DID COVID19 IMPROVE OUR TEACHING?

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Abstract

The COVID-19 crisis has created a shock to our university; starting from March 13th we have been forced to convert all teaching from blended learning, or face-to-face to online mode. Shifting all teaching to online within days is a risky process. A complete online course requires an elaborate lesson plan design, teaching materials such as audio and video contents, as well as technology support teams. The present paper gives insights into the required adaptations for selected courses. In addition to the description of the various cases, quantitative and qualitative data on student opinions is gathered using a survey. The goal of this research is to provide recommendations and learnings from this unplanned switch into a fully eLearning-based environment. This paper strives to point out didactical, organizational, as well as technical implications. Considering these implications from both, the lecturers' as well as the students' viewpoint, ensures a holistic assessment of the situation.

Keywords: COVID19, online teaching, innovation, lessons learned.

1   INTRODUCTION

The COVID-19 crisis has created a shock to most universities in the world. Starting from March 13th all universities in Austria were forced to convert all teaching from face-to-face to online mode without any warning. At the University of Applied Sciences Technikum Wien (UAS TW), some 4000 students are studying in four faculties. The faculty of Computer Science runs two bachelor programs and six master programs. The study programs are either designed as face-to-face or as blended learning programs. In the blended learning programs, around 30% to 60% of teaching already was online before the COVID19 shutdown was coming into effect. Shifting all teaching to online within days is a risky process. A complete online course requires an elaborate lesson plan design, teaching materials such as audio and video contents, as well as technology support teams. However, as there was no other choice, all teachers involved put enormous effort in rapidly shifting their individual courses into a suitable online format. In the present paper, we will discuss in detail the different approaches and their respective advantages and disadvantages. Therefore, the addressed research questions are, "What had to be adapted by the COVID-induced, spontaneous digitalization of teaching? What are the effects of the sudden digitalization?"

Our university decided to do everything possible to help students to finish the semester as planned. Teachers had to find a fast way to change their individual teaching from the used face-to-face or blended design to an online format. At the same time, all offices had to be closed and all work had to be done from home. The following problems had to be solved:

- Course design for online teaching
- Insufficient IT resources at home
- Limited access to library
- No access to specific hardware resources (e.g. gaming lab)
- No or insufficient guidelines lead to many individual solutions (e.g. for video conferences)
- Online exams
- Limited social contacts (e.g. group works)

Many of these problems could be solved to various degrees by highly motivated staff.

The feedback from students showed a variety of reactions. Some of the students feel they learned less, compared to a normal semester. Some students feel there was no significant change. In some cases, the change of face-to-face teaching to online teaching did not work at all; this was probably caused by the inappropriate of course design for online teaching predominantly.

A valuable side effect of this enormous effort in online teaching was a huge increased knowledge among teachers. At the faculty of computer science, many teachers already had personal knowledge in online teaching. This experience helped other teachers to acquire the necessary knowledge rapidly.

2   METHODOLOGY

The paper at hand is based on the approach of a multiple case study. Case studies are "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and context are not clearly evident" [11]. In order adequately do so; a diligent description of the phenomenon, by using different sources and kinds of information is required. By using a case study, it can be ensured that the problem at focus "exists in its natural, real-world setting" [7]. Each selected course follows its own structure, has its detached number of participants, and has its own course culture, rendering each course a case on its own. The selected courses are based on a purposive sample and can be regarded as typical cases in the notion of the research question. In comparison to other university courses, the selected courses can be seen as extreme cases. This is because it only focuses at courses from the field of computer science and that a high number of lecturers have broad experience in online teaching. The case study as research approach was used in order to create "a source of well grounded, rich descriptions and explanations of processes occurring in local contexts" which we believe to render the highest value for the question addressed [9]. The choice of research approach, as Patton puts it, "like diplomacy, is the art of the possible" with no such thing as an ideal solution [10, 8]. Yin shows, that research questions of kind "how" and "why" and the focus on a contemporary event is well suited for the use of the case study method [11].

Qualitative as well as quantitative data is collected in order to describe the different cases. The experience of the lecturers was harvested qualitatively and a questionnaire was sent to the students. The integration of the different kinds of data allow for a more complete view on the phenomenon at focus. Due to the kind of questionnaire used, quantitative as well as qualitative data is gathered. Therefore, in terms of complementarity of data different viewpoints (lecturers and students) as well as different data sources (qualitative description and quantitative analysis) was used [6, 11]. Both data sources were collected simultaneously with the quantitative data being supplemental to the qualitative data, hence creating an embedded mixed method design.

