FIRST-YEAR ENGINEERING STUDENTS AT REYKJAVIK UNIVERSITY: RELATION BETWEEN CLASS ATTENDANCE AND FINAL EXAM GRADE

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ABSTRACT

Modern technology, such as online digital tools, enables some students to gain their university degrees without ever attending onsite classes in person. However, showing up in person to classes and interacting with other students and instructors may be beneficial for the students' academic performance in an active learning environment. At the Department of Engineering at Reykjavik University in Iceland, there are around 200 students enrolled in first-semester engineering courses every year. They enroll in 8 different study lines, and all students take the same four courses in the first 12-week autumn semester. The setup of the four courses is similar, all with 4x45 min lectures and 2x45 min tutorials every week. Attendance is not mandatory, but students can increase their course final grade if they attend a minimum number of tutorials on-site during the semester. In this study, a comparison was made to see if there is a relationship between attendance and the final exam grade the students get in the course final exam. The results indicate a positive relationship between these factors where the students receive generally around 10-20 more points (out of 100) in the final exam if they have attended the tutorials well. According to literature, this is generally the tendency for students in other universities, where related studies have been made.

KEYWORDS

Engineering Education, Onsite Attendance, Active Learning, Learning Assessment, Standards: 8, 11

INTRODUCTION

Access to learning materials for university students has changed much in the last few years, and much of the learning materials, lecture material, solutions to assignments, and lecture recordings can be made available online instead of or in addition to the onsite classes. During the pandemic, lecturers at universities had to move much of their activities to online teaching and the possibilities and limitations of online studies became clearer. It is therefore interesting and important to study whether there is a relationship between onsite attendance and academic performance of students. This has been done in a number of studies over the years, as summarized in the literature review in the next section.

To the author's knowledge, a study comparing attendance and exams among Icelandic university students has not been published. In this paper, data about attendance and final grades among first-year engineering students at Reykjavik University is presented, and the data is analyzed to observe if there is a relationship between the final exam grade and onsite attendance among the students.

LITERATURE REVIEW

From some previous studies, it has been found that there might be a correlation between student attendance and student academic performance where most of these studies indicate a positive correlation between these two factors (Lukkarinen et al., 2016), (Moore et al., 2003), (Purcell, 2007), (Credè et al., 2010) although other factors like how many credits students are taking, travel time to the university and number of working hours outside the university also play a role in the examination performance (Kirby and McElroy, 2003).

Ulmer (2020) showed a relation between professionalism grades (attendance and punctuality) and final course grades. For students earning 80-100% in the final grade, there was a high professionalism grade (above the average final grade), but the professionalism grade went below the final grade for students earning between 70-80% in the final grade. There was a similar professionalism grade and average final grade for students earning below 70% in the final grade.

With students having increasing access to online learning material and recordings from classes, it is also interesting to see if these tools affect the relationship between attendance (online or onsite) and academic performance. In the study of Nordmann et al. (2019), it was found that students who generally performed better also performed better in courses where they used supplementary recordings instead of attending than students who generally performed worse in their studies. This difference was more prominent in the earlier years of their study. Also, results from the study of Varousa-Sousa and Kingston (2015) indicate that students performed better if they attended lectures onsite than watching recordings. Inglis et al. (2011) showed a negative correlation between the frequency of watching lecture recordings and student performance, which might indicate that students performing worse had to revisit the material more often than the students generally performing better in their studies. Results from a study performed by Williams et al. (2012) show that students who only watched recordings performed worse than those attending onsite. However, students who supplemented onsite attendance with recordings performed better than students who only participated onsite and did not revisit the material through the recordings.

Most of the literature regarding this topic covers traditional lectures and tutorials, but less is known about problem-based courses. Bijsmans and Schakel (2018) observed a "noticeable effect of attendance on study success" for three cohorts that were analyzed.

Kirby and McElroy (2016) analyzed the relationship between attendance and grades for first-year economics courses. Their findings show that class attendance had a positive but diminishing marginal effect on student’s grades. Obeidat et al. (2012) analyzed course grades regarding GPA, attendance percentage, and number of credits students were enrolled in. According to their findings, attendance percentage strongly affected the grades in a particular course. Lukkarinen et al. (2016) divided the students from a course into three groups based on their attendance and performance and found that attendance was "positively and

significantly related to performance". However, as stated in their literature review, results from some studies do not indicate a positive relation between these factors, whereas Eisen et al. (2015) did not observe that attending classes improved academic performance in their introductory dermatology course.

According to this literature, there is a clear but nontrivial indication that onsite attendance will improve the student's academic performance. To the author's knowledge, a study of this relationship has not been published for Icelandic universities. In order to contribute to this knowledge gap, data for attendance and final grades were gathered from first-year engineering classes at Reykjavik University in Iceland throughout a couple of years and analyzed.

