Effective Emergency Online Teaching

A qualitative study of academics' perceptions of emergency online teaching

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ABSTRACT (MAX. 200 WORDS):
Due to the COVID-19 pandemic, educators had to conduct emergency online teaching from home. This rapid switch required a lot of individual learning for teachers, even those who had conducted planned online teaching before the health crisis, impacting their effectiveness. As teachers adapted to their digital teaching environments, they faced technical challenges with teaching tools and increasing cybersecurity concerns, while they no longer had access to onsite IT support. Therefore, the purpose of this thesis was to study the measures contributing to the effectiveness of online teaching propelled by the COVID-19 pandemic. It explores the experiences of five Informatics teachers working at five different universities across Sweden, from the early stages of the COVID-19 up until 2022. Qualitative semi-structured interviews were conducted in order to gain insight into how the educators dealt with the aforementioned challenges. Partly in line with existing research, the findings indicate that readiness is the essential measure influencing the effectiveness of emergency online teaching, while it can be decomposed into the following sub-measures: (i) prior experience, (ii) technological infrastructure, (iii) online culture, (iv) combination of different teaching techniques and (v) protection against intrusion.

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Abbreviations

CSFs - Critical Success Factors

F2F - Face to Face

IS - Information Systems

OL - Organizational Learning Theory

VR - Virtual Reality

VTs - Virtual Teams

WFH - Work From Home

1 Introduction

This chapter begins by outlining the practical background of the era of emergency online teaching amid pandemic-related restrictions to put the need for strictly virtual teaching environments into context. Subsequently, the research motivation and purpose, the research problem, the research question and the delimitations of this thesis are addressed. This brief overview is followed by the theoretical framework chapter.

1.1 Background

Despite the natural adoption of e-learning by educational organisations, the concept has been globally embraced since the end of 2019. The newly emerged Coronavirus called COVID-19 was causing a serious respiratory illness (Keni, Alexander, Nayak, Mudgal & Nandakumar, 2020), which infected millions of people rapidly, leading to their eventual hospitalisation (World Health Organization, 2021). In an effort to prevent the spread of the deadly virus, countries around the world have ordered lockdowns (Keni et al., 2020). However, people still needed to meet and perform their regular activities, such as work and school. Therefore, the need for digitisation has increased significantly. Despite that, the pandemic research brings attention to the fact that teachers experience difficulties with online education even in highly digitised countries (Bergdahl & Nouri, 2021). Therefore, in order to provide a seamless alternative for face-to-face (F2F) education, it is essential to understand what contributes to effective online teaching.

Research by Lee, Fanguy, Bligh and Lu (2021) emphasises the vast differences between meticulously planned courses customised for online contexts and hastily adapted courses taught by professors with considerably less online teaching experience. The authors highlight the fact that courses had to be moved online without the usual preparation and support activities, due to suddenly emerging health concerns. As a result, many teachers were left on their own (Lee et al., 2021). As employers and educators scrambled to move activities online, potential cybersecurity threats loomed over many unsuspecting users (Mahr, Cichon & Mateo, 2021; Grajeda & Baggili, 2021). Connecting to video conferencing environments exposed users to hidden cybersecurity vulnerabilities (Mahr, Cichon & Mateo, 2021).

According to Cutri, Mena and Whiting (2020), video conferencing as a teaching tool also caused confusion in various situations. Their research reveals that some teachers found it hard to determine whether or not their students were actually attending class when their cameras were not on and that Internet connection glitches introduced another element of uncertainty to the realm of emergency online teaching. Failure to connect to meetings might not be an individual student's fault in the first place even if it might eventually affect the grading (Cutri, Mena & Whiting, 2020). In addition to those concerns, research conducted by Lee et al. (2021) shows that figuring out how to instantly convert on-premise courses into online versions entailed pedagogical challenges, such as organising group work.

The forced isolation brought on by the pandemic also deprived many teachers of everyday access to technical support as well as the social and professional support systems that they were used to providing each other with (Lee et al., 2021). In addition to this, there were some situations where teachers felt the limiting effects of emergency online teaching as they found

themselves emotionally drained due to the combination of discussing difficult social issues in the virtual classroom and not being surrounded by their colleagues at the office who might otherwise have been able to offer some emotional support (Cutri, Mena & Whiting, 2020). Lastly, Pearlson and Saunders (2013) point out that working remotely distances employees from the organisation's culture and increases feelings of isolation.

The changes required by the COVID-19 pandemic required a lot of organisational learning (Greve, 2020). As argued by Fauske and Raybould (2005), Organizational Learning Theory (OL) has deep roots in the field of psychology and it can provide guidance on how to make organisational learning more effective from a social and technical point of view. Organisational interactions between people promote collective knowledge and collective memories that evolve over time as more information is incorporated into the existing body of knowledge (Fauske & Raybould 2005). The authors refer to such collective memories as mental models, which are based on shared experiences and serve as contextual roadmaps that influence individual and shared responses in different situations. The development of mental models is essential within OL (Fauske & Raybould, 2005).

As reported by the Swedish Ministry of Justice, COVID-19 had not officially been downgraded to an endemic by late March 2022, but as of April 1st, it is not regarded as a public health hazard with the potential to impact society as a whole (Government Offices of Sweden, 2022). There are currently no specific restrictions impacting public gatherings (Krisinformation, 2022). Thus, teaching activities are moving back into physical classrooms, marking the beginning of the post-pandemic era.

1.2 Research Motivation and Purpose

The existing body of knowledge recognises different issues with the organisational effectiveness of online education. However, numerous such researches predate the COVID-19 pandemic. Despite the long tradition of utilising digital technologies in educational institutions, the temporary closure of schools accelerated their adoption rate in in-person education and consequently highlighted its limitations. The educators who conducted teaching solely F2F were forced to transition to use primarily online tools. Therefore, the topic of education gained attention within academia as the pandemic emerged. The thesis aims to address this shift and bring refreshed, more up-to-date information into the body of knowledge concerning the organisational effectiveness of online education.

The main purpose of the thesis is to study the measures contributing to the effectiveness of online teaching propelled by the COVID-19 pandemic. Namely, the impacts of teaching tools, cyber security, and IT support on the effectiveness of emergency online teaching are explored since it has been identified as a knowledge gap. Understanding the process of moving from F2F to remote education and its challenges (primarily in the aforementioned areas) can help students, and educators alike, to improve their educational experience and its effectiveness in the future.

1.3 Research Problem

The problem to be addressed through this study is the measures contributing to the organisational effectiveness of the emergency online teaching. The pandemic caused a temporary closure of educational institutions and the subsequent rapid transition of F2F education to online education. Moreover, the pandemic fostered a boom in the development and marketing of e-learning platforms (Wan, 2021). According to Grand view research (2019), the industry was worth $17.01 billion in 2018 while just two years later Grand view research (2021) reports the business reached a worth of $89.49 billion in 2020, marking 526% growth. However, the online learning platforms have never been used on such a large scale prior to the pandemic (Mascarenhas, 2021; Metallidou, Psannis, Goudos, Sarigiannidis & Ishibashi, 2021; Williamson, Eynon & Potter, 2020). Moreover, various commercial software (such as Zoom) profiting from the COVID-19 propelled online education are not primarily edtech (Teräs, Suoranta, Teräs & Curcher, 2020). Therefore, despite the numerous advantages facilitated by these communication platforms, Teräs et al. (2020) convey that they often focus on financial profit rather than bettering the educational experience and enhancing best pedagogical practices, which may impact the effectiveness of online education facilitated via these platforms.