3   RESULTS - SWITCH TO ONLINE TEACHING

To allow a deeper insight, the authors describe the results achieved after changes to individual courses had been applied.

3.1   Teaching in the Department of Computer Science

The Department of Computer Science offers more than 22.500 hours of teaching in the field of Computer Science. Most lessons are in the fields Software Engineering, Software Quality Management, DevOPs, Digital Enterprise, User Experience Design, Artificial Intelligence, Data Analytics and Information Security. The majority of courses (45%) are designed as "integrated courses", an individual mixture of lessons and exercises, some 20% are classical exercises in face-to-face mode, followed by distance learning courses (10%) and miscellaneous types (25%). The department of Computer Science employs 38 full time researcher and teacher and 200 part time lecturers from industry to ensure state of the art expertise in all fields of computer science [12].

Some lecturers of the Department of Computer Science at the UAS TW gained already experiences in teaching in a fully eLearning-based environment during the Distance Study Degree Programs. These Distance Studies, which have been performed in the years from 2010 to 2018 at the UAS TW, comprised only two presence phases – one on campus phase at the beginning of the semester and a second one at the end during the exam weeks. All weeks in between have been real eLearning phases. These English study degree programs have been very attractive to students around the world based on the maximum study flexibility. The main challenges in these distance studies have been the good didactic planning of the courses, as well as an ongoing support and motivation of the students during the eLearning phases. In various funding projects tools to support lecturers as well as students have been developed. These tools comprised for example a matrix to transfer didactical approaches of on campus phases to eLearning phases, extensive training offerings in the application of eLearning tools as for example Learning Management Systems (Moodle), Authoring tools (f.e. Articulate

Storyline), communication tools (f.e. Skype4Business), as well as certain licenses to use these software systems. Despite all these supporting instruments, there exist many potential obstacles for lecturers and students during eLearning phases. Based on the shock, which was created by the COVID-19 crisis, it took some time to check the reusability to these instruments in the actual presence study degree programs.

3.2 Switch to Online Teaching

On Wednesday March 11th the first management meeting on the topic of Corona was convened. In the context of the meeting it was decided to offer the entire teaching in Distance Study from Monday March 16th Laboratory intensive courses were suspended until further notice and should be made up for at a later date. All other types of teaching had to be done via various solutions - partly hosted online and partly on premise. However, at that time no specific guideline how this can be accomplished could be made.

In a first step, attendance was replaced by online meetings. In the second step the meetings should be recorded and made available to students to ensure time flexibility. The premise was to work as far as possible with existing documents and materials, because at the same period a time-consuming project to redesign the teaching was running. On the one hand, this was an advantage, since this concept was strongly based on eLearning, on the other hand it consumed a lot of time and personnel resources. Your teaching and learning Center as well as the department of computer science provided information courses with best practice approaches and manuals to support the lecturers. The heads competence centre, who are responsible for the lecturers and their teaching, contacted each lecturer to discuss and support the transition to online teaching.

3.3 How Individual Courses have Been Affected

Courses in computer science have very different characteristics, depended on the desired learning outcomes. Several courses are described here to show the very different effects observed.

3.3.1 Innovation Lab 2 – Bachelor´s Program Computer Science, 4th Semester

General Information

The Bachelor course was attended by 104 fourth semester computer science students (91 male, 13 female). The course was set up as a project and was accompanied by 13 lecturers who were divided into 27 project groups.

Initial Course Setup and Tooling

The project groups consisted of 1 to 5 persons. After choosing the project topics and establishing the groups, the students have time to work on their project for 3.5 months in which the groups were mentored and coached by the supervisors individually. The didactic concept is based on problem-based learning. Students work on tasks necessary to complete the project. The advisor accompanies this project and take on the role of a coach or mentor as required.

It was up to the group to agree on intervals and dates for their meetings with the advisors. An interim presentation to the course leaders was planned as well as a technical review of the final results at the end of the course.

The specifications for the implementation of the project were deliberately kept free. The only obligation was the use of a special (online) ALM tool for requirement documentation and source code management. Some project groups work on/with software, others with hardware and software.

Corona Switch

Due to the corona lockdown, 100% of the course was transferred to distance learning. Meetings with the supervisors were held via MS Teams or Zoom. Some supervisors created MS Teams channels to enable collaboration. The necessary hardware was sent from the purchasing department to the private address of the course leads and from there it was repacked and sent to the students. The interim presentations to the course leads were skipped. The final presentation and the technical review were changed to an upload of the project documentation, a thirty second trailer video (to provide an overview) and a three-minute technical review video.

