

Article

COVID-19 Epidemic as E-Learning Boost? Chronological Development and Effects at an Austrian University against the Background of the Concept of “E-Learning Readiness”

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Abstract: The COVID-19 crisis influenced universities worldwide in early 2020. In Austria, all universities were closed in March 2020 as a preventive measure, and meetings with over 100 people were banned and a curfew was imposed. This development also had a massive impact on teaching, which in Austria takes place largely face-to-face. In this paper we would like to describe the situation of an Austrian university regarding e-learning before and during the first three weeks of the changeover of the teaching system, using the example of Graz University of Technology (TU Graz). The authors provide insights into the internal procedures, processes and decisions of their university and present figures on the changed usage behaviour of their students and teachers. As a theoretical reference, the article uses the e-learning readiness assessment according to Alshaher (2013), which provides a framework for describing the status of the situation regarding e-learning before the crisis. The paper concludes with a description of enablers, barriers and bottlenecks from the perspective of the members of the Educational Technology department.

Keywords: e-learning; strategy; e-lectures; online learning; COVID-19

1. Introduction

In a survey by Times Higher Education of 200 rectors from the top 1000 universities, “19 percent think that digital technology will have eradicated physical lectures by 2030, compared with 65 percent who disagree” [1]. The same study from 2018 also shows that European rectors at top universities agree to a wider extent than their US-American colleagues that digital technology will have eradicated physical lectures (and to a lesser extent than Asian colleagues). These results are from a time before the COVID-19 crisis in spring 2020, when, for the first time, presence teaching was restricted in many universities worldwide.

Before COVID-19, apart from a few distance learning universities, most European universities were presence, non-distance universities, teaching more or less physical lectures. Nevertheless, for 30 years different formats and forms of technology-supported learning have been used and implemented in European universities [2]: Learning management systems are often standard; lecture recordings as a supplement to lectures are an option, especially for mass courses; some teachers are shifting the transfer of knowledge to videos and use the course for open questions and exercises. Nonetheless, pure online courses are still rarely found. How to communicate, achieve and improve the advantages of e-learning-supported teaching and online teaching is the task and interest of many e-learning centres,

university didactic institutions and also research units—and in research publications [3]. There are several considerations and models of how to achieve a high level of use and adaptation of online teaching at presence universities and how to assess universities' e-learning readiness. There are also studies that deal with the resistance against and disadvantages of e-learning in higher education [4].

The COVID-19 epidemic had the side effect that online teaching received an involuntary boost and was implemented on a broad scale at Graz University of Technology (TU Graz) within a few days. Within this article we describe how this provisional and temporary, but almost complete, conversion of the teaching system to online (remote) teaching, specifically e-learning, has succeeded. We will describe challenges and bottlenecks. From a scientific point of view, we would like to link this to the question of the e-learning readiness model; whether it should be adapted or if this experience confirms them. We also write this article because only after a few days we realized that the way TU Graz reacted was not the only way to deal with the situation; in the neighbouring country of Germany, a large group of professors teaching at universities clarified that they could not teach online but demanded a “non-semester” [5].

Thus, in this article and our case report we focus strongly on (pure) online teaching and e-learning as technology-supported distance learning and not on technology-assisted or enriched face-to-face arrangements [6], and will describe the situation prior to the crisis, the development within in the crisis, and the effects concerning online teaching. Universities around the world are facing similar problems and we thus want to share our experiences and lessons learned. Therefore, we describe the status quo before the COVID-19 crisis and the developments within the first three weeks, and reflect on enablers, barriers and bottlenecks in this contribution.

2. Research Question, Approach and Sources

In this paper we trace the developments of technology-supported learning in the first phase of the so-called COVID-19 crisis at an Austrian university and explore the following research question: How has this epidemic affected e-learning at a traditional face-to-face university within the first three weeks and is this changing our knowledge about concepts of e-learning readiness in higher education? Therefore, we document the development and describe the situation in Austria, at Austrian universities, including Graz University of Technology, within the first phase of the crisis, a six-week long period, from the end of February 2020 until the first week of April 2020. As a theoretical framework and structure of the status of online learning at university, we use the model for e-learning readiness assessment of Alshaher (2013) [7]. As sources, in addition to research literature, we use Austrian news media and internal data from TU Graz, which was available from the previous semester (if available) and the described phase of six weeks. The current European Data Protection Regulation does not allow us to store data on a long-term basis and our previous strategy did not allow us to save activities of certain user groups on a daily basis. Thus, we cannot, for example, provide data for the same comparison period during the previous year on a daily basis, because we usually only have cumulative data for periods of a year ago, typically on a monthly basis; even this is not the case for all used systems. We use internal strategy papers and information where possible and usable for the context of this contribution. By comparing the aggregated data of the last semester with the figures of the first six-week phase of the crisis, we would like to investigate whether, and to what extent, the changes increase in using e-learning opportunities are also statistically significant.

3. Existing Theory and Knowledge on Implementing E-Learning in Higher Education and an E-Learning Readiness Framework

What is crucial for implementation of e-learning in a traditional university with “brick and mortar” teaching [8]? There are different approaches, theories and models available which try to explain why and how some universities or parts thereof have higher implementation rates than others. Focus group interviews are, for example, the base of a study where “institutional infrastructure, staff attitudes and skills, and perceived student expectations” are seen as important factors [9]. A literature review

of 31 selected studies [10] developed a conceptual framework on the critical success factor affecting implementation of e-learning in higher education. This framework names eight factors: resources, institutions, ethics, evaluation, social interaction, management, pedagogical and technological factors. In addition to higher education, additional research is available for e-learning success in different branches, e.g., business and enterprises [11].

A slightly different approach is the development of “e-learning readiness” assessments. Investigations do not identify important success factors, but draw attention to potential weaknesses. According to a review on existing approaches of e-learning readiness [12] technology is the most important factor, as it is mentioned in all models. Technological aspects that are seen as crucial are (in order of frequency in the models): Internet access, hardware, availability of computers, software, IT support, technical skills, security, communication network and infrastructure (p. 123).

One of the analysed e-learning readiness approaches is an adaptation of the “seven S model” originally introduced by the consulting company McKinsey by Alshaher (2013) on the topic of e-learning readiness [7]. For this, the seven S model—all categories start with the letter “S”—was enriched with analysis of interviews and questionnaires within higher education institutions in Iraq (see Table 1 below). As Alshaher’s model is one of the more recent models [12], we will use it as a structure for a description of the situation at our university before the virus crisis influenced our e-learning activities at TU Graz.

Table 1. Model for e-learning readiness assessment by Alshaher (2013) [7], building upon the seven S model by McKinsey (categories on the left) and Hanafizadeh and Ravasan (2011) [13].

Category	Aspect
Strategy	Vision and mission Goals / objectives Strategic plans
Structure	Centralization Size
Systems	CIO Position Technology Content Platform Support Documentation
Style/Culture	Organizational Culture Leadership Top management support Communication
Staff	Sufficient Manpower Project Team Trust
Skills	Training & education Management Skills IT staff’s skills Students skills
Shared Value	Shared Beliefs

Using the structure of a “model for e-learning readiness assessment” we are able to thus describe all relevant aspects for the university before the crisis.

4. Status Quo of E-Learning at the End of February 2020 in Austria and at Graz University of Technology

Before we describe the situation at Graz University of Technology (TU Graz) in February 2020, we give an insight into the situation in Austria.

4.1. E-Learning in Austrian Higher Education

As for most European universities, Austrian universities are—in addition to single dedicated distance learning universities—traditional presence universities with a focus predominantly on face-to-face teaching. Nevertheless, support of learning management systems, and online communication and services, are widespread and accessible for potentially all students and lecturers in Austria, where mobile internet services are widely used and available in good quality in most locations. Thus, by 2015, for example, all universities of applied science used learning management systems [14]. A total of 49 of 72 Austrian universities (including universities of applied science and universities of teacher education) took part in a survey [15] and described their experience in e-learning over the years: 41 universities showed that they have been using e-learning for over five years, with public universities reporting significantly longer experience in comparison (p. 39, see Figure 1).