Not addressing the measures contributing to the effectiveness of online education propelled by COVID-19 would slow down its adoption and development, making it difficult to become an equivalent to F2F education. This deficiency would affect students and teachers since online education brings along many advantages, such as geographical flexibility or inclusion of disadvantaged students and teachers (Pearlson & Saunders, 2013). The pandemic has moved the tech industry years ahead (Amankwah-Amoah, Khan, Wood & Knight, 2021; LaBerge, O'Toole, Schneider & Smaje, 2020), and the online education will naturally improve over time. However, if the measures contributing to organisational effectiveness are understood, the progress can be accelerated.

Therefore, in order to identify the measures impacting the organisational effectiveness of the emergency online education propelled by COVID-19, the experiences of the individual actors need to be studied. The gained knowledge should lead to the improvement of online education practices and the advancement of the e-learning software tailored to the needs of these users.

1.4 Research Question

This thesis aims to answer the following research question:

<u>What measures contribute to the effectiveness of emergency online teaching?</u>

1.5 Delimitation

This thesis investigates only the experiences of educators who conducted teaching during the COVID-19 pandemic. Emergency online teaching is researched from the perspective of university teachers in order to shed light on what they learned from their experiences. The literature review highlighted some areas that teachers faced issues with while conducting

emergency online teaching from home, namely: teaching tools (Hofer, Nistor & Scheibenzuber, 2021), cybersecurity (Karanasios, 2021) and IT support (Cutri, Mena & Whiting, 2020, Hofer, Nistor & Scheibenzuber, 2021). Thus, the thesis is delimited to academics' perceptions concerning the effectiveness of the aforementioned areas.

Additionally, the study only focuses on the educators within the field of Informatics, teaching at Swedish universities. In spite of the fact that these teaching environments were chosen because of their high level of digitization, some of the findings of this thesis may not be applicable to other countries due to cultural or technological differences. Even though Sweden is a highly digitised country with strong technological literacy among the population (European Commission, 2021), teachers, as well as students, encounter various issues with online education (Bergdahl & Nouri, 2021). Therefore, it is expected that the conclusions of the research will eventually be applicable to other countries as well, as the technological literacy and infrastructure will be improved.

2 Theoretical Framework

In this chapter, research work conducted on the topic of remote teaching so far will be discussed. The path of digital education from its humble beginnings to the current state of online real-time communication will be outlined here. This chapter also investigates how technological development has informed collaboration and communication, how educators were impacted by the pandemic and how this informs their implementation of emergency online teaching. Subsequently, this chapter investigates what it takes to make emergency online teaching effective and elements of OL are linked to the theoretical framework.

2.1 Educational digital technologies before COVID-19

This section focuses on the pre-pandemic state of online education. First, it covers the emergence of e-learning and its success factors. Subsequently, it discusses the positive and negative effects of information systems (IS) on cooperation and exchange of information within the education sector.

2.1.1 Rise of Digital Education

The literature conveys that digitalisation has spread to the education sector well before the COVID- 19 pandemic (Beckman, Apps, Bennett & Lockyer, 2018; Gillett-Swan, 2017; Gunawardena & McIsaac 2004; Harasim, 2000; Klein, da Silva Freitas, da Silva, Barbosa & Baldasso, 2018; Palvia, Aeron, Gupta, Mahapatra, Parida, Rosner & Sindhi, 2018; Roddy, Amiet, Chung, Holt, Shaw, McKenzie, Garivaldis, Lodge & Mundy, 2017; Volery & Lord, 2000). According to Harasim (2000), the adoption of digital technologies by educational organisations can be traced back to the 1970s when email and the computer conferencing were invented. She elaborates that despite the narrow availability of computer networks, academic researchers adapted these tools in their courses, broadening the cooperation tools accessible to students at the time. On the other hand, she points out that in 1981 the first exclusively online courses were provided by Western Behavioral Sciences Institute. She elaborates that the adoption of the first course was ambitious since such a course has never been offered before, putting both teachers as well as students outside of their comfort zone. Feenberg (1993) notes that learnings from this experiment, such as students being likely to lose attention in lengthy online lectures or overly structured discussions lead to participants' withdrawal, remain relevant today.

On the other hand, Gunawardena and McIsaac (2004) note that remote education used to heavily rely on learners' independence in its early stages. However, the invention of interactive technologies such as videoconferencing, facilitated real-time communication between educators and students (Gunawardena & McIsaac, 2004). Many authors agree that the growing use of computers in educational institutions has led to new means of delivering the education (Bradsher, 1996; Feenberg, 1993; Hiltz, 1994; Hiltz & Wellman, 1997; Khan, 1997; Mason & Kaye, 1989). Harasim (2000, p. 42) refers to this notion as online collaborative learning which "affected the definition, design, and delivery of education". However, despite the technologies being able to facilitate real-time communication and promote collaborative learning, they are not very suitable for the long term (Gunawardena &

McIsaac, 2004). Instead, they should be used in a combination with a different method such as an asynchronous online class (available 24 hours a day, 7 days a week, thus can be accessed on students' demand (Rusu, Virca & Popa, 2021)), while selecting the most appropriate medium for the task and minimising its weaknesses by using another complimentary medium (Gunawardena & McIsaac, 2004).

In a more recent study, Palvia et al. (2018) add that learnings from failures of online education have led to concepts of "blended" or "hybrid" learning in the 2000s. These programs combined the online and F2F classes aiming to provide an improved learning experience. The authors note that the growing availability of the Internet during the 1990s-2010s fostered the growth of online educational (e-learning) applications and software, and since 2012 the enrollments to online higher education continue to exceed the number of enrollments to traditional education at the same level. According to Palvia et al. (2018) as well as Dziuban, Picciano, Graham and Moskal (2015), the literature and former research currently recognize four phases the digital e-learning solutions faced. Their findings as well as early developments in the online education field are categorised in Table 1.

Table 1: Phases of digital e-learning in different eras

Era	Developments	Identified by
1970s	The invention of email and the computer conferencing supported cooperation between students	Harasim (2000)
1980s	The emergence of exclusively online courses has led to online collaborative learning	Harasim (2000)
1990s	The education facilitated through internet required courses to be redesigned for online delivery	Dziuban et al. (2015), Palvia et al. (2018)
2000 - 2007	Penetration of Learning Management Systems (LMS) into education led to the emergence of blended learning	Dziuban et al. (2015), Harasim (2000), Palvia et al. (2018)
2008 - 2012	Massive Open Online Courses (MOOC), available to a large number of students at once, were increasing in popularity	Dziuban et al. (2015), Palvia et al. (2018)
2012 - ongoing	The enrollments to the online education continue to increase and are expected to grow	Dziuban et al. (2015), Palvia et al. (2018)

2.1.2 Critical Success Factors of Online Education

With the rise of educational applications and software, there emerged a need to assess the critical success factors (CSFs) of online education. According to the study done by Volery and Lord (2000), in the early years of online education, the CSFs of e-learning at the time were based on three principles - "(i) technology, (ii) the instructor and (iii) the previous use of the technology from a student's perspective" (Volery & Lord, 2000).

In a more recent study, Roddy et al. (2017) convey that the CSFs had evolved and diversified since. Firstly, from the instructors' standpoint, the authors point out that an essential factor is the teacher's agility since he or she must be able to adapt to new programs and operating systems, while effectively communicating and monitoring students' progress. Secondly, from the student's point of view, the authors identified the following CSFs: (i) proactiveness, (ii) technical skills, and (iii) time management. Thirdly, the authors convey that the most significant barrier to online education is the lack of social interaction and meaningful connections.