ENGINEERING STUDY AT REYKJAVIK UNIVERSITY

Reykjavik University in Iceland is a young university that has offered BSc and MSc degrees in engineering since 2005. Around 200 students are enrolled in the first year of undergraduate BSc study every year in seven study lines: Financial Engineering, Engineering Management, Biomedical Engineering, Mechatronics, Energy Engineering, Mechanical Engineering, and Electric Power Engineering. The department has implemented the CDIO approach into its curriculum for more than a decade (Audunsson et al. (2020) and Saemundsdottir et al. (2012)). The setup of the first-year courses is shown in Table 1. All the students take the same courses in the first semester, regardless of which engineering study line they have chosen. The semester is divided into two parts: first, the students take four courses for twelve weeks and then one course for three weeks.

Table 1. Course setup for 1st year BSc Engineering students at Reykjavik University

First semester	**Second semester**
Calculus I (6 ECTS)	Calculus II (6 ECTS)
Physics I (6 ECTS)	Physics II (6 ECTS)
Linear algebra (6 ECTS)	Engineering Programming (6 ECTS)
Programming in Matlab (2 ECTS) Energy (4 ECTS)	Study line specific course (6 ECTS)
Brainstorming (1 ECTS) Introduction to Engineering (5 ECTS) (3 weeks)	Entrepreneurship and Starting New Ventures (6 ECTS) (3 weeks)

In this study, data regarding attendance and final exam grades was gathered for all the first-semester courses (see Table 1) except for Programming in Matlab, Brainstorming, and Introduction to Engineering, and data was also collected for the second-semester courses Calculus II and Physics II. The courses that are not included in the study were excluded as they may not have registered attendance or have different attendance policies between study lines.

The Department of Engineering is a part of the CDIO network, and this study pertains to standards 8 and 11 from CDIO Standards 3.0 (CDIO, 2024). Standard 8: Active Learning is incorporated through active learning methods like tutorials where students are working independently as well as in groups where Teaching Assistants (TAs) are supervising their activities in class. Standard 11: Learning Assessment is through diverse methods of assessing the students' performance, like attendance, exams and home assignments.

DATA COLLECTION AND ANALYSIS

The summary of all the courses that were analyzed for the relationship between attendance and final exam grades in this study is shown in Table 2. Attendance in these courses was only documented for problem classes (tutorials) and not for lectures. Attendance for lectures was never systematically monitored for these courses, but more was focused on encouraging the students to show up for tutorials. Attendance in tutorials is therefore a factor that can count into the final grade, but only if the attendance grade increases the final grade. Generally, the students were divided into tutorial groups, with each group consisting of around 20 students. It is essential to note that although the attendance grade can increase the final grade, this analysis only applies to a comparison between the final exam grade and attendance and not the final course grade. The attendance grade does not have direct input into the final exam grade.

The course assessment differs between courses, but in all the courses listed in Table 2, attendance can be a factor in the final course grade. The final course grade is calculated from various factors for learning assessment, including home assignments, group projects, midterm exams, and final exam, where the final exam can account for a maximum of 70% of the course grade.

Table 2. Summary of the courses in the dataset used in the study.

No.	Course Name	Year	Sem-ester	No. of students taking the final exam	Attend-ance weight in final grade*	Attendance grade calculation and weight
1	Physics I	2019	1	188	10%	Attending at least 2/3 of tutorials gives a 100% attendance grade. Attending less than 2/3 of tutorials gives a 0% attendance grade*
2	Physics I	2022	1	161	10%	
3	Physics II	2022	2	139	10%	
4	Physics II	2023	2	159	10%	
5	Linear Algebra	2018	2	204	10%	Attending at least 8 of 11 tutorials gives a 100% attendance grade. Attending <8 gives N/8 attendance grade, where N is the number of classes attended *
6	Linear Algebra	2019	2	195	10%	
7	Calculus II	2019	2	127	10%	
8	Calculus I	2019	1	211	10%	
9	Calculus I	2022	1	215	5%	Attending at least 7 of 10 tutorials gives a 100% attendance grade. Attending <7 gives N/7 attendance grade, where N is the number of classes attended *
10	Linear Algebra	2022	1	183	5%	
11	Energy	2022	1	161	3%	Attending at least 6 of 8 tutorials gives a 100% attendance grade*

						Attending less than 6 of 8 tutorials gives a 0% attendance grade*

*Attendance only counts into the final grade if it increases the final grade. If the attendance grade lowered the final grade, it was omitted from the final grade, and the final exam grade weighted more in the final grade.

The following applies to the data from the courses listed in Table 2:

- All the courses had 4x45 min lectures per week and 2x45 tutorials per week during the 12-week semester.
- Attendance grade was calculated into the final grade, but only if it increased the final grade. The final exam weighed more if the attendance grade did not increase the final grade.
- Attendance was only registered for tutorial classes and not for the lectures.
- If students took both the final exam and the retake final exam, or only the retake final exam, the grade from the retake exam was used for the dataset.
- Students who had attendance registered but neither took the final exam nor the retake exam were excluded from the dataset.
- The attendance grade did not count into the final exam grade but only into the final grade.