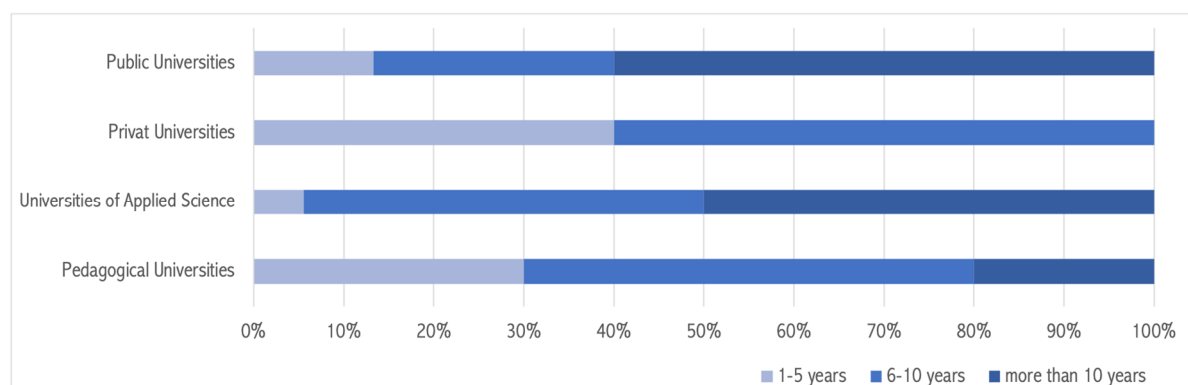


Figure 1. Experiences with e-learning in years per type of university in Austria. Source: Own diagram, using data by Bratengeyer et al., 2016 [15], taken from p. 40, Figure 6.

Thus, the broad majority of Austrian universities have had experience with e-learning for over ten years. However, currently the official implementation of pure online or blended studies is not widespread. In an Austria-wide survey concerning e-learning in higher education in 2016, the authors discovered that only 5 of the 22 Austrian public universities had already officially declared “blended learning studies” within their intellectual capital statements [15]. It is of note that there are 15 private universities in Austria [16], but only a small portion (4%) of Austria’s students are enrolled at one of these [17]. More recent studies are not available, but we assume that the situation did not dramatically change before the end of 2019: all Austrian universities and ministries support strategies and activities to support the integration of technologies into learning in teaching, but had not shifted to pure online education.

It might be helpful to also refer to an OECD study to describe the general level of digitalisation in education in Austria [18,19]. One of the newest comparative datasets was made available in the Austrian national education report 2018, building upon data by the OECD. According to the data, digital literacy in Austria is more prevalent than the average of the 28 EU countries. For example, 66 percent of 16- to 34-year olds in Austrian have digital skills above the basic knowledge, compared to 52 percent in the 28 EU countries, and, for example, only 61 percent in Germany [18,19].

4.2. E-Learning at TU Graz Following the Model for E-Learning Readiness Assessment by Alshaher (2013)

In Austria, TU Graz has about 16,600 students and 2400 lecturers and researchers. The university was founded in 1811 and has 96 institutes which are classified in one of the seven faculties, namely architecture, civil engineering, computer science and biomedical engineering, electrical and information engineering, mathematics, physics and geodesy, mechanical engineering and economic science, and technical chemistry, chemical and process engineering and biotechnology [20]. TU Graz is—as are

other Austrian universities—including in the top 1000 ranking of Times Higher Education (place 400–500) [21].

We will now give a status quo description of e-learning at the end of February 2020 at TU Graz, using the e-learning readiness assessment framework by Alshaher [7]. Whereas [7] refers more or less to a special e-learning system, we use a broader description of the situation of TU Graz regarding e-learning. As described before, we tried to deliver “objective” data, but our own readiness, or “shared values” have not been evaluated in a study to date, so the objectivity of our description is potentially limited.

The first category for readiness assessment is “**strategy**”. For this, we cite official statements by the university concerning *vision, mission, goals and strategic plans*. First, TU Graz describes itself as a “traditional university” (English version), or “as an avowed presence university” (German version, own translation) which “will not replace but enhance classroom teaching with digital media” (English version of [22]). The vision of the department of Educational Technology is to sustainably enhance classroom teaching with modern media to improve communication by a centralized service. TU Graz shall represent a community of teachers and learners in tomorrow’s information society. This vision is expressed by the guiding principle “the Power of the People”, underpinned by the slogan “We care about eEducation” [21]. The strategy of the Educational Technology department is reviewed every three years and concerns nine fields of action, which are part of the department’s mission statement [21]: “Operation, maintenance and development of digital online platforms for teaching and learning and applications; design, production and deployment of digital resources for teaching and learning [amongst others e-books, streaming media]; support and consulting for planning and realisation of digital supporting measures in teaching; qualification measures and skills development; open access to education and knowledge [open educational resources]; organisational setting and incentive systems; Interuniversity co-operations and enhancement of (inter-)national exchange in the subject area e-learning; strengthening of lifelong learning and research and innovation”. In 2017, the university published internal Guidelines of the Rectorate and the Senate on: “Virtual Teaching at TU Graz” [23]. Within the summary, it highlights the now official “three pillar model” to anchor virtual teaching at TU Graz in the long term:

- “(1) The use of digital learning elements and formats is always possible as a didactic means of enriching classroom teaching.
- (2) Virtual teaching as a didactic tool within the framework of lectures or the lecture section of a university can be freely implemented by the lecturer up to a threshold value of 20% of the semester hours to be held.
- (3) In all other cases, the proportion of virtual teaching must be approved by the Study Commission Working Group and the Curricula Commission for Bachelor’s, Master’s and Diploma Studies or the Curricula Commission for Doctoral Studies and University Courses and anchored in the curriculum accordingly.” (from the summary, own translation).

Our external counsellor describes his current perception of the e-learning strategy as follows: “I feel that the approach to e-learning at TU Graz is cautious, careful not to frighten or snub anybody, very pragmatic, not blatant, not expressively visionary, but still constantly evolving and this feels very good to me. A straighter vision could give more direction, more confidence and motivate even more to go into this direction”.

Concerning the second category, **structure** [7], the situation of e-learning at TU Graz can be described as following: First, there is a clear *centralisation* of responsibility for e-learning, as a department of Educational Technology was already established in 2006 as a working group, and in 2007 was established as a division of the Central IT Service with 2 people. In 2016, the Rector established Educational Technology as an organizational department under the direction of the Vice Rector for Academic Affairs at TU Graz [24]. The department has been permanently growing and has, as of today, reached about 40 staff members (28.5 full-time equivalents in January 2020, see internal organisation

plan, described below in more details). Universities have better conditions than smaller institutions because there are “bigger pools of sophisticated professionals” and a relatively big budget [7]. In the case of TU Graz, many department members are or were students at the university, and at other universities it is probably more difficult to identify good suitable people. Concerning structure, the importance of a CIO (chief information officer) within an organisation is highlighted [7], which is the head of the IT services, an established department, and a position existing for several decades.

Several **technical systems** are in use at TU Graz: TU Graz is well-equipped concerning *technology*, it has, for example, campus-wide Internet access and free WiFi (eduroam), all students and lecturers have access to private or institutional computers, and an IT service department is responsible for technology, security, communication network and infrastructure. Furthermore, the department provides a university-wide learning management system, an e-assessment platform, a video portal and also the Austrian massive open online course platform iMooX.at. *Content-wise*, a special feature of TU Graz is a strategic emphasis on open access and positioning regarding open educational resources (OER). The first strategy towards OER was established in 2011 [25]. Educational content and materials are made available within the learning management system TeachCenter and special services and *platform support* such as Tube, which offers videos and live streaming. The Educational Technology department runs these e-learning services and others, such as several apps (TU Graz My Apps) and an e-book author system (ABC ebooks). *Documentation* of these services and technologies is available in detail, not least because of the strict European General Data Protection Regulation and its implementation at the university.

Concerning **style and culture**, the situation at TU Graz will be described from the authors' perspective as well as from impressions of people from outside the organisation. The *organisational culture* concerning e-learning can be described as a non-enthusiastic, pragmatic attitude concerning technology as support for teaching amongst management and lecturers. Most of the lecturers and researchers are reluctant to use (new) technologies in teaching. For these, the implementation is not really needed and an extra effort. The official university's strategy is to sustainably enhance classroom teaching with modern media to improve communication by a centralized service and to remain a traditional university with face-to-face lectures (see paragraph above). Thus, there is only a moderate expectation, but not pressure, to adapt technologies for learning. Similarly, the *top management support* for e-learning topics is given, as demonstrated by the establishment and expansion of the Educational Technology department and the anchoring of the topic in strategic papers of the university and its general efforts towards digitisation. Concerning leadership and communication, we asked an external counsellor and trainer who has supported the development of the department for some years: concerning *leadership*, he points out that the leader of the department is a well-known expert in his field, who has learned to make and communicate strategic decisions, which are comprehensible to others. By developing team leaders in Educational Technology who take on leadership in an operational sense, there is also an opportunity for strategic considerations for the head of the department. Concerning *communication*, our counsellor shared the following: “The department leader is very well connected in- and outside of the university and has an effective stakeholder management. The Rectorate knows that the Educational Technology team can deliver trend-setting results without friction losses and therefore supports the department. Within the department, communication is characterised by situationally necessary and relevant topics and is operationally optimised”.