The assessment of online education CSFs has been revisited during the COVID-19 period. Contrary to the research by Roddy et al. (2017), the research by Yudiawan, Sunarso, Suharmoko, Sari, and Ahmadi (2021) indicates lesser importance of the learners' and instructors' characteristics. They highlight that the quality and infrastructure of e-learning systems as well as the speed and capacity of Internet networks are the most significant CSF in the pandemic era. Additionally, the authors point out that the value of institutional quality and provided services decrease with the transition to online education.

Table 2: CSFs across different eras

Era	CSFs	Identified by
Early stages	User interface of e-learning technology	Volery and Lord (2000)
	Instructor's characteristics	
	Student's tech-savviness	
Pre-pandemic	Diverse instructor's characteristics	Roddy et al. (2017)
	Diverse student's characteristics	
Pandemic	Quality and infrastructure of e-learning systems	Yudiawan et al. (2021)

The evolution of CSFs (visualised in Table 2) highlights that some essential prerequisites such as good Internet connection and quality e-learning software were implicit. Thus, it indicates that people who participated in online education prior to the pandemic were expected to have a good Internet connection and education institutions were expected to facilitate satisfactory e-learning systems. However, in the era of emergency online education propelled by COVID-19, these factors have been explicitly named as CSFs.

2.1.3 Effects of Information Systems on Remote Teaching

According to Pearlson and Saunders (2013), IT increases the collaboration among actors, as they are able to easily exchange information among themselves. Additionally, the authors point out that besides facilitating the conversation, the Internet allows users to virtually co-create something new. Harris and Rea (2009), exemplify this view in the Information Systems (IS) education setting. They note that the use of collaborative web 2.0 technologies such as wikis, blogs, and podcasts has the ability to enhance the learning and teaching experience.

Literature conveys that IT enables some employees to carry out their job anywhere at any time (Martins, Gilson & Maynard, 2004; Messenger & Gschwind, 2016; Pearlson & Saunders, 2013). Pearlson and Saunders, (2013) point out that the popularity of telecommuting has been growing since the 1990s. According to their pre-pandemic work, the main motivation for telecommuting is geographic flexibility. However, in a more recent study, Felstead and Henseke (2017) emphasise that remote working brings benefits for both employees and employers.

Firstly, from the employee's standpoint, this way of working is more inclusive towards people with restricted movement disabilities, parents rearing children as well as it allows employees to save time commuting physically to the institution (Lei & Gupta, 2010; Pearlson & Saunders, 2013). Mupinga (2005) concludes that the same benefits of geographical flexibility apply to students and educators. Additionally, Felstead and Henseke (2017) point out that flexible work arrangements contribute to increased enthusiasm and job satisfaction. On the other hand, Harris and Rea (2009), mention that IT supports students to actively engage in lessons.

Secondly, from the business perspective, telecommuting allows organisations to bring together experts regardless of their location, thus expanding the hiring pool (Pearlson & Saunders, 2013). Gould (2003) adds that hybrid education allows institutions to maximise their resources since online classes are available for a larger audience of students compared to F2F classes. Furthermore, Felstead and Henseke (2017) discuss that remote working results in higher organisational commitment and increased job-related well-being. However, the authors conclude that evidence of the advantages of working from home is still incomplete and the concept requires further research.

Researchers convey that adoption of the IS in an organisation comes with challenges (Felstead & Henseke, 2017; Pearlson & Saunders, 2013). Pearlson and Saunders (2013) point out that employees struggle with work-life balance as the flexible working situation enables them to work around schedules of e.g. their children, resulting in employees being always connected. The authors point out, this leads to increased stress and more working hours than a standard "nine to five" job. Lastly, Pearlson and Saunders (2013) point out that remote work is especially not recommended for new employees as they need to be introduced to the organisation's culture and best practices. On the other hand, Harris and Rea (2009) and Kim (2021) note disadvantages from the students' and teachers' standpoint such as the ease of plagiarism breaches when students use the Internet for assignments as well as security concerns such as disrupting the class or sabotaging the virtual environment and privacy issues.

2.2 Consequences of COVID-19 for educators

The following section discusses the overall experience of transitioning from F2F to online education, along with the challenges of using new teaching tools and potential cybersecurity threats. The section concludes by assessing the level of IT support the educators expected and received during pandemic times.

2.2.1 Transition to the online work environment

Educators had to quickly adapt to work from home during the pandemic, which posed difficulties since teaching is not a traditional job to be done remotely. Therefore it often requires teachers to upgrade their competencies in technology proficiency on top of their academic skills (Gillett-Swan, 2017). Marek, Chew and Wu (2021) add that the effects of the transition from offline to online education during the pandemic varied among teachers. The authors elaborate that some educators needed to update all their existing teaching materials in order to provide information to the same extent as in F2F classes, while others who had already utilised digital technologies and had their materials ready online felt more prepared.

Hodges, Moore, Lockee, Trust and Bond (2020) convey that the new situation of distance education has caused a deviation from established pedagogical principles, traditional practices and previous research. They emphasise that teachers needed to take into account the fact that not all students were able to switch to online learning immediately and therefore it has been necessary to adjust deadlines and increase asynchronous activities. Additionally, teachers needed to take into consideration the fact that the tech-savviness of students varies (Beckman et al., 2018, Williamson, Eynon & Potter, 2020). The research by Marek, Chew and Wu (2021) indicates that good students were able to easily adapt to distance education and their motivation to learn persisted, on the other hand, weaker students have had difficulties adjusting and were more likely to drop off.

Several studies reveal that in general, students are less involved during lessons in distance education compared to physical education (Gillett-Swan, 2017; Marek, Chew & Wu, 2021). Young people tend to engage in teaching if "their learning environment fosters relationships, employs productive instructional strategies, and encourages social and emotional development." (Marek, Chew & Wu, 2021, p.91). Research in the field of online education reveals methods for encouraging students to be active during lessons. Firstly, in the pre-pandemic study, Gillett-Swan (2017) notes that facilitating engaging online learning can alleviate feelings of isolation among young people and motivate them to get involved. Secondly, Klein et al., (2018) say, the joint communication of teachers and students via social networks has a positive effect on collaboration and knowledge sharing.

Lastly, the recent study by Marek, Chew and Wu (2021) also indicates that empathy on the part of teachers has had a positive effect on the transition to online education during the pandemic and motivated students. Additionally, the authors point out that many educators felt stressed as this type of teaching requires extensive preparation, putting many outside of their comfort zone. On the other hand, the authors add that the pandemic increased teachers' confidence in the use of digital technologies during the lessons.

Researchers convey that the transition from in-person to online teaching has been especially challenging for industries requiring internships (Chick, Clifton, Peace, Propper, Hale, Alseidi & Vreeland, 2020; Lim, Oh, Koh & Seet, 2009). Additionally, Lim et al. (2009), based on their research of distance education in the medical field during the SARS epidemic, conclude that contact with "live" patients and practical hands-on experience is so far irreplaceable. The educators in this area had to rely on mannequin-based simulated patients, which had proven to be effective in the past (Gillett, Peckler, Sinert, Onkst, Nabors, Issley, Maguire, Galwankarm & Arquilla, 2008; Ali, Ahmadi, Williams & Cherry, 2009). Besides the use of more traditional teaching tools such as "digitised still images to teach radiology and anatomy, video vignettes and virtual patients to teach clinical examination" (Lim et al., 2009, p.2), teachers

had utilised also novelty practices such as 3D visualisation for anatomy teaching (Petersson, Sinkvist, Wang, & Smedby, 2009), mannequins enhanced with virtual-reality facilitating the teaching of resuscitation (Semeraro, Frisoli, Bergamasco & Cerchiari 2009), laparoscopy (Kössi & Luostarinen, 2009) or palpation (Zhang 2009). However, Lim et al. (2009) point out the need for further enhancement of pedagogical methods used in distant teaching, as future pandemics may occur.

