TEACHING DURING A PANDEMIC

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ABSTRACT
March 12th, 2020 was the day that the Norwegian Government put Norway in lockdown due to the COVID-19 pandemic. The implication of this was that all kindergartens, pre-schools, elementary schools, high-schools, colleges, and universities were closed from Friday the 13th March.
The universities, and all the other teaching institutions, were instructed by the government that teaching was to go on as normal as possible, only digitally. In other words, students were not to miss any teaching and there was no adjusting of curriculum. By the following Wednesday, all our teaching was digital; lectures, rehearsals in regular bachelor and master courses, and mentoring of bachelor, master, and PhD-projects. This was done regardless of what pedagogic and didactic background the teachers have. This was also to be done from home, where most of the teachers did not have an office or teaching aids other than their computer.
This paper looks at the didactic methods for digital teaching and mentoring and compare them to how this was done in a crisis, where we had to make it work. The paper also looks at the recommended ways of conducting digital home exams in regards of testing the curriculum and not having the opportunity to control the environment in which the students are taking the exam. And last, it also investigates if the teaching and examination process impacted the students' grades and satisfaction.

Keywords: Teaching, supervision, pandemic, exam, civil engineering education

1 INTRODUCTION

E-learning is a fast-moving trend and is becoming a promising alternative to traditional classroom learning. Alternative methods have been recommended for both exams and teaching. This agrees with the assumptions made by Barr et al. [1] that we are moving from a teacher-centred to a student-centred learning. According to Raaheim et al. [2] the main barriers to change from the analogue methods we use today is lack of knowledge about the alternative solutions and lack of digital skills. A survey done by Heimly et al. [3] discovered that the use of flipped classrooms could reduce the failure rate and increase the students' average grades. The use of flipped classrooms makes it possible for the students to watch the lectures when it suits them. However, Zhang et al. [4] discovered that lectures held digitally, where the students could actively participate, resulted in a higher learning outcome and satisfaction.
During the spring of 2020 the coronavirus disease quickly spread across the world and in March the World Health Organization [5] declared the situation as a pandemic. The Norwegian Directorate of Health [6] decided upon implementing a number of measures, including closing the universities. This affected the way of teaching in a drastic manner, making the teaching completely digital. It also affected the way we planned to carry out the exams in the spring semester. We had to have a plan for this relatively quickly, and plan for the situation where single parents had to be kindergarten-teachers at the same time as they were students and taking an exam. The students in Norway are a diverse group, many of them have children that were to be home schooled. This influenced their ability to study, because they had to be teachers during the day and students at night or at the same time as they were teaching their children. This affected how we made the curriculum available to the students – what type of teaching was best fitted for the situation we were in as a society?

2 CASE

At University of Agder all our teachers shall within two years of being hired, have completed a 200 hour course called "university pedagogics". In recent years, a small part of this course touches on the pedagogics and didactics of digital teaching, but many of the teachers at the university had no theoretical background to support their digital teaching decisions. How did this affect the choices for teaching? The

case used in this paper is the teaching done at the civil engineering department at the University of Agder. The focus will be on the students' learning outcome and feedback, regarding the different methods and tools used by the teachers from lockdown until today. In addition, the exams held in the fourth semester for the civil engineering students is used as a case to look at the development of grades.

3 METHOD

The method used in this paper is an evaluation of the way of teaching during a pandemic. As programme coordinator I can get an overview of the different solutions applied by teachers. At the same time, I am in direct contact with the students and receive their unfiltered opinions and feedback. This paper looks at how the various teachers solved teaching during the pandemic induced lockdown. It also investigates the different types of examination used. The first semester under lockdown came suddenly and brought about a sudden paradigm shift – all teaching went from being based on physical attendance to completely digital. This was therefore done as good as possible with the tools available. In the next semesters, however, the students' feedback, time and competence made it possible to create better circumstances for learning when it comes to supervision, teaching and exams. By doing this evaluation we will be able to identify the solutions matching the students' needs and requirements, and at the same time meet the demands from the National Guidelines for engineering studies [7].

In addition to evaluating these semesters, we collected the grades from three different subjects. The three subjects were BYG124 Water and wastewater treatment, BYG213 Structural design – foundation engineering and structural design and BYG214 Urban and road design. These subjects are part of the second year of the study of civil engineering. The data collection consisted of grades from the spring semester in 2016, 2017, 2018, 2019 and 2020. By comparing these subjects, and not subjects from the first semester, we avoided the insecurity with newer students – especially the students who started in 2019. It was not possible to compare the third-year students because they write their bachelor thesis in the spring semester and will not have any typical examination this semester. The grades were calculated into number values; were an A equals 5 and an F equals 0.