Concerning the **staff** at TU Graz, [7] focuses on the educational technology department, specifically the e-learning team. The first criterion is “*sufficient manpower*”. The Educational Technology team of TU Graz comprises about 40 persons (about 28.5 full-time positions) and is thus well positioned compared to other Austrian universities; however, the persons are largely financed by third-party funds, which means that they are in fact only partially available for internal activities. In the last five years, strategy papers, communication structures and organisational changes have been made to clearly position, integrate and stabilise the team within the university. In January 2020, the *team* of educational technology comprises 41 persons (not equivalent to full-time positions), organised in

five teams responsible for instructional design (eight persons), videos, recording and streaming (nine persons), IT projects and research (10 persons), technical infrastructure (12 persons), management and administration (two persons). Most of the staff are funded externally, so they are only partly responsible and available for internal activities of the university (source: internal organisation plan). The head of Educational Technology is constantly striving for further development of the team, also regarding *inner trust*: For several years, regular team training and development days have been offered with the help of an external moderator. Concerning inter-trust of the e-learning team and other departments, there has been good cooperation for several years. Concerning the *training and education* of users, there is a wide range of materials and offers for lecturers at the university. The instructional design team offers two get-together activities on a regular basis, namely “Teacher’s Regular Table” and the “Educational Technology Breakfast” where lecturers are provided with news related to innovative teaching. Furthermore, lecturers can book individual counselling to enhance their teaching with new technologies and possible blended learning scenarios; e-didactic courses; and courses within the university-wide Teaching Academy (open educational resources trainings, on-boarding courses for learning management, coaching for technology-enhanced learning, flipped classroom trainings). Recently, in 2019, the team developed and realised a project called “TELucation folder” (TEL refers to technology-enhanced learning) which comprises current issues concerning e-learning and educational technology tools for higher education teaching in an analogue folder-format but with a digital equivalent in the TU Graz learning management system TeachCenter. This project is intended to bridge the gap between the lecturers that still work in analogue and helping those who are already into digital teaching with further information.

Concerning **skills**, ref [7] takes skills of all stakeholders into account, namely *management*, *IT staff* and *students’ skills*. As a university of technology, the conditions here, as well in comparison with other higher education institutions in Austria, are sufficient. Even beginners bring in base skills [26].

Finally, the last category which describes e-learning readiness is “**shared value**”. We cannot refer to existing texts or study and need to describe the situation from our perspective as a support team with support requests from lecturers and students. Perhaps because we are a university of technology, there is a great understanding, a *shared belief* and also a demand for technical infrastructure and technical support of the lecturers. Questions relating to didactics in higher education are comparatively less important, even though the department’s services are gladly accepted. To promote internal *e-learning champions* within our university, we have had experienced and innovative lecturers speak at our internal training sessions since 2018 or present them in our internal magazine. Since 2019, e-learning has additionally been part of the internal award in “excellence of lecturing”.

4.3. E-Learning Activities in Figures in Winter Semester 2019/2020

Differently to other universities, only lecturers who actively request a course will have an active course within the learning management system TeachCenter or they reuse existing courses (and content) from previous semesters. This approach ensures that most of the courses in the learning management system are active. The system currently holds 1906 active courses. The learning management system in the winter semester 2019/2020 shows about 860,000 to 1.43 million activities per month. Within our statistics, we count for example, if a user opens a course page, opens an activity, downloads a file, opens the forum, writes a post in the forum or subscribes to a forum thread. Students performed about 606,000–974,000 activities and 39,000–92,000 were from lecturers. About 32,000–86,000 were from tutors, who are typically advanced paid students (see Table 2). With about 16,600 students and 2400 lecturers, a lecturer had about 28 log-ins on average per month, and an average student about 49 log-ins per month, in the winter semester 2019/2020.

Table 2. Log-ins into the learning management system in winter semester 2019/2020. Source: Graz University of Technology, Educational Technology. Note: “anonym” are activities from people who are not logged in and navigate within courses with open access; “all” is not the sum, as some users have more than one role (e.g. a student who is also a tutor).

Month	Students	Tutors	Lecturers	Anonym	All
19 October	930,935	31,949	92,131	188,844	1,328,338
19 November	974,236	86,778	88,648	206,528	1,428,688
19 December	606,563	47,509	39,243	125,881	860,172
20 January	711,740	57,680	51,966	201,925	1,077,012

These data are also available for the previous semesters, so that a good overview of the constant growth of activities in the TeachCenter can be given (see Figure 2): the winter semester starts at the first of October, the summer semester typically at the first of March with some small variation; the winter semester is the typical start of study programs. Looking at the last four semesters, we can see a trend of increase of activities in the learning management system: while it is continuous amongst lecturers, there are fewer activities amongst students in the summer semester, but 500,000 more activities between the summer and winter semesters.

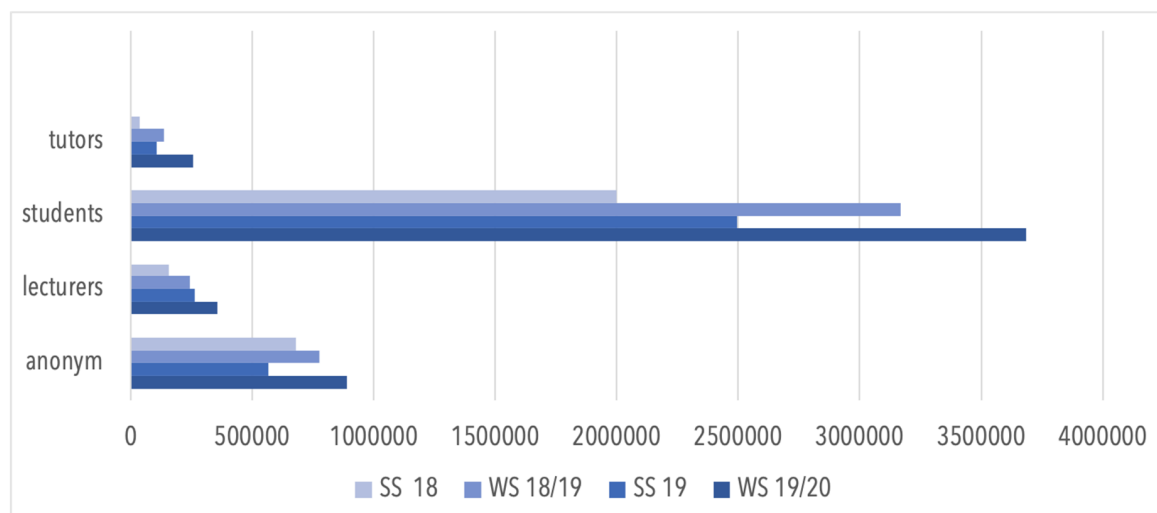


Figure 2. Sum of activities in TeachCenter for different user groups per semester at Graz University of Technology. Source: Graz University of Technology, Educational Technology. Note: SS is an abbreviation for summer semester, WS for winter semester.

As described, TUBE is a video portal hosting recorded and streamed videos at the university offering lecture videos, event videos, and other interesting videos of TU Graz. Lecturers and institutes also use other video hosting options such as YouTube. Within the winter semester 2019/2020, there were about 120 uploads (“publications”) and 29,000 clicks on all TUBE publications on average per month (see Table 3).

Table 3. Publications and clicks at the video portal TUBE in winter semester 2019/2020. Source: Graz University of Technology, Educational Technology.

Month	TUBE Publications Per Month	TUBE Clicks Per Month
19 October	172	34,800
19 November	129	35,680
19 December	71	22,521
20 January	101	22,713

The described dates and activities mainly refer to winter semester 2019/2020 and thus to the period before COVID-19 became a topic that influenced the activities at our university.

5. Developments within the First Phase of COVID-19 Crisis

In this chapter, we first describe the developments from the end of February to mid-March 2020, and then use the access and usage figures to describe and illustrate the increase in e-learning activities.

5.1. Chronological Overview of Measures of the First Days of the Shift from Presence to Online Teaching

In the following we summarize important developments in Austria, at TU Graz and in the Educational Technology team in Figure 3. On the one hand, this makes it possible to show the short-term nature of the processes. On the other hand, it is also clear that the implementations had an immediate positive effect, also through appropriate preparatory work.