Several studies highlight that the switch to online environments was perceived as radical and sudden by educators. Recent research by Saha, Pranty, Rana, Islam and Hossain (2021) indicates that the level of acceptance of online classes among university educators largely depends on their familiarity with the edtech tools as well as the speed and reliability of the available Internet. Those findings are consistent with research by Lee et al. (2021) who highlight the fact that many teachers found themselves facing two challenges at once: (i) teaching online classes originally intended and designed for F2F education and (ii) doing so whilst working from home. This research draws a line between planned and emergency online teaching (Lee et al., 2021).

2.2.2 Teaching Tools

Hofer, Nistor and Scheibenzuber (2021) emphasise the importance of taking the diversity of online teaching methods and tools into account when aiming to identify widely applicable ways of making online teaching more effective in purely virtual environments without any in-person interaction. Research by Li, Qin and Zhu (2021) indicates that emergency online teaching effectiveness increases when teachers have a chance to prepare for teaching sessions and when they manage to involve the students in constructive discussions, quiz activities or tests related to the topic. The authors point out that simply distributing course material without guidance or interaction makes emergency online teaching less effective, which also applies to F2F teaching.

One of the primary online video conferencing tools utilised during the pandemic was Zoom Video Communications, Inc., a platform with the main focus on video chatting, while also supporting related activities such as webinars and online conferences (Bond, 2021). Microsoft Teams, Skype and a selection of Google applications are other increasingly popular video conferencing solutions (Mahr, Cichon & Mateo, 2021). Research by Saha et al. (2021) indicates that Google Classroom outperformed Google Meet in teaching contexts during the COVID-19 pandemic, but the vast majority of respondents who participated in their study preferred Zoom over both of them by a significant margin.

Archibald, Ambagtsheer, Casey and Lawless (2019) highlight secure recording functionality as a major benefit for Zoom users. Participants are notified when a recording starts and the meeting host can choose whether to store the recording locally or in a cloud environment available to Zoom users who pay for the service (Archibald et al., 2019). Research by Le, Nguyen, Tran, Ngyuen, Nguyen and Nguyen (2022) shows that video recordings of virtual classes also served as emergency online teaching tools, which was helpful for students who had not been able to join the virtual session, as well as for students who wished to repeat what they had learned by watching the video material after class. According to the authors, video recordings helped teachers reach students who struggled with their own set of technical issues. However, making digital content available online and instructing students to make use

of it does not guarantee that teachers perform knowledge checks to ensure that students are keeping up (Le et al., 2022).

On the other hand, Mahr, Cichon and Mateo (2021) highlight that the number of Zoom users skyrocketed as work and teaching activities were moved online, which revealed cybersecurity threats, such as protocol vulnerabilities and violations of privacy. Those discoveries resulted in gradual cybersecurity upgrades of the Zoom platform (Mahr, Cichon & Mateo, 2021). Hofer, Nistor and Scheibenzuber (2021) highlight the fact that many teachers were unfamiliar with the software solutions and video conferencing environments which they had to use in order to conduct emergency online teaching. The authors argue that mandatory lockdowns forcing teachers to work remotely posed significant difficulties for many of those who lacked prior experience with online teaching tools and practices.

2.2.3 Cybersecurity

Despite cybersecurity not being explicitly stated as CSF (Roddy et al., 2017; Volery & Lord, 2000; Yudiawan et al., 2021), many researchers point out its importance within edtech software and online education (Chen & He, 2013; Kim, 2021; Metallidou et al., 2021; Raitman, Ngo, Augar & Zhou, 2005). Moreover, Karanasios (2021) highlights an increase in cyberattacks during the period of emergency online education propelled by COVID-19. As argued by the author, a lot of organisations were caught off guard by the sudden need to shield themselves in a new reality that exposed previously unknown vulnerabilities. The author points out that there was an uptick in online threats and cybercrime as people were forced to move activities to virtual environments. The opportunism of cybercriminals targeted individuals as well as organisations, especially since many found themselves suddenly working from home (Karanasios, 2021).

Teachers working from their homes had to adapt to radically different circumstances immediately without the preparation and planning that typically precede the introduction of online courses (Lee et al. 2021). In addition to this challenge, they were exposed to the potential risks of authenticating themselves remotely as legitimate users via the Internet. According to Stallings and Brown (2018), hackers and other cyber intruders can steal authentication credentials from unsuspecting users as systems are being accessed this way, but multi-factor authentication blocks intruders that have managed to steal user credentials. With multi-factor authentication, an extra step is added to the login process, such as a biometric scan or entering digits sent to a physical token separate from the device being used to access the system (Stallings & Brown, 2018).

Research by Stamp, Alazab and Shalaginov (2021) highlights the fact that plenty of malware has been customised to steal information from Android devices since a lot of users are connecting to various services via mobile devices. The authors point out that cybercriminals can steal highly sensitive information, such as social security numbers, credit card information or business-critical data by infecting devices (mobile or otherwise) with malware. Such intrusions can have huge consequences for affected individuals and organisations, especially if the malware impacts entire networks, and illegally obtained personal data may even be misused for the purpose of committing identity theft and fraud (Stamp, Alazab & Shalaginov, 2021).

As teaching was forced into online environments, cybersecurity threats reached unprecedented levels, which many organisations had no contingency plan for (Karanasios, 2021). According to the author, cybercriminals quickly and opportunistically adapt their illicit activities in order to be able to exploit the changing online behaviours of everyday users. During the COVID-19 pandemic, cybercriminals typically assessed the new opportunities, chose their targets, decided how to attack them and finally attempted some type of social engineering activity (Karanasios, 2021). As demonstrated in the next section, this placed additional responsibilities on the shoulders of teachers who no longer had access to on-premises IT support.

2.2.4 IT Support

As argued by Hofer, Nistor and Scheibenzuber (2021), technical infrastructure and IT support are some of the fundamental prerequisites for effective online teaching activities in general. The authors also emphasise the importance of training and preparing teachers in order to make it possible for them to conduct online teaching effectively. This view is supported by Li, Qin and Zhu (2021), who point out that effective online teaching requires organisational support and proper workload management. In societies with frequent power failures, Internet connection breakdowns and low-speed broadband services, emergency online teaching activities face many technical challenges (Saha et al., 2021). The authors point out that the reliability of mobile broadband services also impacts how teachers perceive online teaching in general.

Le et al. (2022) point out that emergency online teaching during the COVID-19 pandemic confronted teachers with many simultaneous challenges, especially if they were also unfamiliar with online teaching. The authors argue that the virtual classroom environments made it harder to communicate and interact with students. Being required to adapt to new teaching practices and learn new technical skills placed a new set of responsibilities on teachers who had demanding workloads in the first place (Le et al., 2022). According to the authors, teachers who feel overwhelmed by such requirements might be unwilling to upgrade their skill set, which might have detrimental effects on their emergency online teaching.