Challenges and Learnings

The biggest challenges for students was to work in teams remotely, especially if they had to work with hardware because not all team members got hardware by mail. Some groups sent the hardware via mail to each other's. But it took time, interrupts collaboration and produces a bottle neck in their project setting. On the other side advisors reported back that meeting intervals were reduced and, in some cases, weekly meetings were held. If there were no problems, these meetings often lasted only 15 minutes. This improved the project result compared to previous years. An exception were projects with high and expensive hardware requirements. Here the project results were significantly below those of previous years.

3.3.2 Scientific Methods – Master's Programs, 2ⁿᵈ Semester

General Information

The course is attended by 43 Master's students, with 12 females and 31 males. The course is intended at teaching research methods and scientific writing as a preparation for their own Master's thesis project.

Initial Course Setup & Tooling

The course is split up into two groups, with each about 20 students and course units on seven evenings. Each evening is dedicated to a different research method with inputs, discussions, and exercises for this specific research method (like e.g. reading publications using the method and discussing the appropriateness of use and output). The students grades is made up of two assignments (write a literature review, conduct and code an interview) as well as a written test at the end of the semester. At the final test the students have to read a published paper and give a detailed peer review on it.

Corona Switch

The switch to online sessions took place in the middle of the course. The online sessions structure remained as planned with explanations, short quizzes to see if they keep up with the contents, and the discussion and exercises with the method at focus. The assignments remained the same, too. Instead of the written test we conducted oral exams online. As a preparation the students received a list of about 15 generic questions on a scientific publication in advance (e.g. how do you rate the use of the method). 90 minutes in advance to their oral exam appointment they then received a published paper for which they had to discuss the general questions. A 20-minute oral exam was then held to discuss and learn about the rationale behind their findings.

Challenges and Learnings

During the course the biggest challenge was to keep the students motivated during the appointments. The short quizzes in the beginning earning them points motivated nearly all of them to participate in the online sessions. A surprise quiz in the middle of one of the sessions then showed us, that not of all them stayed focused during our course (28 out of 38 participants could answer the question, 6 did not participate in the quiz at all). Moreover, we could see that discussions were limited to only very few students where we could usually motivate nearly everyone to discuss with us in class. The students knew each other already, therefore the information exchange worked well in-between. We saw that students tended not to participate actively due to several reasons, one definitely them being "shy" because sessions were also recorded. Some students answers in the questionnaire moreover suggest that on site they felt more integrated in course sessions on site, and therefore also participated less when conducted online.

3.3.3 Interaction Design – Master´s Program Software Engineering, 2ⁿᵈ Semester

Initial Course Setup and Tooling

The course "Interaction Design" of the master´s program "Software Engineering" is designed as PBL (Project Based Learning) course. This means, students form groups consisting of 3 to 5 students. These groups work on one interaction design project each as a group. The role of the teacher is to guide the students through the design process, to assist in the answering of question arising while studying and in finally judging the found solution. Traditionally most teaching takes place in small seminar rooms, where the students and the teacher meet to discuss the various aspects of the project. For presentations purposes students and teachers use software tools to create slides and project them on screens.

Corona Switch

The course was changed entirely to distance learning. All meetings were done various tools for video conferences, including the final presentation of the project and grading.

Challenges and Learnings

The only challenge to overcome was getting used to the tools. After a short period of confusion, all teachers agreed on using zoom as the only tool. Once students and teachers got used to the tool, teaching continued without any major obstacle. Moreover, when reviewing the course, teachers and students agreed to keep the setting even after the pandemic will be over. The reason for this unexpected outcome was simple: Most students work in companies, therefor using a video conference tool allowed for a much easier organization of all types of meetings. Travelling was unnecessary and therefore much time could be saved.

3.3.4 Case Study 2

General Information

Case Study 2 is a course in the second semester of the Bachelor Study Degree Program Business Informatics. This lecture provides the opportunity to realize taught techniques from relevant courses of the semester during a project. It offers an opportunity for students to apply their previously gained knowledge in various disciplines (project management, market research, benefit analysis, configuration) in the context of a software selection project. Students must develop in project groups a web-based CMS application to support enterprise business processes. This is performed according to project- and engineering best practices.

Corona Switch

With the abruptly occurrence of the COVID-19 crisis in Europe and the accompanying switch from on campus learning to online teaching, it was necessary to make a fast but well thought through chance in this lecture.