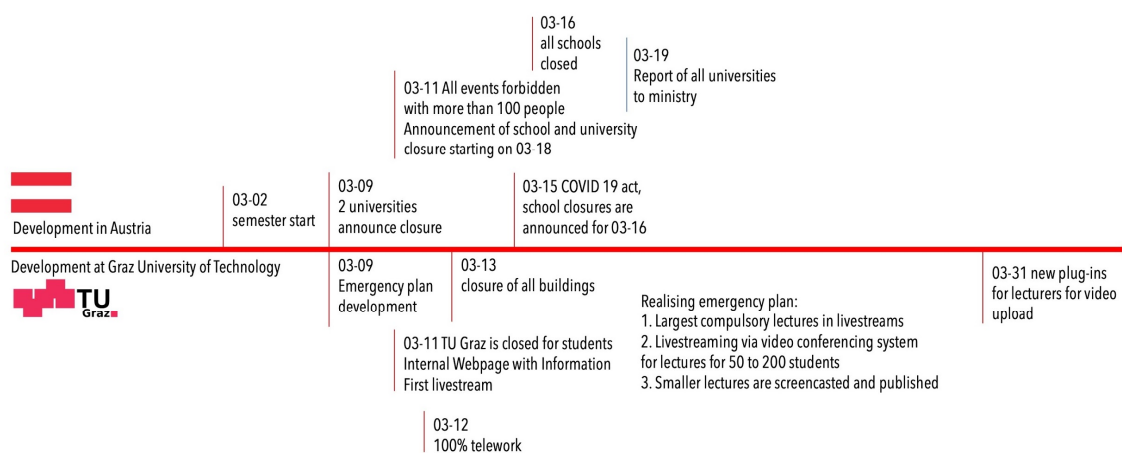


Figure 3. Key measures and development in Austria, at TU Graz and the Educational Technology team during COVID-19 crisis until the end of March 2020.

At the end of February and the first week in March 2020, the public attention around the coronavirus grew dramatically in Austria. At TU Graz, similarly to all other Austrian universities, the summer semester started on the 2nd of March as usual. A first communication exchange between the Educational Technology department and the Rector on 28th of February drew attention to the fact that the universities could stop teaching because of corona cases. A second mail exchange on 7th of March highlighted the case of the University of Washington [27], which announced it would close on 9th of March because of a COVID-19 case.

On Monday, 9th of March, at a meeting of Universities Austria (UNICO, an organisation which handles the internal coordination of the 22 public Austrian universities), the first two Austrian universities announced that they would close their buildings and stop teaching. The Educational Technology team developed an emergency plan and discussed the consequences with e-learning departments or units in other Austrian universities.

One day later, Tuesday, 10th of March, in a morning call, the Rector agreed to the emergency plan. All Educational Technology members were asked to install the university-wide used video conferencing system, and the news was shared internally. The team arranged an extra communication channel for documentation. At midday, TU Graz announced the discontinuation of classroom teaching (internal and public) and a restriction of physical presence at the university starting the next day: rooms and facilities would no longer be accessible to students. The emergency plan had come into effect.

The emergency plan describes which lectures should be transferred to digital format, and how: “University Management has decided to stream the largest compulsory lectures on TUBE, the video portal of TU Graz. Compulsory lectures between 50 and 200 students can be streamed by lecturers via the video conferencing software WebEx. Smaller lectures and continuous assessment courses

can be filmed via WebEx.” Within seconds, the first lecturer asked for support. This influenced the organisation of Educational Technology: For example, after the suspension of all video production projects (as instructed by the head of the department), the Video and Animation team staff were repositioned in order to accommodate the enormous number of TUBE services requests, part of which was the live streaming of courses comprising 200 or more participants (as instructed by the Vice Rector for Academic Affairs).

On 11th of March, the Austrian chancellor announced school closures and university closures throughout Austria from 18th of March onwards (some already before) and declared all events as prohibited when over 100 persons take part. The Educational Technology team installed and shared an internal Website for all urgent developments, e.g., development and publication of livestreaming plans and more information for lecturers on the intranet page. It included usage of the video conferencing software, streaming and screencasting with it. The Educational Technology team supported the first livestreaming of a lecture. At 8.00 a.m., a first meeting with the Vice Rector for Academic Affairs was organised. This meeting was held regularly for the following two weeks. Similarly, a key group within the Educational Technology team started regular meetings at 12.00 p.m. on all working days.

On 12th of March, the rector allowed all staff to work from home, if desired. The Educational Technology team received the status of a system critical unit and was asked to work in independent teams to avoid total breakdown, if one team member became ill. Instructions for screencasting with Microsoft PowerPoint and other alternatives were published.

On Friday, 13th of March, the Austrian chancellor announced quarantine regulations for infected persons and a curfew for Austria. All staff of TU Graz were released from being physically present on site. At 3.00 p.m., all universities’ premises were closed. The Educational Technology team updated the server infrastructure for live streaming.

On Sunday, 15th of March the National Council agreed to the COVID-19 Act, school closures were announced for the following day. Public TV announced special school TV starting the following day.

On Monday, 16th of March the important topic of the daily team meeting was the upload of videos on TeachCenter (learning management system) after a system crash caused by a large upload. A third auditorium was prepared for live streaming. Lecturers who tended to use several blackboards were particularly satisfied with this development, even though it was unnatural for everyone to teach in empty halls.

On 19th of March, all universities were asked to report to the Austrian ministry on how they were dealing with the current situation.

After the intense three weeks at the beginning of the semester facing the entire switch from traditional teaching to remote online teaching, the situation did not settle for the Educational Technology team. Three members of the team or their relatives were tested positive (all potentially from different sources, outside the Educational Technology team). Several members became ill and needed some time to recover, potentially caused by the intense workload, including nights and weekends, at that time.

Within the next few days, the following communication took place: On 31st of March 2020, the Vice Rector for Academic Affairs informed all employees about a new, simplified video upload tool on the TeachCenter, “TUBE Drop”. On 2nd of April 2020, the Vice Rector sent out information to all students and lecturers about sustaining online teaching over Easter.

Although at that time it seemed for many that the situation would ease over Easter, the Vice Rector announced that the university would stay closed till the end of the semester for students and that only online teaching would be allowed until the end of the semester on 9th of April 2020.

5.2. Development of Activities in Learning Management System in Figures

As described, the learning management system TeachCenter (TC) is the central point for all lectures and seminars where teachers provide supplementary teaching materials or use the system for further tasks and communication with students. Thus, it is to be expected that this system would register significantly more activities. We registered small increases every semester. For example, nine

new courses were created in March 2019. As described, at TU Graz new courses are not automatically created every semester, but are reactivated and reused. In March 2020, we received requests for 108 new courses. Thus, these are ten times more additional courses.

Not only did the course number increase. In March 2019, the data transmission volume was 2000 GB, which typically does not include video files, as they should be hosted on TUBE. In March 2020, the data transmission volume increased to 46,000 GB, equivalent to about 1.5 TB per day. This is a staggering increase of 2300 percent. These high numbers are probably due to the fact that many teachers uploaded their videos to the learning management system and these were then downloaded by hundreds of students. One consequence of this was the development of an upload plug-in for videos to TUBE on the LMS, “TUBE Drop”.

Figure 4 shows the average activities per user group from last summer (starting 1st March 2019) and the winter semester (starting 1st of October) and from March 2020. According to the data, the activities within the TC of the students from March 2019 to March 2020 increased by about 100 percent, and lecturer activities increased 139 percent. The activities of tutors increased around 199 percent, thus, they had tripled in size. Please note that the number of tutors is not as constant as the number of lecturers and students.