Research by Cutri, Mena and Whiting (2020) indicated that the increased focus on technology during the era of emergency online teaching impacted the dynamics in the virtual classroom. According to the authors, teachers who were faced with suddenly emerging technical issues requiring solutions beyond their own level of skills were helped out by supportive students. Accepting IT support from students required an open-minded attitude toward the fact that some students were more technically familiar with the online teaching tools than the teachers themselves (Cutri, Mena & Whiting, 2020). As teachers were forced to use their own home networks as the basis for online education, responsibility for technical issues shifted from the IT support department to the individual teacher (Saha et al., 2021). Le et al. (2022) also highlight the fact that overall organisational support has a high impact on how teachers perceive emergency online teaching, which requires them to deal with technical challenges, such as hardware supply, digital course material access and Internet connectivity issues.

2.3 Effectiveness of Emergency Online Teaching

Effective online learning can be achieved by systematic planning and design of online education (Hodges et al., 2020). The outcome of virtual teaching sessions can be maximised if the activities are designed in a way that increases the students' involvement and provides a level of guidance and feedback that suits the tasks (Hofer, Nistor & Scheibenzuber, 2021). According to Yudiawan et al. (2021), the role of the teacher is essential in effective online education. Ensuring that students receive feedback and that their work is assessed in a timely manner are essential elements of effective emergency online teaching (Lee et al., 2021). This view is supported by Hofer, Nistor and Scheibenzuber (2021) as well as Rusu, Virca and Popa (2021), who highlight the importance of feedback in online teaching contexts in general. Without such communication, students may become demotivated to such an extent that they set lower goals for their academic achievements (Hofer, Nistor & Scheibenzuber, 2021).

Hofer, Nistor and Scheibenzuber (2021) point out that emergency online teaching during the COVID-19 pandemic highlighted what is required in order to make online teaching, in general, more effective, and that fulfilling those requirements quickly in emergency contexts is essential. The authors mention that teaching practices that work well in the F2F setting may successfully be applied to contexts requiring emergency online teaching. The authors also point out that it is important to bear in mind that emergency online teaching requires a more proactive approach from students when it comes to organising their work in groups and as individuals.

Effective online education should facilitate a learning ecosystem, thus not just provide instructions, but also promote co-curricular activities and social support (Hodges et al., 2020). However, according to many authors, such community supportive collaborations were made more difficult during the era of emergency online teaching due to the isolation caused by the COVID-19 pandemic (Lee et al, 2021; Hodges et al., 2020; Bergdahl & Nouri, 2021).

Research by Hofer, Nistor and Scheibenzuber (2021) indicates that the individual ability of each student to navigate in virtual teaching environments affects how both students and teachers perceive the effectiveness of emergency online teaching. Enabling teachers to support each other by promoting collaborative environments in which they can share knowledge is an important way of supporting professional development among educators (Lee et al, 2021). According to Li, Qin and Zhu (2021), evaluating the effectiveness of emergency online teaching requires a deeper understanding of how both teachers and students feel about such virtual teaching environments and how those attitudes as well as other factors in need of further empirical research might ultimately affect the outcome of emergency teaching activities.

Lee et al. (2021) also point out that students at higher academic levels often possess good time-management skills and strive to gain deeper insights into a topic. This facilitates their learning in virtual teaching environments, but it also makes it more challenging for teachers to prepare properly in order to make virtual teaching sessions as rewarding as possible for the students (Lee et al., 2021). Furthermore, large groups may experience more difficulties during virtual cooperation and the lack of social context can contribute to lesser effectiveness of communication (Martins, Gilson & Maynard, 2004). Therefore, many authors bring attention to the importance of using suitable tools, since the type of technology used impacts the effectiveness of the learning processes (Beckman et al., 2018; Gillett-Swan, 2017; Harris & Rea 2009; Martins, Gilson & Maynard, 2004).

Table 3 summarises how pre-pandemic and post-pandemic literature addressed the effectiveness of communication, collaboration and education propagated through online environments across different eras.

Table 3: Research literature discussing effective online teaching

Addressing effectiveness	References
Pre-pandemic era	
Suggestions for effective communication within online education.	Berger (1999)
Conditions and means for achieving effective online education require more research.	Harasim (2000)
Evaluation of the effectiveness of online delivery of education.	Volery and Lord (2000)
VTs effectively facilitate a connection between geographically distant employees. However, large groups may experience more difficulties with this type of setup, as well as a lack of social context contributes to lesser communication effectiveness. Additionally, the authors bring attention to the type of technology useds since it impacts the effectiveness of the VT.	Martins, Gilson and Maynard (2004)
Suggests counselling students in order for them to become effective online learners.	Mupinga (2005)
Possibilities of effective use of Web 2.0 technologies within the classroom require further study.	Harris and Rea (2009)
Paper suggests that distance education facilitates learning more effectively than F2F education. Additionally, online education can reduce costs of education and increase the efficiency of communication between students and faculty.	Lei and Gupta (2010)
There is a remaining challenge to find a suitable platform that could effectively support a sense of community between students and teachers.	Gillett-Swan (2017)
Does not address the effectiveness of online education, however, the authors mention cost-effectiveness as a benefit of WFH.	Felstead and Henseke (2017)
Evaluates requirements of effective online learning.	Roddy et al. (2017)
Pandemic era	
The paper calls for a future study of the teaching methods used during emergency online education, while the most efficient methods should be employed in driving the innovation within the education system.	Chick et al., (2020)
The author points out that effective online learning can be achieved by systematic planning and design of online education, which was lacking in emergency online education. He elaborates that effective online education should facilitate a **learning ecosystem**, thus not just provide instructions, but also promote co-curricular activities and social support.	Hodges et al. (2020)

Finally, the authors point out that factors impacting online education such as the reliability of edtech systems or provided support for educators conducting online teaching should be used to inform the design of the online education.	
Addresses the effectiveness of emergency online teaching practices.	Cutri, Mena and Whiting (2020)
The authors note that there is room for more effective education. They elaborate that the efficiency of edtech could be increased by employing analysis of behavioural data.	Teräs et al. (2020)
The primary focus of the paper is not effectiveness, however, the authors point out that "all young people should have the ability to access and skills to use technology effectively and safely". Additionally, the authors mention that there should be support provided for students to navigate the Internet safely and effectively.	Williamson, Eynon and Potter (2020)
Addresses the effectiveness of emergency online teaching tools and practices.	Hofer, Nistor and Scheibenzuber (2021)
Addresses the effectiveness of emergency online teaching practices.	Li, Qin and Zhu (2021)
Addresses time efficiency vs. evaluation of student's work.	Saha et al. (2021)
The authors mention that the emergency online education did not allow for effective community supportive learning, which can be present if the online education is thoroughly planned. Additionally, the authors point out the need for effective strategies guiding educators in teaching students with special needs.	Bergdahl and Nouri (2021)
Addresses the effectiveness of emergency online teaching practices.	Lee et al. (2021)
The authors point out that the conversion of F2F classes online highlighted the potential effectiveness of educational technology.	Marek, Chew and Wu (2021)
The authors consider the role of the teacher essential in effective online education.	Yudiawan et al. (2021)

2.4 Organizational Learning Theory

Organizational Learning Theory (OL) is a multifaceted theory that is concerned with the competitive relationships between organisations (Levitt & March, 1988). The theory takes into account the stages of learning the organisation undergoes in order to remain competitive in a changing environment (Daft & Weick, 1984). In the context of emergency online teaching, the organisation can be represented by the educational institution and changing environment by the forced transition to online education caused by the COVID-19 pandemic.