At first, we developed the learning paths for the self-study phases, as well as for the online workshops, that the students were well informed about the recommended process of online learning and teaching during Case Study 2. Based on the experiences we made during the Distance Study Degree Programs between 2010 and 2018, we know that the most important thing for students is not to feel alone during the studying process. So therefore, recommended learning paths help them very well to know how to go on with their studies.

Challenges and Learnings

Of course, also online learning materials are important for students, but the advantage of this lecture was, that it is a project which is set up based on previous courses, so there were no new learning materials/ contents needed.

A further very important step during the switch from presence to online learning and teaching was the coordination of six lecturers whom were involved and teaching in this course. So, we decided to make a kick-off online conference for the lecturers' team and set up a forum in the moodle course wherein we discussed questions of students and our review process of the delivered project results of the student groups. This coordination process between the lecturers is since the start very time consuming, also when we know that it is necessary to deliver agreed answers to students.

3.3.5 Object Oriented Programming and Modelling

General Information

This bachelor's level course was taken by 57 business informatics students (36 male, 21 female) in their second semester, divided into two groups (each one supervised by one of the two lecturers).The course consists of a lecture/demonstration part and an exercise part.

Initial Course Setup & Tooling

In the lecture part, the lecturer explains theoretical concepts and demonstrates them using programming and modelling examples. Additionally, short programming examples are handed out that are to be solved by students directly in class and discussed afterwards (not graded). In the exercise part, students have to solve (graded) task assignments by themselves (mostly between the regular course appointments). To support students with these assignments, short video clips of a few minutes which summarize concepts (such as inheritance, polymorphism, I/O, exceptions, etc.), are provided;

these clips were not specifically developed due to Covid-19, but have been part of the course for years. The course participants are motivated to deepen their knowledge by themselves, using the video clips while working on their assignments, and ask questions or discuss problems in the next lecture unit, which is in spirit of a flipped classroom concept (see e.g. [2]).

Corona Switch

The online version of the course during the Covid-19 pandemic tried to keep as much of the original course design as possible. To this end, all lectures and demonstrations were given via a video conference tool (MS Teams) at the regular appointments. For the practical coding demonstrations, screen sharing paired with an audio conference was used instead of a video conference. In the modelling part, a tablet with a stylus and drawing software was used to share UML sketches. Due to Covid-19, the flipped classroom concept (self studying/deepening of knowledge based on video clips and discussing them in the next course units) turned into an online flipped classroom [1].

Challenges and Learnings

In the online format, difficulties arose from the fact that there was no direct feedback from students. Since most participants were passive listeners, it was difficult to evaluate during lectures and demonstrations if the audience can still follow. Active participation was explicitly encouraged, such as by asking questions and suggesting applications that are to be implemented by the lecturer, or discussing problems that occurred during self studying (flipped classroom). However, except for around 3 students per group, the vast majority followed the course passively. In some cases, it turned out much later that there was a strong desire in the group to discuss certain topics again or to see more examples, but the participants did not dare to ask directly. Instead, with a delay of some course units, they dropped written request for additional examples to persons not directly in charge of the course (such as the program coordinator), which further delayed clarifications. While this hesitation to ask questions may also occur in on-site courses, relying on audio only seems to increase the problem.

Another difficulty concerned the small programming examples (not graded) that were planned to be solved and discussed by students in class (between the lecturer's explanations). Due to difficult two-way communication and the hesitation to participate actively, involving the participants did not work out well and in most cases these exercises had to be directly solved and explained by the lecturer, with the drawback of reducing the chances to practice programming in class.

The two planned interim tests (computer tests with programming tasks) were held remotely as open-book tests and have been graded by automated test cases as planned. Obviously, communication between students during tests could not be prevented (although it was officially forbidden). These interim tests, however, count only for bonus points (even in the original grading schema), which is why this possibility was accepted. Also the final exam (also a computer test with modelling and programming tasks) was held remotely mostly in the originally planned form, except that it was open-book as well. However, due to the possibility of communication between students, an additional short oral exam of 20 minutes per candidate was held in order to check if they can also explain their submission (causing an additional workload of around 10 hours per lecturer for first exam appointment). In summary, the exercises and interim tests based on automated test cases could be held without any significant problems, with the only significant change being that there was no exam supervision.

3.3.6   Agile Software-Development and Lean UX

General Information

This compulsory course, which is part of the second semester of the master's degree program Innovation and Technology Management, was attended by 40 students (9 female, 31 male) in the summer term 2020.