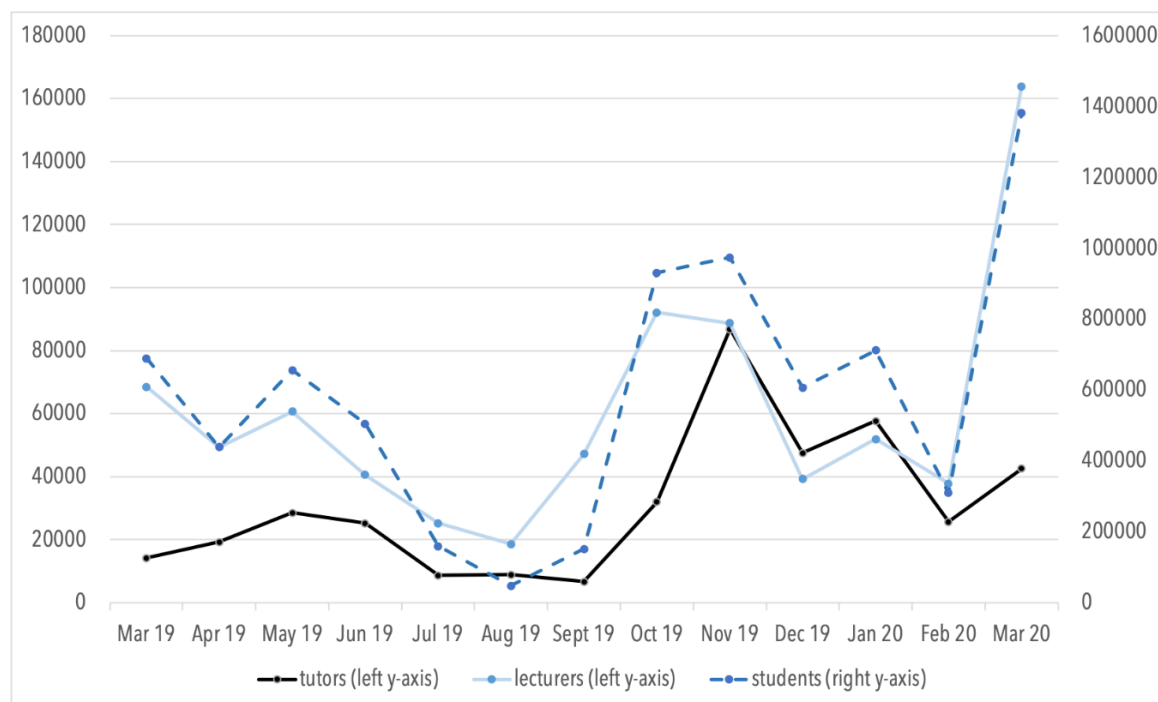


Figure 4. Sum of activities in TeachCenter for different user groups per month from March 2019 to March 2020 at the Graz University of Technology. Source: Graz University of Technology, Educational Technology.

An analysis of the user activities on the TeachCenter within the first phase of the COVID-19 development shows more details. The two highest peaks are potentially related to the announcement of the closure of universities (16th of March 2020) as well as the reaction to the new possibilities and features of TeachCenter and TUBE on 31st of March 2020 (see Figure 5).

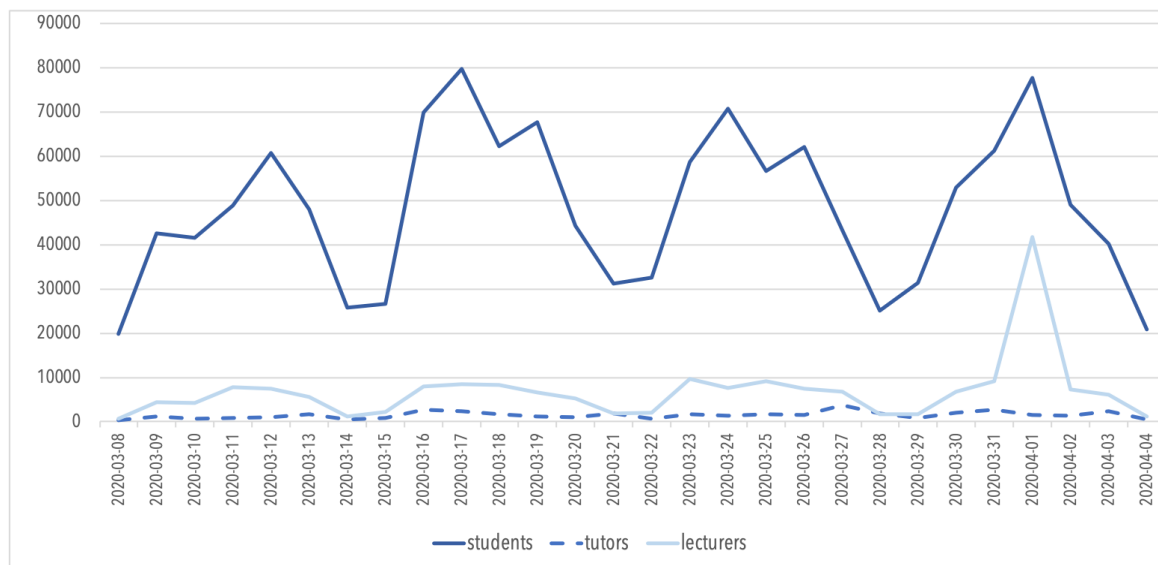


Figure 5. Sum of activities in TeachCenter for different user groups per day from 8th of March 2020 to 4th of April 2020 at the Graz University of Technology. Source: Graz University of Technology, Educational Technology.

5.3. Development Concerning Videos and Live Streaming in Figures

Similarly, the TUBE system had an impressive increase: whereas 19,081 views were counted in March 2019, 120,282 were counted in March 2020. Figure 6 shows the monthly TUBE views and publications starting in the winter semester, October 2019, with about 25,000 views; whereas in October 2019 about 172 publications were counted on TUBE, 614 were registered in March 2020 (more than triple).

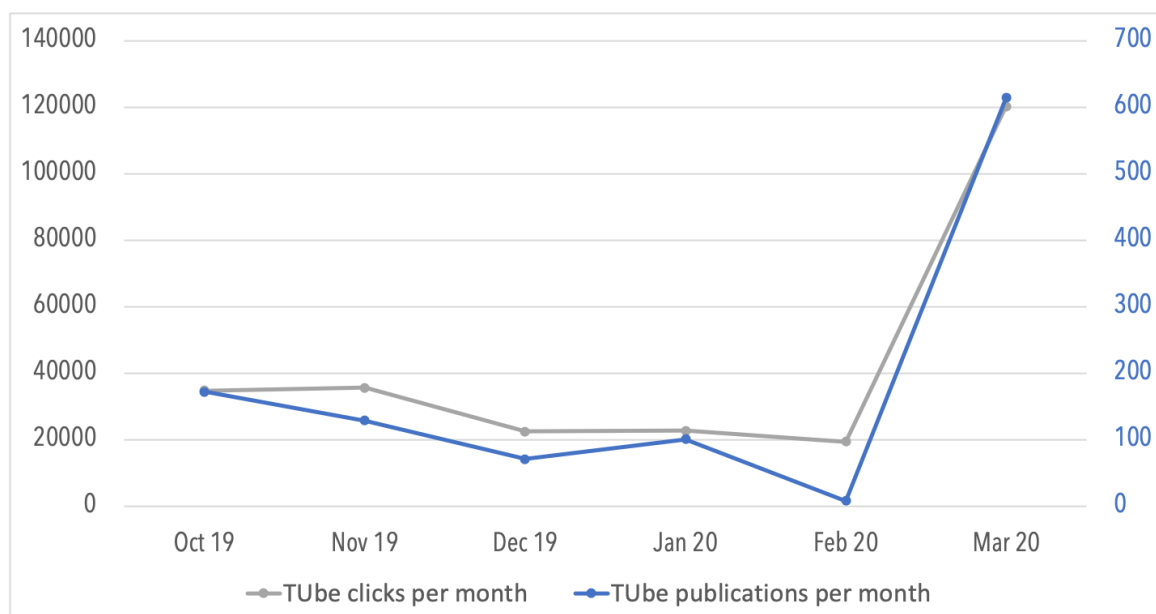


Figure 6. Sum of TUBE views and TUBE publications per month from October 2019 to March 2020. Source: Graz University of Technology, Educational Technology.

Two data sets are available and presented per day concerning the TUBE video service (see Figure 7). The first is the number of daily applications for TUBE: each user needs to apply to obtain the right to upload videos on TUBE. Additionally, the number of published videos per day are presented. Typically,

a single user makes only one application, whereas the same user publishes several videos; thus, the number of applications is lower than that of publications. On the 16th of March 2020, the number of applications was higher than of publications.