Cangelosi and Dill (1965) characterised organisational learning as step-by-step responses prompted by specific issues, rather than steady and constantly ongoing processes. In a more

recent study, Castaneda and Ríos (2007) elaborate that the organisational learning processes can be split into the following subprocesses, which appear in the order they are stated - (i) intuiting, (ii) interpreting, (iii) integrating and (iv) institutionalising. According to Crossan, White and Ivey (1999), firstly, in the intuiting process people start noticing some recurring patterns which they need to further evaluate. Secondly, the interpretation process can be, according to authors, seen as a procedure of abstracting insights or ideas and formalising them, so they can be better conveyed to other people. Thirdly, integrating is defined as "the process of developing a shared understanding among individuals and of taking coordinated action through mutual adjustment" (Crossan, White & Ivey, 1999, p.525). Lastly, according to the authors, the institutionalising process can be understood as the implementation of the given actions from the integrating process, but across the whole organisation, by embedding the individual and group learnings into routine activities.

According to Argyris (1977), identifying and adopting methods that lead to desirable learning outcomes are core elements of OL. The author differentiates between single-loop learning (learning what it takes to achieve a certain result without changing the overall goal) and double-loop learning (critically evaluating the overall goal itself). In the context of this thesis, an example of double-loop learning might be teachers evaluating the effectiveness of online or hybrid learning in order to decide whether or not to make it a permanent substitute for F2F learning.

Argyris (1977) points out that the organisational open-mindedness that is required in order for individuals to be able to challenge deeply rooted norms is not always present in learning processes. However, even if there is some level of internal political resistance to deviation from the established organisational norms, change might still be made inevitable by forces beyond the control of management, such as some kind of crisis (Argyris, 1977). The learning that teachers were faced with during the COVID-19 pandemic was characterised by a high level of uncertainty, which challenged assumptions about how to learn on an individual level by observing those who know more (Greve, 2020). According to the author, the sudden emergence of the COVID-19 pandemic created an unprecedented situation in which existing beliefs had to be re-evaluated. The rare occurrence of long-lasting pandemics should not prevent organisations from incorporating the lessons learned from crisis management countermeasures into their long-term learning strategies, since the effects of such events may linger for decades (Greve, 2020).

2.4.1 Application of OL

Our theoretical framework focused on understanding how emergency online teaching propelled by the COVID-19 pandemic impacted the teachers of the organisations that went into emergency online teaching. With that in mind, we discovered three important focus areas that determine how technology, central to emergency online teaching, has been viewed and we aimed to investigate whether experiences within those areas offered any learning that can influence future online teaching for those teachers and their organisations. For a comprehensive understanding, of the OL is particularly helpful to understand organisational effectiveness, which is built around a number of key concepts, some of which have been important for our study, as follows: (i) levels of learning with focus on individual learning (Crossan et al., 1995; Fauske & Raybould, 2005), (ii) type of learning influenced by the level of uncertainty about the outcome (Greve, 2020), (iii) complexity of the environment (Cangelosi & Dill, 1965; Levitt & March, 1988), (iv) dynamism of environment (Martínez-

León & Martínez-García, 2011), (v) stress (Cangelosi & Dill, 1965), and (vi) socio-cultural environment of the organisation from the technological perspective (Levitt & March, 1988; Martínez-León & Martínez-García, 2011).

The model below is a visualisation of how elements of OL were connected to the theoretical framework of this thesis. Learning and the online environment are viewed as factors informing overall organisational effectiveness. Type and level are subcategories of learning and in this case, the thesis is focused on individual learning at the level of general uncertainty about the outcome of the teaching activities within the organisation. The online environment is made up of the technical complexity of the environment itself, the dynamism of the transformation that the environment was constantly being impacted by and the stress caused by the technical challenges that teachers were facing while also experiencing socio-cultural consequences of being physically separated from their colleagues and having to figure out how to navigate the emerging online culture instead.
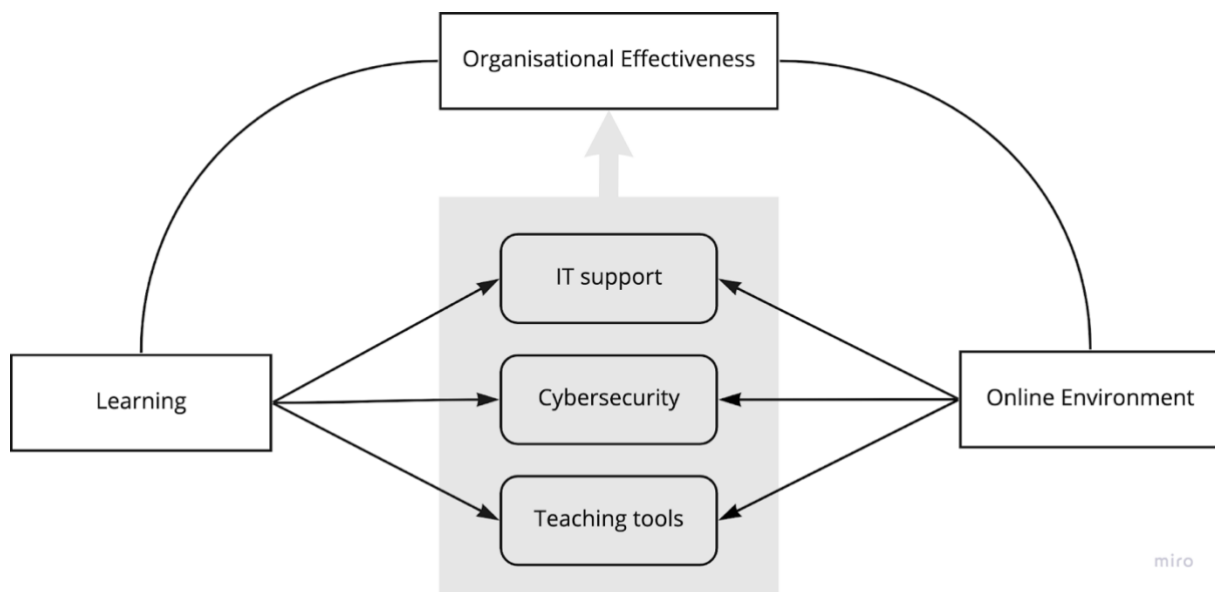
Figure 1: Organisational effectiveness is looked at through the concepts of learning and online environment pointing to the three focus areas of the research - IT support, cybersecurity, and teaching tools

2.5 Summary of the Theoretical Framework

Based on the literature review, it can be concluded that a lot of research has been conducted on the topic of the pros and cons of distance learning since the late 1970s. Many researchers have addressed the paradigmatic shift towards collaborative learning, hybrid learning and completely virtual learning environments. The existing body of literature reflects an increasing trend of remote work, not only within teaching professions. For many years, researchers have aimed to understand how people are impacted by this. One of the important findings is that fundamental teaching principles also apply to emergency online teaching contexts. Methods and practices that work well in physical classrooms work well in virtual environments too.

However, emergency online learning has its own set of challenges and researchers have pointed out that virtual teaching environments may vastly differ from each other. Research

conducted on various educational levels highlights that the diversity of emergency online teaching environments is an important factor to consider when establishing principles increasing the effectiveness of this type of education. In the pre-pandemic research literature, F2F teaching was still mostly referred to as the norm to which online teaching was compared and there was an underlying assumption that all participants would have the required equipment and infrastructure available. However, during the era of emergency online teaching, the factors considered prerequisites of online education, such as Internet speed and stability, were identified as CSFs.