Initial Course Setup and Tooling

The course introduces students to the principles of agile methodologies as well as the basic methods of usability engineering [3], user experience design and Lean UX [4]. Since Innovation and Technology Management is a part-time degree program, this course uses a blended learning concept and heavily relies on self-study. The course defines four on-campus days spread over the whole semester, in which students discuss and present their work and the two teachers give short lectures addressing new subject matter. Between the on-campus days, students are asked to work on exercises and projects in groups. Since the course consists of two parts, namely the agile methods

and the UX methods, the lecturers decided to ask students to use the agile methodologies to accompany and support students in their group work concerning the UX exercises and projects. For instance, the students were asked to develop a high-fidelity prototype as their final project and use Kanban or Scrum to manage their tasks and communicate efficiently.

Corona Switch

After the initial on-campus kick-off, the outbreak of the pandemic did not allow for any additional on-campus days. We chose to hold the remaining three planned on-campus days online on MS Teams during the same scheduled timeslots. On the second on-campus day, students would have presented their work on the first exercise, followed by a short teacher lecture. To avoid technical difficulties during the online session, the students were asked to prerecord their presentations and share them in the course forum instead of presenting them live. The extra time was used to spend more time preparing students for the next project in self-study, namely the preparation of a usability test study.

The third on-campus day would have been a hands-on lab day at the university in which students perform the prepared usability test with each other, each group providing test subjects for the other groups. Converting this lab day to an online session was the most challenging and uncertain change to the course, since the success of it completely depended on the students. After a short common meeting explaining the procedure, each team was sent to their own MS Teams channel to prepare an online meeting and provide all relevant material for a remote usability test (URL to the website, questionnaires, task descriptions, …). Afterwards, each team sent out one team member to be a test subject for another team. After an intensive test session of two hours, the students were asked once again to join a common meeting for a quick introduction of the next exercise and a short lecture. This first-time online lab day went surprisingly well, no severe difficulties were encountered.

On the fourth on-campus day, the students would have presented their final projects, a new improved high-fidelity prototype of the system they tested, followed by an overall reflection on the course including an anonymous course feedback. Given our good experience from the online lab day, we decided to keep the students' presentations and let them present virtually, which turned out to be a success.

Challenges and Learnings

We only identified two challenges that should be addressed the next time: 1. The test sessions took longer than expected due to the additional hurdle of performing the test on the participants' computer with screen sharing. Another reason was that it was not always clear whether a virtual test room is currently free, although students were asked to indicate this in their MS Teams channel. 2. The lecture after the intensive test session was not very effective, since the students were too exhausted. While this would have also been the case with on-campus tests, we felt that this effect was notably stronger than the preceding year. Overall, we only needed to perform minor adjustments to the course design, with the online lab day being our personal highlight.

3.3.7 Web Technologies

General Information

Web Technologies is part 2 of a one-year series about technologies and techniques on how to create web pages, i.e. HTML, CSS, JavaScript, XML, JSON, PHP, using databases and different kinds of web-libraries and frameworks. This bachelor course is held by two lecturers and has 150 students enrolled.

Initial Course Setup and Tooling

Lectures (= attendance hours with new material) and exercises (= attendance hours to consolidate and repeat what has already been learned, students are divided into four groups) are held alternately on a weekly basis. The aim is to provide the necessary skills to create websites at the level of computer scientists, which means that students should gain as much practice as possible. Instead of written examinations students have to deliver six practical home exercises over the term, six self-assessment tests (i.e. Moodle tests that can be completed at self-chosen times within a slot of two weeks) and a final project, which is a web shop for the sale of self-created photos and for the purchase of other photos. Ongoing home exercises are checked randomly (during attendance hours), the final example is evaluated by a personal acceptance.

Corona Switch

Due to the very high level of practical work students had to do - according to the motto "you only learn a programming language when you practice it" - switching from face-to-face to online was not a very big challenge for the lecturers, actually it was done from one day to the other. The lecturers, who both had some experience with online teaching before, tried to transfer familiar structures directly into the online mode. A study carried out in 2016 at the Department of Computer Science at the UAS TW showed that students in computer science related courses are almost completely equipped with their own hardware [5]. At least from this point of view, an immediate change from classroom teaching to online teaching was easy and students were not dependent on hardware provided by the university. Nevertheless, there were some difficulties that had to be solved:Some students were not prepared for switching so fast, they had problems with internet access being not fast enough or with limited data capacity. Although students had to mute their microphone during online lessons (they could ask questions using chat functions) it was sometimes necessary to go into direct conversations with a student with voice and a student's screen being transmitted (e.g. for checking his/her home exercise). Sometimes a connection was so bad that it was impossible to understand the student, sometimes one could hear other people speaking in the background very loudly or passing a motorbike, so that any conversation was impossible for about half a minute