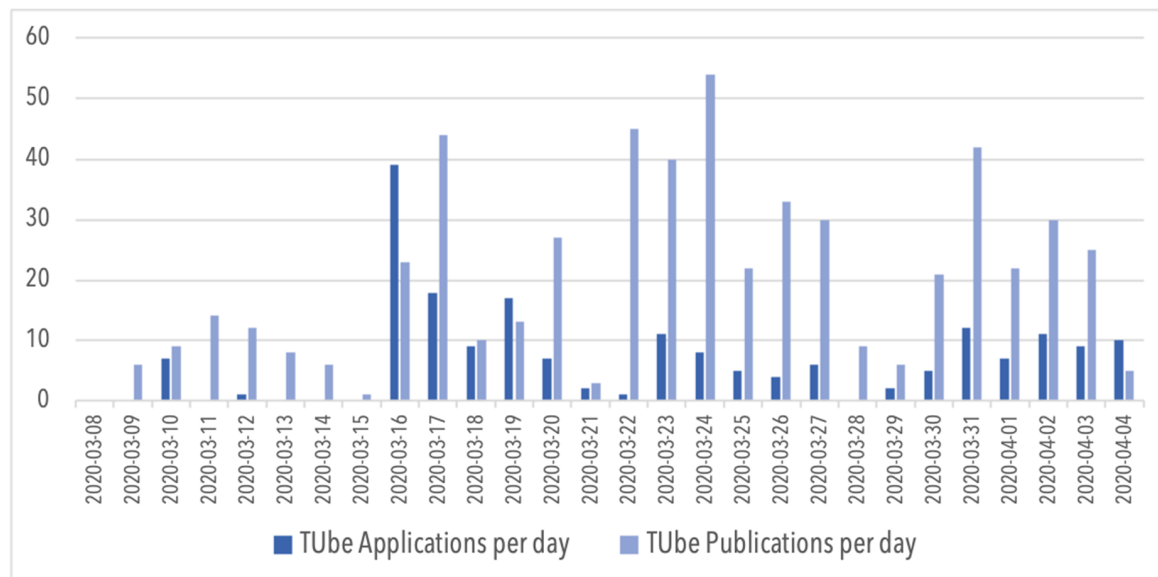


Figure 7. Sum of new applications and publications per day on TUBE from 8th of March to 4th of April 2020. Source: Graz University of Technology, Educational Technology.

5.4. Development Concerning Video Conferences in Figures

For the previous year, to date, a university-wide license for Cisco Webex has been available at TU Graz. The system was only used sporadically in teaching and rather served researchers for meetings and exchanges with colleagues. This changed abruptly at the beginning of March 2020. Figure 8 shows the dramatic increase: while there was no usage at all at the beginning of the semester, for example, on the 8th of March, this literally changed from one day to the next. In the period shown, there were on average 218 video conferences per day (including weekends) with an average of 2300 users per day.

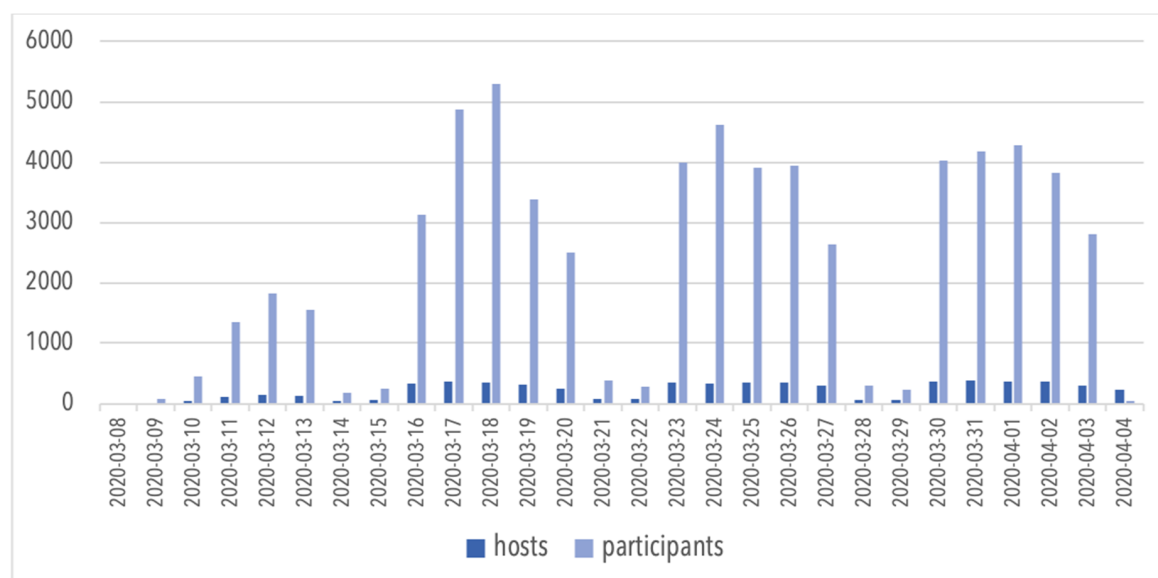


Figure 8. Sum of hosts and participants per day at the university-wide video conferencing system from 8th of March to 4th of April 2020. Source: Graz University of Technology, Educational Technology.

5.5. Review of Developments of Figures for Significance

E-learning activities at TU Graz have increased continuously in recent years. It can be observed that the activities in the winter semester are always somewhat more intensive than in the summer semester, but the trend is increasing. It must be asked to what extent the growth rates shown in mid-March/early April exceed the expected growth rates. Since there are no suitable classical significance test procedures for the available data, we applied an approximation. We took the average monthly data of the activities of students and lecturers on the learning management system (TeachCenter, TC) and the number of publications and views on TUBE of the last semester as a basis. Then, we calculated the mean value and the standard deviation. Assuming a normal distribution, a monthly value of the mean plus 3 standard deviations would be a significant deviation. If we assume a normal distribution, only 0.13% of the data should be located over this range. We show the calculations in Table 4.

Table 4. Monthly activities of students and lecturers in the winter semester 2019/2020, and an estimation of a hypothetical extreme increase and real data for March 2020. Source: Graz University of Technology, Educational Technology. Note: The “hypothetical extreme increase” was calculated as a mean value plus 3 standard deviations.

Month	Student Activities (TC)	Lecturers Activity (TC)	TUBE Publications	TUBE Views
19 October	930,935	92,131	172	34,800
19 November	974,236	88,648	129	35,680
19 December	606,563	39,243	71	22,521
20 January	711,740	51,966	101	22,713
20 February	309,589	37,778	8	19,388
Mean value from winter semester 19/20	706,613	61,953	96	27,020
Standard deviation	269,076	26,567	62	7,625
Hypothetical extreme increase	1,513,839	141,655	281	49,895
20 March	1,380,444	163,837	614	120,282

This calculation shows how extreme the increase was in March 2020: whereas the real activities of students in March 2020 were fewer, the lecturers’ activities, and the number of TUBE publications and TUBE views, were even higher than these estimates. If further data is available for the current semester, we can use traditional testing methods. We assume that these will confirm significant deviations in user behaviour.

5.6. Realisation of Online Teaching—An Impression

The given strategy, alternating between face-to-face and e-learning, was to produce videos that were shared as livestreams and/or recordings for smaller events the students could later view. This still has little to do with a high-quality e-learning setting.

A student and co-worker of Educational Technology was interviewed by a student radio programme and described the situation as multi-fold: there are teachers who have now put their slides onto the learning management system and—at least in the first two weeks—offer no additional interactivity. Other lecturers have also held seminars as webinars or have extended their live streaming with interactive queries [28].

At the moment, there is no detailed knowledge of the implementations building upon a qualitative and quantitative survey available.

5.7. Subjective Evaluation of the Effectiveness of the Activities in the Educational Technology Department

The abrupt change from presence to online teaching was a great challenge for all involved, from the students to the Educational Technology staff, other strongly affected departments, and also for all teachers and management personnel. It is probably that not everyone is satisfied with the

current situation, which remains a challenge. We have received a significant amount of support and encouragement from all sides; decisions were made quickly and resources were made available on our demand. In particular, we want to share a public post by our Vice Rector for Research in a social network on 13th of March 2020 who thanked the department and added: "I have already said several times today that it is fantastic how all this works in such a short time. I am very proud to be at the TU Graz!" We also know that these first weeks are just the beginning.

6. Reflection on the First Three Weeks: Enablers, Barriers and Bottlenecks

The semester is far from over and the Educational Technology department is still under pressure. The workload concerning the advice and support of lecturers and students is permanently high. This is evident from the fact that several other projects of the department are currently suspended; more staff than planned work on user support and development because of the crisis. The good work of the team has been confirmed by positive feedback received during these first three weeks. Nobody actually expected such a situation to arise; nobody expected the changeover to be easy and yet many things were achieved in a short time frame and also in a very cooperative, considerate and grateful atmosphere. Now, in the middle of April 2020, we are still within this very special phase—or, perhaps, at the start of a transition. Furthermore, the following is clearly written from our perspective, but we want to give a short overview of what we see as enablers, barriers and bottlenecks within the previous weeks. We hope that other educational technology support-teams in universities can use this as a recommendation, if still of use.

