from “Studiebarometeret” [4] for the bachelor students, this is still higher than the results of 2.8.

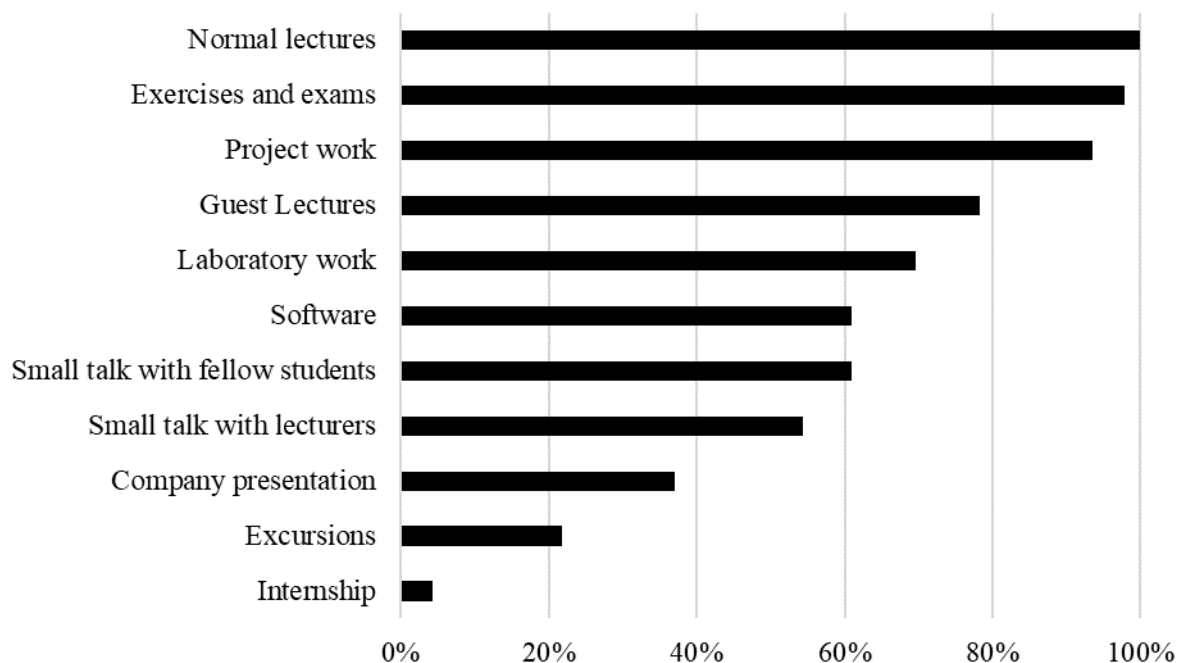


Figure 2. Experienced activities for students during their bachelor study

Internship is clearly ranked as the most work-relevant activity by students, and, as summed up by Chu [6], a number of studies show significant results in non-academic, career and academic benefits for the students participating in internships. The findings of this study suggest excursions, company presentations, laboratory work, guest lectures and projects to enhance the perceived work relevance in a study programme. These activities could be viable and effective alternatives to internships as encouraged by the white paper “Education for restructuring – increased working relevance in higher education” (Meld. St. 16 (2020-2021)) [2].

#### 4 CONCLUSIONS

This study set out to investigate what the students find work relevant in their study programme, and thus give other study programmes suggestions on how to decrease the gap between academics and the industry. On a free text question regarding what students consider to be work relevant in their study programme 56% of the answers were specific academic courses taught at the University of Agder. The students rated the following activities, normal lectures, guest lectures, excursions, laboratory work, exercises and exams, project work, internship, company presentations, software, small talk with lecturers and small talk with fellow students, high with regards to work relevance in their study. Internship is the highest-rated activity by the students when asking of work relevant activities. However, diverse expectations, the required competencies to establish a professional practice, and inadequate resources from universities and students who struggle to secure a suitable internship experience can be obstacles when implementing internships in higher education. Excursions, laboratory work and project work score higher than internships when combining the results of relevant or highly relevant among the bachelor students. Excursions have a motivational factor and can increase the students’ interest in a subject. There was a significant difference in the feedback regarding project work. 81% of the bachelor students found project work as relevant or highly relevant while only 64% reported this amongst the master students. This study has identified excursions, company presentations, laboratory work, guest lecturers and project work to be viable and effective alternatives to internship when it comes to increasing work relevance in higher education.

The major limitation of this study is the relatively small sample size. This will need to be repeated over several years to identify trends. Also, it would be interesting to distribute corresponding surveys to other universities.

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