It was quite difficult to find an adequate tool for the online conferences. At the beginning a proprietary tool the "BigBlueButton" was used, which is part of the UAS TW Moodle instance and is therefore being hosted by the university itself. In cases where many people had to be served at the same time (e.g. Web Technologies with up to 80 students at a time and some other lectures simultaneously) the server completely broke down. Especially recording the sessions (students asked for this) was impossible then. Later, MS Teams was used, which did a better job, but students were not subscribed automatically, which had to be done manually. From the technical point of view MS Teams worked great, but usability was a mess for the lecturers, and it was quite time consuming to get used to the ideas behind the user interface. In the end it worked well that both lecturers in parallel were able to connect to a single student to control his/her exercise in a private session, while at the same time the whole group could work independently on small tasks. Switching between several sessions that were open at the same time worked perfectly, and the fact that personal discussions between lecturer and student could be held was an additional advantage.

Towards the end of the course a relatively large number of students was lost, they no longer took part in the online lessons. This may have different reasons and was also observed in earlier years, so it does not necessarily have to be due to online processing of the course. But this a point that has to be evaluated.

Holding online sessions was much more time consuming compared to the face-to-face version. Additional work had to be done for organization, informing students, calling students for personal discussions, struggling with technical problems (mostly on students' side) and switching between session.

It was difficult or even impossible for the lecturers to determine how the students were doing during the online sessions because there was neither an acoustic nor a visual feedback. Questions were asked very rarely, and it was always the same few students being active. Sometimes it was conspicuous that students did not leave the online session after finishing, which suggests that these students were in fact busy elsewhere and not actively participating.

Challenges and Learnings

Despite some disadvantages, the changeover from classroom teaching to online teaching went smoothly from the perspective of the lecturers. The procedure and examination modalities did not have to be changed. Handling the course in online mode was by far more time consuming and "passive" feedback, like watching students' faces, was missing.

3.4 How students experienced the switch

To assess how students experienced the switch the following questions had been answered by 130 students from the faculty of computer science.
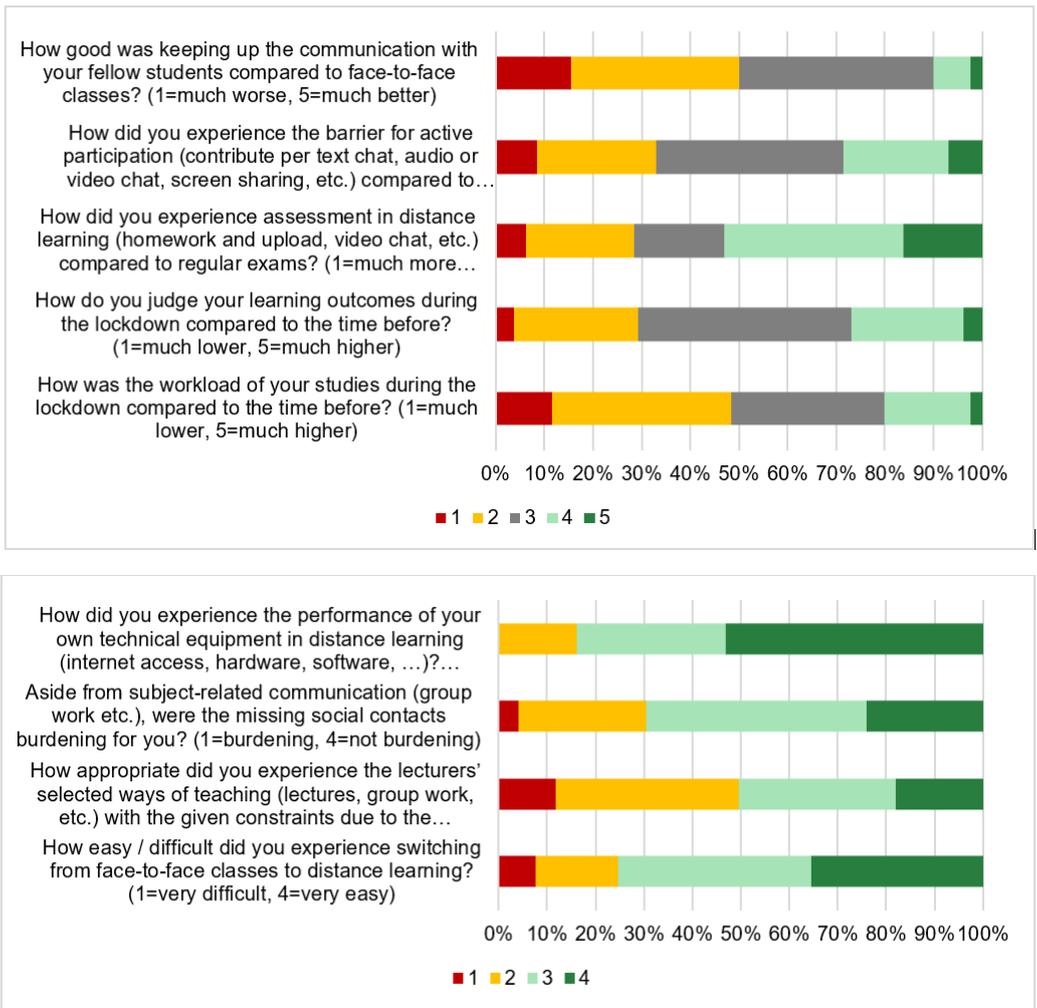
Figure 1. 130 evaluated answers from students when asked on details on the COVID19 switch.