The following issues we see as enablers:

- Looking back, we have had good prerequisites. Systems were available and functional; they were adapted; materials were provided and a support team was established. The internal communication and work had been already realised online (slack, a cloud system, and more).
- From our perspective, it was good that the semester had just started: The lecturers wanted to do their job; they all were prepared and had already started to give their lectures.
- From our perspective, our university's culture of engineers was able to solve (technical) problems and to keep things going, with a sense of responsibility and perseverance was very decisive. In particular, during the first period many lecturers tried new technologies and established whether those could assist their way of (online) teaching.
- Clear decisions and flexible communication channels between Rector, Vice Rector for Academic Affairs, the department of Higher Education and Programme Development and the IT services were a big driver.
- In connection with this, it was very helpful that—although we had expected this—there was no discussion regarding the proposed solutions and that they trusted our proposal. This saved time and resources.
- Never before has there been such an intensive exchange with other e-learning managers and colleagues who shared their experience, for example, publishing performance tests on the Internet or sharing hands-on tips.
- It was also helpful that the activities of the various departments were bundled, communicated in joint mailings, and were professionally edited and translated.
- Despite, or perhaps because, of different conditions and backgrounds, the personal exchange with other e-learning support centres at Austrian universities was also helpful.
- With regard to the team, all were prepared and equipped for work from home—only one employee was provided with a laptop at short notice. Since the schools were closed, employees could apply for extra leave days, which were hardly used in the department.
- Different departments within the Vice Rectorate for Academic Affairs formed task forces and collaborated quickly to support and relieve the Educational Technology support-team members.

Barriers we or colleagues need to overcome from our perspective:

- In general, the team was too small for this rush and situation.
- The infections within our team and the workload were important barriers. Looking back, we developed a strong connectedness as a team.
- Hardware equipment at some teachers' and students' home offices, especially poor Internet connections, have caused problems.
- It was difficult to update the systems under time pressure because there was no sufficient test phase. We had such difficulties updating TUBE.
- Within a short time, people and units had to work together, despite some not knowing each other beforehand. The different communication practices were challenging.
- A real challenge was the changing conditions; for example, due to the worldwide increased use of video conferencing systems, their performance was also influenced, and it was not clear from the outset that we would actually have an entire digital semester. Many things were initially intended as a provisional solution.
- Dependence on external services, e.g., plagiarism service, which were temporarily not functional, especially during the crisis, led to complaints and waiting time for gradings in lectures and seminars.
- A surprising challenge was the work with the press. There were many requests for interviews and partly incorrect articles, which were not helpful in this situation.

There are some issues we experienced as (potential) bottlenecks:

- Our small support team was exhausted after a few days. The department immediately received an offer to hire staff, but this had to be turned down because of the challenge of familiarising someone new with the processes and issues in the shortest possible time. Looking back, we were lucky that colleagues got infected later or not at all.
- Before the crisis we solved many requests of individuals by e-mail or telephone. Now, however, written instructions for action were necessary, which were simply not (yet) available.
- Hardware could have been a bottleneck, but it was provided to us by the IT Service department without any problems (and with budget on our side).
- We have little redundancy in the team. Strictly speaking, we were very lucky that the team leaders and people with special knowledge remained operational.
- The video team was too small and work was exhausting, as the number of incoming videos increased by an unprecedented amount and the process required manual work initially. This also applied to first-level support.
- The bandwidth of the university's network line could also be a bottleneck.

In our case, these bottlenecks did not turn into major problems—but that was also partly due to plain luck. In the future, we anticipate that the positive mood of the first few weeks towards us as service and support staff could change again if it is seen as a usual service.

To sum up our experiences as a recommendation for other teams responsible for Educational Technology in universities, we want to emphasize:

1. Be prepared as early as possible: it is essential to have a strategy for handling a mass of switching lecturers.
2. Trust and clear communication are needed: a large number of discussions about the used or recommended technologies or the availability of services if there are no clear (and supported) decisions is unproductive and leads to lost time.
3. Identify where are the next bottlenecks: this is important to prepare handouts or clear advices. New services may become necessary.
4. Choose effective measures: a good reasoning for us was always to reach as many students as possible with a measure. Thus, mass lectures, and how to handle them in such a crisis, were a first factor to consider.

5. Care about your team: your team and its possibilities are in general the bottleneck of this change. Use this potential to get the needed support, focus on what is really needed for the university as well as for your own team.

7. Discussion on Readiness for E-Learning Assessment and Criteria

We described the situation and activities at our university in an objective way. However, our own readiness, or “shared values” have not been evaluated in a study to date, so the objectivity of our description is limited. Dealing with the e-learning readiness assessment by Alshaher [7] was very helpful for us to structure our description of e-learning at TU Graz.

We think that we have coped very well with the new situation in the first weeks. In our view, there was actually only one point in the criteria mentioned according to Alshaher (2013) that spoke in favour of implementation to a limited extent, namely, the clear strategic positioning of the university as a presence university. However, the COVID-19 crisis and the legal requirements for the closure of the universities have very blatantly established a new framework and mindset: it was clear to everyone involved, and there was a strong commitment, that teaching must now be offered and carried out online.

At the same time, we have already referred to the situation in neighbouring Germany in the introduction. In Germany, the semester had not yet started and there were many calls for the semester to be cancelled, and many universities only started their (online) teaching activities weeks later than planned. We would therefore like to add another aspect to Alshaher’s framework [7] based on our experience: there are obviously also better or worse opportunity structures that allow for a smoother implementation of such an essential change. It was perhaps because of the special time factor for us that the semester and the teaching ran for just 10 days and everyone had the feeling that “somehow it had to go on”. We are unsure about this, but in exchanges with other e-learning departments at Austrian universities we have learned that they all work in very similar “positive and constructive” contexts and have been able to change the way they teach.

Additionally, our data and experiences are only a part of the “e-learning readiness result”. To critique Alshaher’s framework [7] and its appropriateness, we should also have answers for the following questions:

- How do the general conditions change the quality of teaching, the study-ability of the subjects and also the learning outcomes of the students?
- To what extent do the experiences of teachers and students change future behaviour with regard to e-learning?

We will try to play our part in examining these issues and challenges in more detail in the coming months. The conversion from face-to-face teaching to e-learning has probably not per se contributed to an increase in teaching quality, but we hope that teachers will gain experience from the measures now forced by the situation, which will ensure better and possibly also new technology-supported teaching offerings in the future. However, we believe that this is an open question, as it is likely to involve many frustrating and demotivating experiences. Nevertheless, we need this data and experiences for a complete critique of Alshaher’s framework.

8. Next Steps: Quality Improvement and E-Assessment

Of course, one must critically question what has actually been and is being implemented here as “e-learning”. As a contribution to the discussion in Educause notes, “emergency remote teaching”, such as making teaching materials available in a learning management system, is not the same as (good) online learning [29]. Indeed, the quality of teaching is also seen as an essential factor for e-learning implementations: “One of the most crucial prerequisites for successful implementation of e-learning is the need for careful consideration of the underlying pedagogy, or how learning takes place online.” [30] In terms of a strategy from the perspective of e-learning innovations [31,32], the

current “strategy” might be described as “back to the basics”: existing target groups are to be served and reached in the best possible way under the new conditions. This does not exclude innovations in teaching and longer-term changes in behaviour and attitudes towards online teaching, but is currently being considered, with any decision probably not due for the next few weeks.

In order to support lecturers at our university in developing stimulating methodological-didactical implementations, our department now offers a regular online consultation hour in addition to all existing materials (TELucation). Additionally, our student representatives will ask students about how the individual courses are implemented in a survey end of April.

In addition, the topic of assessment has now moved onto our agenda. This directly affects the department in the context of the e-assessment. A further problem is that the assessment must be carried out in large lecture halls in which our live streaming hardware is installed and must be converted into other rooms. Procedures and processes for assessment in presence are currently being described in the context of the very limited presence assessment that will be possible in the future. Therefore, the department is involved in the development of materials for lecturers, as well as an online course for all students who will take part in such an assessment to be prepared for the procedures during the assessment (e.g., disinfection).