4 RESULTS AND DISCUSSION

The spring semester 2020 started out as normal, with regular teaching of classes and mentoring of students working on their bachelor and master thesis. This meant that in most cases the lectures were done in classrooms and auditoriums and mentoring were done by physically meeting the students and discussing their progress and problems. On the 12th March, the government [6] closed Norway down, and at the same time informed that the teaching at the universities were to continue as close to normal as possible, only digitally, from the following Wednesday. This meant that the teachers had 5 days, including the weekend, to change their teaching methods and adjust the curriculum to accommodate digital teaching. As mentioned earlier in this paper, all teachers at the university must complete a course in pedagogics. In later years, this course includes digital teaching, but many of the teachers have completed this course long before that became a part of the course. As a result of this, the programme coordinators and section leaders had to do a lot of information work towards the teachers, on what tools we had available to keep the courses going. The tools we had was Microsoft Teams and Zoom. Many of the classrooms and auditoriums at campus have facilities to stream the teaching from the classroom live and with recording to the students. However, this was not an option for teaching in the spring semester, because the universities were closed. All teaching had to be done from home, with the resources we had available. However, we had the opportunity to get equipment from our offices – such as external screens, docking stations etc.

The first few days were full of discussions on how to teach the courses in the best possible way. How do you teach and have rehearsals in for example a static course? That is the kind of a course were most of the teaching is done by doing calculations on the whiteboard. How do you do this, when the standard laptop we have at University of Agder, is a standard laptop with no possibility to write on the screen? Some teachers contemplated making step-by-step presentations, with calculations done by writing formulas and solving them in e.g., Microsoft Word. Some teachers had scanners at home and scanned handwritten notes and put them into a presentation. This worked to get started teaching again, but both the teachers and the students missed the step-by-step calculations that were usually done on the whiteboard. There were in the days after we started teaching again, many ways to get back to this step-by-step teaching. The solution for some teachers were to turn the web camera and use it as a document camera, others used their smartphone as a document camera, and some bought pen tablets to assist their

teaching. The university were very supportive when it came to buy these things. As time went by, and we realized that this situation would last more than a few weeks, the department also supported buying iPads or similar products where you can write directly on the screen and save the document and upload it later to the LMS.

At the same time as it was important to keep the teaching going, it was also very important to keep in close contact with the students. This was for many reasons; one was to inform them on the situation and what we knew. Another reason was to know in what courses the teaching was working, and they got the information they needed, and in what courses we needed to adjust better to the situation. It is important to keep the courses interesting for the students as this is one of the main reasons why students drop out [8].This interaction with the students was also so that they felt part of the process and that they felt that the common goal was to give them the best possible teaching and keep them interested in the courses that they were taking. This is in accordance with what Skodvin [9] says; that it is important to engage and arouse curiosity in students. This was very difficult to do during digital lectures. But by keeping them part of the whole process, we feel that we achieved some of this.

Inger Marie Dalehefte did a survey based on 2200 students' feedback regarding access to information, learning arrangements and general conditions before and after the Covid-19, which was published on the University of Agder's webpage [10]. The main findings from this survey were that the students prefer physical attendance, but if digital they preferred asynchronous online teaching with group work. They expressed it to be difficult to see the structure and coherence of their courses. Dalehefte also presented some of the results in a conference at the University of Oslo last year [11]. The conclusion was that 91% of the students experienced poorer learning outcome, but that they felt informed about the situation.

After a while we realized that the universities were to be closed for the rest of the semester, and we also had to focus on how to carry out the exams. There were many things to take into consideration when it came to this, for example many of our students are parents and schools and kindergartens were also closed. Many people were in quarantine and did not have the possibility to have grandparents babysit during the exams. This meant that this also was something we had to take into consideration when planning the exams. The faculty gave us the opportunity to change how the exams were to be carried out, this meant that we could change from graded grade, to passed/not passed. By changing the duration and format of the exams we risked sacrificing the constructive alignment as described by Biggs [12]. Regardless of the circumstances, the students still wanted grading on their exams. The civil engineering section chose to try to meet the students' wishes on keeping graded grades and chose to give exams with long exam time. This meant that the exams were given over 24 hours, with all aids – they could use the internet, books etc. The only thing that was not allowed was collaboration between students. By giving the exam over 24 hours, we informed the students on estimated time to solve the exam so they could still take care of their children and act as teachers and kindergarten teachers for their children. This was successful; however, we later saw through evaluations that many students actually worked on the exams for close to 24 hours. This was not intended from our side, and when we later had to change exams again in the fall semester, this was taken into consideration.