Another important aspect the authors tried to assess was the question if students did experience some improvement in teaching. The following questions had been used to get an overview on the opinion of students. Please not, the question had been asked in general; therefore, it is not possible to differentiate between different types of lessons.
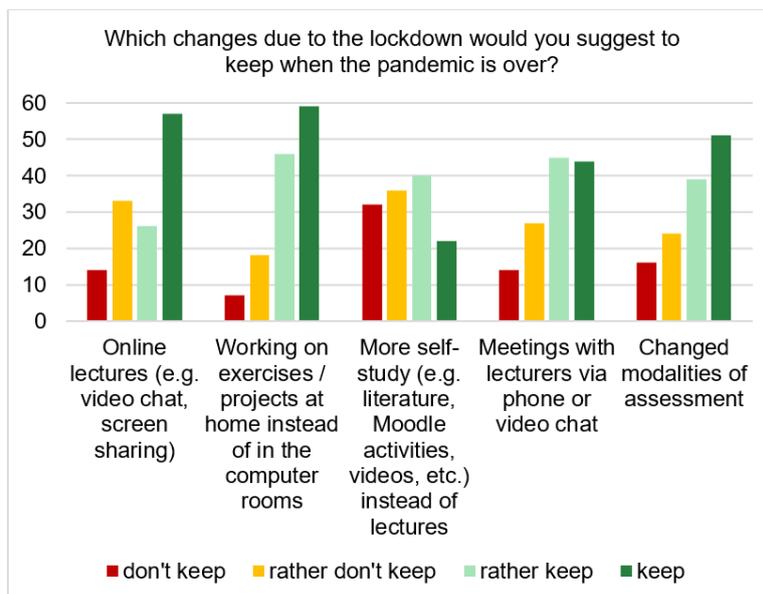
Figure 2: Did students experience improvements in teaching? 130 answers evaluated.

It is interesting to see that students tend to suggest keeping most COVID19 measures, except one, namely "self-study". This fact will be investigated in future work.

4   CONCLUSIONS

Due to most teachers' personal commitment, the transition from classroom teaching to online teaching was quite fast and successful. In many cases, the teaching concepts could be transferred directly from classroom to virtual teaching. Since this is not really useful for all scenarios, we are currently working on refining the teaching concepts. This concerns especially subjects where the presence of students is considered absolutely necessary, primarily courses with a high degree of interaction between teachers and students, such as laboratories and exercise work. If teaching is bound to special equipment that is only available in the rooms of UAS TW, then completely new concepts for teaching have to be considered.

In the meantime, there are also clear guidelines from the university management on how to deal with online teaching. This includes the use of predefined tools (in particular MS-Teams and Zoom for online teaching) as well as clear guidelines for holding online exams. The majority of courses in winter 2020 will again be held as online classes. Classroom teaching will only be held where it is considered absolutely necessary, such as exercises and laboratory work. Furthermore, the respective first years of the study programs will be held in attendance, to promote social contacts among the students. Group sizes have generally been halved in order to comply with the distance rules prescribed by law.