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References

1. Matthews, D. How will technology reshape the university by 2030? Results from *THE's* university leaders survey. *Times Higher Education*. Available online: <https://www.timeshighereducation.com/features/how-will-technology-reshape-university-2030> (accessed on 27 September 2018).
2. Ellis, R.A.; Ginns, P.; Piggott, L. E-learning in higher education: Some key aspects and their relationship to approaches to study. *High. Educ. Res. Dev.* **2009**, *28*, 303–318. [CrossRef]
3. Fischer, H.; Heise, L.; Heinz, M.; Moebius, K.; Koehler, T. How to identify e-learning trends in academic teaching: Methodological approaches and the analysis of scientific discourses. *Interact. Technol. Smart Educ.* **2015**, *12*, 31–43. [CrossRef]
4. Islam, N.; Beer, M.; Slack, F.; E-learning challenges faced by academics in higher education. *J. Educ. Train. Stud.* **2015**, *3*, 102–112. Available online: <http://shura.shu.ac.uk/10403/> (accessed on 26 May 2020).
5. Tagesspiegel. “Nicht-Semester” an den Hochschulen gefordert. Article from 2020-03-23. Available online: <https://www.tagesspiegel.de/wissen/folgen-der-coronavirus-pandemie-fuer-die-unis-nicht-semester-an-den-hochschulen-gefordert/25672436.html> (accessed on 26 May 2020).
6. Guri-Rosenblit, S. ‘Distance education’ and ‘e-learning’: Not the same thing. *High. Educ.* **2005**, *49*, 467–493. [CrossRef]
7. Alshaher, A. The McKinsey 7s model framework for e-learning system readiness assessment. *Int. J. Adv. Eng. Technol.* **2013**, *6*, 1948.
8. University of the Potomac. Online vs. Traditional Learning. 2020. Available online: <https://potomac.edu/learning/online-learning-vs-traditional-learning/> (accessed on 26 May 2020).
9. King, E.; Boyatt, R. Who is responsible for e-learning success in higher education? A stakeholders’ analysis. *Br. J. Educ. Technol.* **2015**, *46*, 1272–1280. [CrossRef]
10. Basak, S.; Wotto, M.; Bélanger, P. A framework on the critical success factors of e-learning implementation in higher education: A review of the literature. *Int. J. Educ. Pedagog. Sci.* **2016**, *10*. Available online: <https://publications.waset.org/10004989/a-framework-on-the-critical-success-factors-of-e-learning-implementation-in-higher-education-a-review-of-the-literature> (accessed on 26 May 2020).

11. Sela, E.; Sivan, Y. Enterprise e-learning success factors: An analysis of practitioners' perspective (with a Downturn Addendum). *Interdiscip. J. E-Learn. Learn. Objects* **2009**, *5*, 335–343. Available online: <https://www.learntechlib.org/p/44839/> (accessed on 2 September 2019).
12. Mosa, A.; Naz'ri bin Mahrin, M.; Ibrahrahim, R. Technological aspects of e-learning readiness in higher education: A review of the literature. *Comput. Inf. Sci.* **2016**, *9*, 2016. Available online: <https://pdfs.semanticscholar.org/7eaf/f2f445c538145ddd4d2bd7f3b286d9b06733.pdf> (accessed on 26 May 2020). [CrossRef]
13. Hanafizadeh, P.; Ravasan, A.Z. A McKinsey 7S model-based framework for ERP readiness assessment. *Int. J. Enterp. Inf. Syst.* **2011**, *7*, 23–63. [CrossRef]
14. Pflichter, F. *Blended Learning, Qualität der Lehre, Lehrkompetenz und Integration Behinderter und Chronisch Kranker Studierender an den Universitäten, Dargestellt in den Entwicklungsplänen ab 2015, Wissensbilanzen 2014 und in den ersten Entwürfen der Leistungsvereinbarungen 2016–2018*; BMWFW: Wien, Austria, 2015.
15. Bratengeyer, E.; Steinbacher, H.-P.; Friesenbichler, M.; Neuböck, K.; Kopp, M.; Gröbinger, O.; Ebner, M. *Die Österreichische Hochschul-E-Learning-Landschaft. Studie zur Erfassung des Status Quo der E-Learning-Landschaft im Tertiären Bildungsbereich Hinsichtlich Strategie, Ressourcen, Organisation und Erfahrungen*; Verein Forum neue Medien in der Lehre Austria Graz: Graz, Austria, 2016; Available online: <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=2ahUKEwj14eDy6unoAhWMDOWKHQPADMkQFjABegQIAhAB&url=https%3A%2F%2Fwww.fnma.at%2Fcontent%2Fdownload%2F1431%2F4895&usq=AOvVaw189J3zD9GMzYbrRm8radh8> (accessed on 26 May 2020).
16. Alle Privatuniversitäten in Österreich. Available online: <https://www.studium.at/hochschulen/privatuniversitaeten> (accessed on 15 May 2020).
17. Bundesministerium für Bildung, Wissenschaft und Forschung: Unidata—Zahlen und Fakten auf Knopfdruck. *Datawarehouse Hochschulbereich des Bundesministeriums für Bildung, Wissenschaft und Forschung*. Available online: <https://unidata.gv.at/Pages/default.aspx> (accessed on 15 May 2020).
18. Oberwimmer, K.; Vogtenhuber, S.; Lassnigg, L.; Schreiner, S. Nationaler Bildungsbericht Österreich 2018. Das Schulsystem im Spiegel von Daten und Indikatoren. 2018. Available online: https://www.bifie.at/wp-content/uploads/2019/04/NBB_2018_Band1_v4_final.pdf (accessed on 26 May 2020).
19. Organisation for Economic Co-operation and Development (OECD). *Bildung auf einen Blick 2017*; OECD Publishing: Paris, France, 2017.
20. TU Graz (Graz University of Technology). History. Available online: <https://www.tugraz.at/en/tu-graz/university/history/> (accessed on 26 May 2020).
21. Times Higher Education. World University Rankings 2019. Available online: https://www.timeshighereducation.com/world-university-rankings/2019/world-ranking#!/page/0/length/-1/sort_by/rank/sort_order/asc/cols/stats (accessed on 26 May 2020).
22. TU Graz (Graz University of Technology). Mission Statement. Available online: <https://www.tugraz.at/en/oe/lehr-und-lerntechnologien/ueber-uns/ziele-und-strategie/> (accessed on 26 May 2020).
23. Technische Universität Graz [Graz University of Technology]. Richtlinie des Rektorats und des Senats zu: "Virtuelle Lehre an der Technischen Universität Graz". TU Graz: RL 94000 VILE 078-01. 2017. Available online: https://www.tugraz.at/fileadmin/public/Studierende_und_Bedienstete/Richtlinien_und_Verordnungen_der_TU_Graz/Virtuelle_Lehre_Richtlinie.pdf (accessed on 26 May 2020).
24. Ebner, M. Lehr-und Lerntechnologien/Educational Technology #tugraz. Weblog posting from 2016-01-01. Available online: <https://elearningblog.tugraz.at/archives/8547> (accessed on 26 May 2020).
25. Ebner, M.; Stöckler-Penz, C. Open Educational Resources als lifelong-learning Strategie am Beispiel der TU Graz. In *The Lifelong Learning University*; Waxmann: Münster, Germany, 2011; pp. 53–60.
26. Nagler, W.; Haas, M.; Schön, M.; Ebner, M. Professor YouTube and their interactive colleagues how enhanced videos and online courses change the way of learning. In *Proceedings of EdMedia + Innovate Learning*; Bastiaens, J.T., Ed.; Association for the Advancement of Computing in Education (AACE): Amsterdam, The Netherlands, 2019; pp. 641–650.
27. University of Washington. Beginning March 9, Classes and Finals will not be Held in Person (Message to Students). News from 2020-03-06. Available online: <https://www.washington.edu/coronavirus/2020/03/06/beginning-march-9-classes-and-finals-will-not-be-held-in-person-message-to-students/> (accessed on 26 May 2020).

28. Aircampus. Hörsaal für Zuhause. Podcast published on 2020-04-20. Available online: <https://www.aircampus-graz.at/podcasts/fernlehre/> (accessed on 26 May 2020).
29. Hodges, C.; Moore, S.; Lockee, B.; Trust, T.; Bond, A. The difference between emergency remote teaching and online learning. *Educ. Rev.* **2020**. Available online: <https://er.educase.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning> (accessed on 26 May 2020).
30. Govindasamy, T. Successful implementation of e-Learning Pedagogical considerations. *Internet High. Educ.* **2001**, *4*, 287–299. [CrossRef]
31. Euler, D.; Seifert, S. *E-Learning in Hochschulen und Bildungszentren*; De Gruyter: Berlin, Germany, 2009.
32. Collis, B.; Moonen, J. *Flexible Learning in a Digital World: Experiences and Expectations*; Kogan Page: London, UK, 2001.



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