When the fall semester was planned, it was possible to have students at campus, but the capacity of classrooms and auditoriums were reduced due to the pandemic and having to keep our distance. Hence, some courses had to be taught fully digitally and some could have a reduced number of students present. One big difference from the spring semester, was that in the fall we could use the streaming facilities at campus. Some teachers chose to go back to teaching in the classroom with streaming and some chose to keep everything digital, and use Zoom as the teaching platform. Exams were also planned to be carried out at campus. This changed in October, when we were told that once again exams were to be home exams. When we planned these exams, we had fresh in mind the fact that quite a lot of the students worked on the exams for close to 24 hours. So, we changed some exams to portfolio exams, where hand-ins became the basis for grading, and others were kept at the original exam length with graded grades. We informed the students that these exams were prepared to be so much work that it would take the whole length of the allotted time, and that they were given an extra 30 minutes to scan and upload the exam. This worked well, and the students were pretty happy with this arrangement. There were some other things that made this kind of exam possible, one was that the schools and kindergartens now were open, and students with children did not have to be teachers at the same time as they were taking an exam. We also informed the students in advance of both the spring and fall exams, that by uploading their exams answers, they agreed upon that this was their exam answer and that they had not collaborated

or used other aids than what we had said was ok to use. Basically, they had the use of all aids except from collaboration with other students.
At almost the same time as we were told that the exams in the fall were to be home exams, we were also told by the university that the exams in spring of 2021 were to be home exams too. The difference from earlier, was that we now had time to plan the examination process instead of just finding an ad-hoc solution. This led to more courses with portfolio exams or a combination of portfolio and digital oral exams. Others again, have chosen to keep the original exam length + 30 minutes for scanning and uploading. This could have a positive effect by giving the students alternative ways of demonstrating their acquired skills. Looking at Chickering and Gamson's [13] 7 principles for good practice this addresses the seventh principle: Respects diverse talents and ways of learning.
The grading in three different subjects over the past five years is illustrated in Figure 1. The reason to compare these grades is to investigate if the learning outcome or the examination process have been affected by COVID-19. The results indicate a small increase in the grades in the spring of 2020. This is not significant compared to the variance through the last five years. This indicates that the grading is as expected if the semester had been without a pandemic. However, it is worth noting that there is an increase across all three subjects from 2019 to 2020. This is not seen for any other one-year periods. Even though Dalehefte [11] implied that students experienced a lower learning outcome this does not seem to apply in this case. Dalehefte did her survey in May 2020, which was a month before exams. An alternative explanation might be that the students worried about the effect of COVID-19 since 47% of the students also worried about the technology failing during exams. Another explanation to the apparent increase in grades could be that some students perform better under a 24-hour examination process instead of the traditional ones, which corresponds to the theory of Chickering and Gamson [13]. Whether the slight increase is a result of the digitalization which Zhang et al. [4] implied would need further investigation.