The research literature reflects a gradual development of online teaching tools and practices, including the adoption of blended or hybrid learning environments. A recurring challenge in online teaching over the years has been communication between the teachers and their students since facial expressions, gestures and body language might get lost over a video call, especially if there are occasional glitches in the connection. Before the pandemic, technical aspects informing the quality of online teaching were often discussed, while the emergency online teaching was mainly mentioned as a temporary solution, for example, when communities struggled with outbreaks of SARS. However, the COVID-19 pandemic was the first situation that required emergency online teaching for an extensive period of time.

Since the beginning of the COVID-19 pandemic, the research literature has had increased focus on (i) comparisons between planned and emergency online teaching, (ii) the evolution of edtech tools, (iii) the emotional toll of long-term isolation, (iv) potential security concerns and (v) how to adapt emergency online teaching methods in order to support collaboration between students. Together, these sources paint a picture of fast-paced technical evolution and an increase in cybersecurity threats that add further layers of complexity to the challenges that teachers were already experiencing. The existing body of research literature also warns of the potential for upticks in plagiarism, cyber sabotage and misappropriation of personal data in online teaching environments.

When assignments and home exams are created and submitted using digital tools and the Internet, teachers and students might be impacted by cybersecurity vulnerabilities and privacy breaches. The research literature published during the pandemic highlights the fact that emergency online teaching presented challenges even for teachers who had prior experience with planned online teaching since teachers suddenly had to WFH amid looming cybersecurity threats and less immediate access to IT support. Learning how to teach in new ways and developing new technical skills while working from home with limited access to IT support became new tasks that were added to the existing responsibilities that teachers were already struggling to manage.

The references discuss different aspects of remote work and emergency online teaching, but together they shed light on a situation in which issues regarding teaching tools, cybersecurity and IT support converge. Emergency online teaching turned teachers' homes into their places of work where they had to ensure that their Internet connections were reliable enough for virtual sessions. They also became responsible for making sure that their home network cybersecurity solutions provided sufficient protection from an increasing number of cyber threats. Additionally, some teaching tools were new to many teachers and one of the main video conferencing solutions exposed its users to cybersecurity vulnerabilities. In case teachers encountered technical issues, they did not have access to onsite IT support.

The literature review provided insight into potential impediments to individual learning processes in organisational environments. Applying lessons learned and daring to question organisational priorities might be difficult for individuals impacted by collective norms. The uncertainty caused by a sudden crisis, such as the COVID-19 pandemic, confronts organisations with a new reality in which a lot of people have to quickly learn new ways of working. Uncertainty is also linked to the stress factors driving organisational learning processes. As individuals and teams experience a need to find less stressful ways of working, they learn and adapt their methods. There is learning on an individual level, but that learning is also influenced by the organisational context in which it takes place.

Although some of the OL research literature was written decades before the COVID-19 pandemic, it is still in line with findings presented in research literature written in the era of emergency online teaching. Organisations that were focused on providing education were forced to respond to an unprecedented crisis by learning how to adapt course content and teaching methods to virtual environments. Even for universities that were used to planned online teaching, this was a step-by-step learning process prompted by a worldwide state of emergency.

3 Research Methodology

In this chapter, the selected research methodology is presented. It describes how the data was collected and analysed as the qualitative study was conducted, starting with a pre-study to test the selection of interview questions. Finally, ethical considerations, requirements for scientific quality and limitations of the research method are discussed.

3.1 Research Approach

The research question should inform the appropriate course of study taken to answer it (Recker, 2013). The research question of this thesis is - *What measures do teachers think contribute to the effectiveness of emergency online teaching?*, which indicates that in order to answer it, it is needed to study the perceptions of the educators in the context of online education propelled by COVID-19 pandemic.

The qualitative research method was selected as most appropriate for this research. Firstly, this method is designed to study people in their natural setting allowing researchers to study how they operate and behave (Recker, 2013). Secondly, the qualitative research method supports researchers to shed light on how humans attach meaning to lived experiences and make sense of the contexts in which they took place (Patton, 2015). Finally, this method is suitable for "exploratory research where a phenomenon is not yet fully understood, … or still emerging" (Recker, 2013, p.88), which is the case with the influence of teaching tools, cybersecurity and IT support on the effectiveness of emergency online teaching.

Qualitative research does not have to be interpretive (Walsham, 2006; Klein & Myers, 1999), but interpretivism is a popular approach to qualitative research since it enables researchers to investigate human behaviours in particular contexts and subsequently apply their own interpretations of the observed phenomena (Recker, 2013). Goldkuhl (2012) highlights the fact that gaining a deeper understanding is a goal in and of itself in interpretive research. Thus, we have chosen to conduct qualitative research, while adhering to interpretive philosophy, in order to identify and understand the measures contributing to the effectiveness of online teaching in the context of COVID-19.

3.2 Approach for Literature Review

By conducting the literature review, we wanted to get a better understanding of the field of online education and get familiar with the body of knowledge concerning this phenomenon. We performed a literature review with three goals in mind: (i) establish guidelines for locating and researching existing literature, (ii) get up to date with the latest development in the area of the study but also understand the beginnings, (iii) set standards for what resources we allow in the study.

We managed to achieve the first goal by starting with the "breadth-first" approach - locating any seemingly relevant resources for a given topic. We used online tools such as Google, Google Scholar, LUBSearch, and LUBCat, with search terms like "online education", "remote

teaching", "critical success factors of online education", and "emergency online teaching". Another starting point for the literature search and review efforts was benefiting from our pre-existing works, which were topically similar. This way we were able to build a sufficient library of search phrases, search tools, and articles, which allowed us to start performing an initial review.

To fulfil the second goal, we started reviewing the resources acquired in the first goal. Since the aim was to get familiar with the latest developments in the field, we primarily selected the articles which were published during or after 2020. We also applied advice from Randolph (2019) and started using references in reviewed studies, which helped us enrich the collection of the literature produced around the pandemic times. However, as we run out of such resources, we dived deeper into the recent past (2010+). Additionally, in order to get a better understanding of the beginnings of the field, we also started reviewing literature which was published in the 20th century.

As our last goal, we wanted to ensure we do not base our work on faulty assumptions and research papers that may be invalid or have low impact. We attempted to set some internal guidelines for what constitutes a quality resource (for example, a well researched and peer-reviewed article with many citations) and what does not (a random article on the Internet without an author or date of publication). Therefore, we agreed on evaluating the following criteria (stated in order of importance): (i) author's familiarity with the topic, (ii) number of citations, (iii) year of publication (context-dependent), (iv) impact factor of publishing journals, (v) other criteria. We generally tried to follow the aforementioned criteria whenever possible. However, in some instances, we had to relax them due to various reasons. For example, the relevant research, which captured the COVID-19 pandemic, started coming out in the second half of 2020 and 2021, therefore we could not solely rely on metrics such as the number of citations, since older articles tend to have a higher number of citations.

3.3 Data Collection

There are various techniques to gather empirical data, while employing qualitative research methods (Recker, 2013). However, the most prominent one is interviewing (Recker, 2013). We conducted descriptive interviews, which according to Recker (2013), allow researchers to explore multiple subjective perspectives of the phenomenon and generate multi-faced descriptions, catering for interpretive understanding. The conducted interviews were of a semi-structured nature, which is distinct for asking respondents about the topics of study following a predefined interview guide, while allowing flexibility for new questions to be brought up as the conversation with the respondent unfolds (Recker, 2013). This interview approach can be used to confirm the existing knowledge as well as generate new learning because the interviewees often provide answers together with their reasoning (Recker, 2013).