The dataset summarized in Table 2 was analyzed in the following manner. The final exam grades for students who got 100% grade for attendance (the calculation of the attendance grade is shown in Table 2) are compared to the final exam grades of students who became attendance grades below 100%.

RESULTS

Table 3 shows the results of the average final exam grades for the two groups; one group consists of students who achieved 100% attendance grade, the other where students achieved attendance grade below 100%.

Table 3. Results of final grades and attendance grades for the courses listed in Table 2.

Course no.	Average final exam grade where attendance grade was 100%	Average final exam grade where attendance was <100%	No. of students with 100% attendance grade	No. of students with <100% attendance grade
1	70%	58%	41	147
2	68%	66%	127	34
3	72%	64%	39	100
4	69%	59%	124	35
5	67%	49%	134	70
6	65%	56%	127	68
7	68%	60%	97	30
8	71%	49%	173	38
9	63%	46%	160	55

10	63%	52%	124	59
11	74%	62%	110	51

Figure 1 shows a graphical representation of the results for the two groups of students, one where the students got 100% attendance grade and the other group where the students got <100% attendance grade in the course.

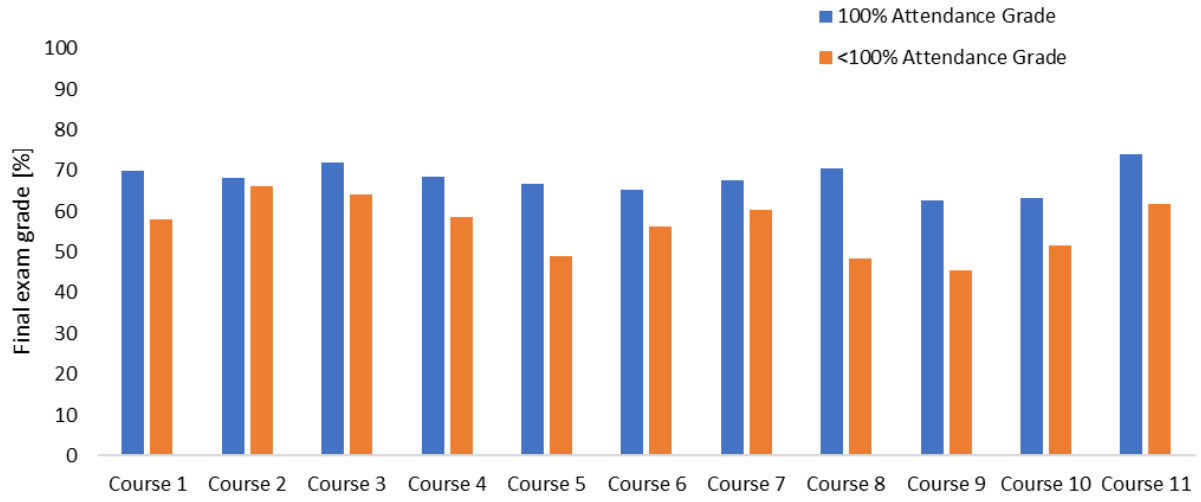

Figure 1. Results of the comparison of the final exam grades of two groups of students; one group consists of students that got 100% attendance grade, and the other group consists of students that got <100% attendance grade.

The results shown in Table 3 and Figure 1 indicate that there might be a positive relation between the final exam grade and the student's attendance in the tutorials. This is evident in all courses that were analyzed, and the difference in the average final exam grades of the two groups (one with 100% exam grade and the other with less than 100% exam grade) is between 2 and 22%.

DISCUSSION

Data from eleven first-year engineering courses at Reykjavik University were analyzed regarding students' final exam grades and attendance. It is important to note that the attendance grade is not a part of the final exam grade, but it can weigh into the final course grade.

Figure 1 shows results from the comparison between the students who had sufficient attendance in tutorials and students who showed up less often. It is clear from these results that students who are active in attending tutorials onsite are more likely to get higher final exam grades than the other group. This is the case for all the 11 courses where the grades were analyzed.

There is a clear indication that students who show up for class do better in their final exams. This is not statistically analyzed in this paper, although the average grades of the two groups that differ in their attendance grade are compared. It would be highly interesting to collect data from more courses and perform a study showing if there is a direct relation between these two

factors: exam grade and attendance. Also, other factors that could affect the performance in the final exam, like time spent on non-academic activities, students' accessibility to resources, and students' self-directed learning abilities, could be affecting the exam grades, but these factors were not included in the study.

CONCLUSION

In today's learning environment, online solutions can enable students to access learning material online without showing up for classes. However, the results shown in this study, as well as other studies found in literature, can encourage students to show up for classes and become more engaged and active in learning as there is a strong indication that they will perform better in their final exam if they are active in attending tutorials.

It would be interesting to analyze these results in more detail and perform a statistical analysis of the correlations between these factors, attendance, and final exam grade. It would also be interesting to extend the perspective of the student's performance to factors other than attendance in tutorials, which are also important factors and are not included in this work.

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