For the project "Case Study 2" it is a fundamental success factor to describe learning paths for the students, so that they knew how to go on with the project during the abrupt change from on campus learning to distance learning. Furthermore, it was very important that the didactical approach of online conferences was planned in detail by lecturers and that they were moderated by them.

Case studies do not allow for statistically drawn conclusions as they usually produce more variables than data points. Same line of argumentation is true for the problem that controlled deductions cannot be made based on qualitative data. Moreover, missing replicability and generalizability is also common critique on qualitative approaches.

Integrating and activating students, motivating the students to discuss is the most crucial part. A fully digital course appointment requires diligent design of inputs and tasks, including assessment of tasks (e.g. short quizzes) that motivate them to actively do something.

Moreover, don't forget that the students also had different new challenges besides online learning (e.g. taking care of children, elderly relatives, anxieties related to a potential loss of their job) which had imposed an additional dimension of stress on them during the Covid-online switch

The general lockdown in March 2020 has massively changed the entire university system and confronted many teachers and students with seemingly unsolvable problems. In the end, all subjects in summer term could be successfully completed, most of them even without delay. As a result, many courses have been redesigned to make it easier for students to follow online courses and do their studies from home. This includes the following measures:

- Promote a higher student self-learning rate and greater personal responsibility
- Clear guidelines for online exams
- Recommended tools for holding online courses
- The lecturer's role is changing from teacher to coach
- Better support for lecturers in the form of templates, how to examples, best practices, toolboxes, …
- Providing lecture halls with streaming equipment for a mixed operation of classroom teaching and distance learning
- Support students in the form of learning progress checks and self-assessment tests
- Open new channels for communication between all parties (lecturers, students, administration)

In summary, we conclude that the change was hard, we experienced both, an increase in teaching quality and a decrease in teaching quality, depending on the initial setup of the individual lesson. The survey done among the students showed that students seem to be more flexible than we had thought and many of them are quite happy with the new situation, as it has also brought a number of advantages, such as time savings due to the lack of traffic routes or greater flexibility with employers,

in case work is done alongside studies Another advantage was that many courses had to be adapted in a form that would have had to be done at a later date anyway as part of standardization measures. Experiences from the Covid-19 related conversions can thus be incorporated into further processes of course development; therefore, the effort of the adaptations is not in vain.

REFERENCES

[1]   Knapp, N.F. Increasing Interaction in a Flipped Online Classroom through Video Conferencing. TechTrends 62, 618–624 (2018). https://doi.org/10.1007/s11528-018-0336-z

[2]   I. Vieira, A.P. Lopes, F. Soares (2014) The Potential Benefits of using Videos in higher Education, EDULEARN14 Proceedings, pp. 750-756.

[3]   J. Nielsen, *Usability Engineering*. San Francisco, CA, USA: Morgan Kaufmann Publishers Inc., 1993.

[4]   J. Gothelf, J. Seiden, *Lean UX: Designing Great Products with Agile Teams*. Sebastopol, CA, USA: O'Reilly Media, 2016.

[5]   Holweg, Gerd; Pucher, Robert; Schmöllebeck, Fritz (2016); How Bring Your Own Device (BYOD) concepts can increase learning efficiency and decrease teaching costs – a case study; in Proceedings of the 8th annual International Conference on Education and New Learning Technologies, EDULEARN16, Barcelona (Spain), 4th - 6th of July, 2016

[6]   T. Das, "Qualitative research in organisational behaviour," Journal of Management Studies, vol. 20, no. 3, p. 311pp, 1983.

[7]   A. S. Lee, "A Scientific Methodology for MIW Case Studies," MIS Quarterly , pp. 33-50, May 1989.

[8]   J. McGrath, "Dilemmatics: the study of research choices and dilemmas," in Judgment Calls in Research, Bevery Hills, Sage, 1982.

[9]   M. Miles and M. Huberman, Qualitative Data Analysis: A Sourcebook of New, California: SAGE, 1984.

[10]   M. Patton, Qualitative Research & Evaluation Methods, London: SAGE, 2002.

[11]   R. K. Yin, Case study research: design and methods, 5 ed., Los Angeles: SAGE, 2003.

[12]   Pucher, Robert ; Holweg, Gerd ; Mandl, Thomas ; Salzbrunn, Benedikt: Optimizing Higher Education for the Professional Student – The Example of Computer Science Education at the University of Applied Sciences Technikum Wien. Digital Universities (ISSN 2385-2992), V.2 (2015), N. 2-3: S.39-50. - (http://digitaluniversities.guideassociation.org/wp-content/uploads/DU_2015_2-3_Pucher.pdf)