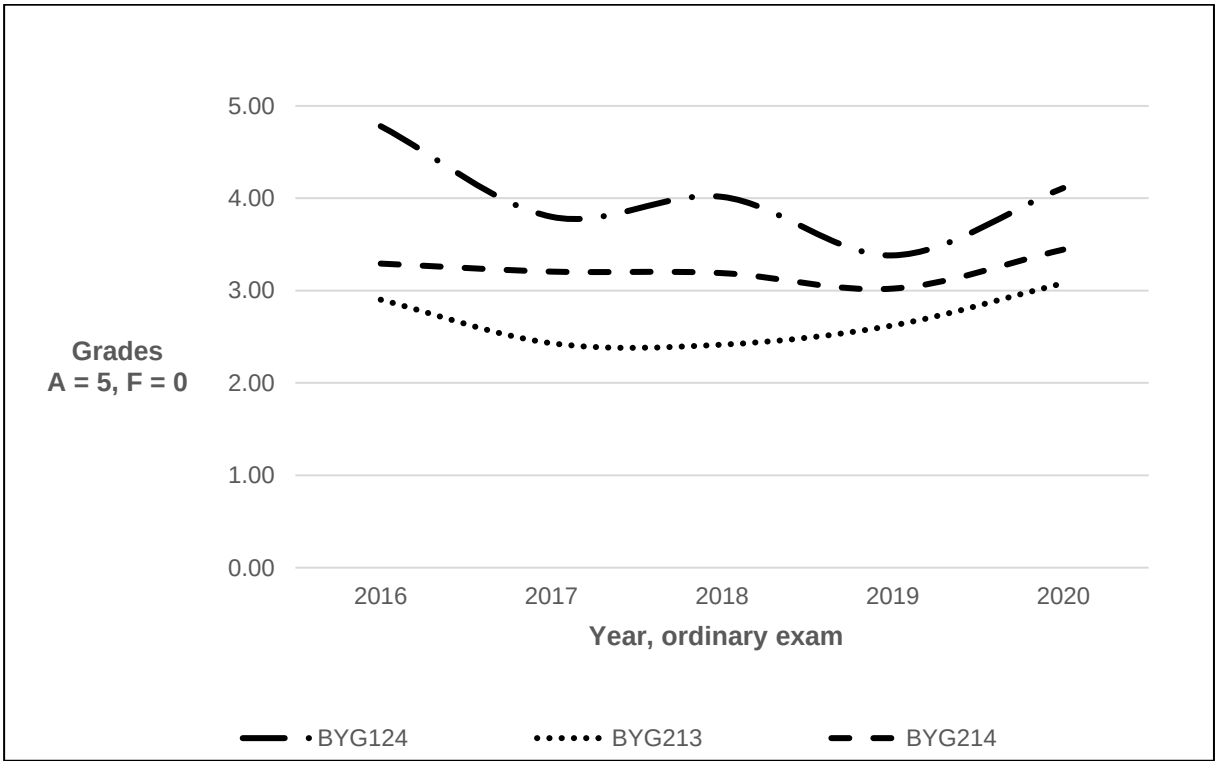

Figure 1. Grade distribution in three courses over five years

The teaching in spring of 2021, was planned very similar to the fall of 2020 – some were to have students in the classroom and use streaming facilities, some were fully digital, and some were to use digital teaching and flipped classroom. Few days before teaching were to start in January 2021, the government closed the universities again. This meant, once again, that all teaching were to be fully digital. There was one big change from earlier though, now we could use the classrooms with streaming facilities. Many teachers chose to use this solution, but without students in the classroom. Luckily, our university were able to open for students in the classroom again from the 1st February.

The courses that were planned with digital teaching and flipped classroom, continued with this solution. By using flipped classroom and problem-based learning, one engages the students in a different way, they get more mentoring but at the same time they work more independent in the course [4]. The courses with flipped classroom are planned a little different, there are some lectures given by the teacher and they also are given access teaching videos at LinkedIn Learning and digital mentoring. The mentoring is scheduled in the timetable, but the teacher is flexible when it comes to when the students can get mentoring. Some students wish for mentoring according to the timetable, but many of them prefer to be able to send an e-mail to the teacher and ask for mentoring when they are working on the problem given in the course. This of course does not suit every teacher, but in these courses, it actually adds up to slightly less time spent on mentoring than in a normal situation where the teacher is available for 2x45 minutes a week. It also means that the time spent on mentoring is efficient, usually the students need 15-20 minutes of mentoring when they ask for it. Most of the time it is 3-4 students in one mentoring session. These mentoring sessions are more fulfilling for the teacher because you can discuss with and help the students when they need help, instead of sitting in a classroom for 90 minutes and maybe spend half that on actually mentoring.

5 CONCLUSIONS

After having an abnormal teaching situation for going on three semesters, it is only natural that the teachers exchange experiences from the last semesters' different ways of teaching. There is some interesting feedback, many of our colleagues say that they do not see that they in the future will return to teaching only in the classroom. They say that they are more open to have a combination of physical and digital teaching. This is especially common in courses were one can use short videos to show how to tackle problems that they know many students are going to ask about. A short video that the students can watch again and again, reduces a lot of questions to the teacher, and the students' time with the teacher can be used for discussions and dialogue instead of lecturing. However, we see that some teachers, often with many years of teaching experience, are saying that as soon as everything is back to normal, they will go back to their old way of teaching. We also see that the same teachers want to go back to how the examination process was before COVID-19. Many of our more progressive colleagues are now discussing different types of exams, instead of just the old fashioned 4-hour written exam, situated in a classroom with inspectors present. The grades for selected subjects in the spring of 2020 showed a slight increase. This could imply that a combination of digital teaching and digital examination produce similar and expected grades to traditional teaching and examination.

The authors of this paper think that post COVID-19, there will be changes to how we teach engineering sciences at the University of Agder. Not because we must, but because we have been forced to think differently about our teaching and have learned a lot on how we can teach differently than pre COVID-19. One of the changes will be 30 minutes of supervision instead of 60 minutes. This has proven to be more efficient, and the students spend these 30 minutes more structured and prepared. Another change is the examination process. By having portfolio as part of the final grade in the subjects the students are evaluated on different qualities, and not only on one single exam. The third change will be the use of digital tools to support traditional teaching. Since the students have seen that there are different ways of being taught and to work with their studies, they also more than likely, want to keep some of these changes.

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