Our descriptive semi-structured interviews were conducted virtually, via Zoom, in order to reach respondents located in different parts of Sweden - Lund, Växjö, Umeå, Örebro and Östersund. This platform is evaluated as an online option for qualitative research interviews (Archibald et al., 2019), while it also gave us an opportunity to record the meetings, facilitating easy transcription of the interviews.

All empirical data were collected from university teachers at the department of Informatics in Sweden. This decision was informed by an assumption that educators within Informatics have a predisposition for transition to online education since some universities offer education in this field solely online (Linnaeus University, 2022). Additionally, the choice of respondents teaching within the same field allowed us to obtain comparable data.

We conducted the interviews with the following scientific guidelines in mind:

Firstly, Patton (2015) points out that the level of subjectivity in qualitative research has raised a lot of criticism since it challenges the traditional assumptions regarding scientific objectivity in research processes and that researchers arguing in favour of quantitative studies promote anonymous experiments and tests as preferred research methods. However, surveys, experiments and tests are also constructed by people with their own set of assumptions and potential biases, which might inform the selection of survey questions and/or the statistical analysis of the obtained data, as argued by the author. There is no bullet-proof research method that can guarantee unbiased findings (Patton 2015).

Secondly, Schultze and Avital (2011) emphasise the importance of asking questions in a way that extracts detailed descriptions of lived experiences during interview sessions. Researchers aiming to probe the deeper layers of memories and interpretations can guide their interviewees on such a journey by asking questions that invite participants to share more detailed stories that capture intentions as well as social interactions (Schultze & Avital, 2011). Walsham (1995) refers to the information received during interview sessions as first-order concepts and the researchers' interpretations as second-order concepts.

Thirdly, as an interpretive researcher, it is recommended to keep an open mind and be prepared to reconsider or even discard any assumptions that prove to be erroneous as more data is collected and analysed (Walsham, 1995). According to Recker (2013), researchers play a central role in qualitative research work as they enter the environments of their interviewees and interact with them in order to obtain data, make observations and identify underlying patterns and meanings as they analyse their collected data from a bottom-up (inductive) point of view and formulate their research findings.

Lastly, as argued by Patton (2015), the descriptive nature of qualitative data provides building bricks for detailed storytelling. Qualitative data give us a golden opportunity to view the world through other people's eyes (Patton, 2015). According to Recker (2013), descriptive interviews open up a window to the experiences and perceptions of interviewees, giving researchers access to individual and subjective interpretations of phenomena and events of interest.

3.3.1 Design of the interview guide

The questions for the semi-structured interviews were derived from the theoretical framework. They are categorised into five groups, based on the researched area: (i) overall perceptions of emergency online teaching, (ii) IT support, (iii) cybersecurity, (iv) teaching tools and (v) technical skills inequality. Since the concept of technical skills inequality is discussed by Beckman et al. (2018) as well as Williamson, Eynon and Potter (2020) as an underlying issue contributing to the challenges with teaching tools, we decided to ask specific questions about this as well in the interviews.

We conducted a pre-study in order to test the potential questions before moving forward with the live interviews (Kim, 2011). Thus, we reached out to teachers at Lund University. In order to obtain information from different perspectives, we selected two teachers who conducted online teaching during the COVID-19 pandemic. They were not responsible for any of the courses that we have taken within the Master's Programme in Information Systems. This gave us an opportunity to get feedback from teachers who have experience with the research topic. As requested by one of the teachers who participated in the pre-study, the questions were shared via email and feedback was received the same way.

Based on the feedback from the pre-study, the following adjustments were made. Firstly, question-set number 1 (shown in table 4) was added, facilitating the generation of contextual data. Secondly, the number of questions was reduced. Lastly, we came to the conclusion that at the beginning of the interview, each participant should be provided with a shared definition of the concept of "emergency online teaching" - *teaching activities that are quickly moved to virtual environments due to sudden events such as the COVID-19 pandemic*. This definition is based on research by Lee et al. (2021).

The guide for semi-structured interviews includes some broad questions, leaving room for follow-up questions. As reflected in the transcripts (Appendix C-G), this opportunity for clarification was an important part of the conversations with the respondents, since it enabled them to share experiences that they felt were relevant, prompting further discussions about related topics. Table 4 lists the questions included in the final version of the semi-structured interview guide used to gain insight into lived experiences with emergency online teaching.

Table 4: The interview guide for semi-structured interviews

Question number	Question	Area	Colour
1a	When you think back you were first informed about switching to exclusively online teaching, what was that day like?	Overall perception of emergency online teaching	
1b	What specific tasks did you perform?		
1c	Did you know who to contact in order to get the required information about emergency online teaching?		
1d	What technical issues did you consider?		
2	Could you describe a typical day in an online emergency teaching setup? How does it compare to F2F teaching?		
3	Could you describe the IT support that was available to you during emergency online teaching?	IT Support	
4	Have you experienced something that could be improved about IT support to maximise the efficiency of online teaching?		

5a	Can you think of Internet issues during emergency online teaching?	
5b	Were you able to solve them yourself?	
6a	Have you faced any challenges with teaching tools during the emergency online teaching?	Teaching tools
6b	Do you see any improvements to these teaching tools that would make the teaching experience better?	
7	How do you perceive the effectiveness of asynchronous online classes (available to students on-demand 24/7)?	
8	How do you perceive the usage of wikis, blogs, and podcasts in emergency online teaching?	
9a	Have you experienced any joint communication between teachers and students via social networks?	
9b	If so, how did that impact the efficiency of emergency online teaching?	
10	Did you feel more exposed to cyber threats while working from home?	Cybersecurity
11	Have you noticed any increase in cybersecurity threats during the era of emergency online teaching?	
11a	If so, what were they?	
12	Have you experienced any security or privacy issues yourself during emergency online teaching? such as students or hackers disrupting the class or sabotaging the virtual environment	
13a	Did you experience any significant differences between students' tech skills?	Technical skills inequality
13b	If so, how did that impact the efficiency of emergency online teaching sessions?	
13c	Have you experienced something that can minimise the gap between the students?	
14	Looking back on your days of emergency online teaching, is there anything that you would do differently if you had to do it again?	Overall perception of emergency online teaching

3.3.2 Participant Selection Process

One of the characteristics of qualitative research is purposive sampling, thus purposefully selecting participants of the research by certain properties of interest (Recker, 2013). Therefore, in order to answer the research question of this thesis, it was necessary to collect empirical data by interviewing teachers with experience in online teaching during the COVID-19 pandemic.

We identified potential participants by visiting the homepages of Swedish universities. Subsequently, we sent emails and made phone calls to program coordinators, course administrators, teachers and one department manager, depending on what type of contact information we were able to find on the homepages. We informed each recipient that we were planning to conduct interviews in English via Zoom, which enabled us to reach non-Swedish speaking teachers. In those cases where we could not identify a potential participant, we sent a request to course administrators or program coordinators informing them about the research that we were planning to conduct. We asked them to forward the request to a teacher who had experience with emergency online teaching within Informatics/Information Systems during the COVID-19 pandemic.

The first version of the interview request email included details about the study and the semi-structured interviews such as confidentiality and recording of the session, resulting in a lengthy message. We experienced that the potential participants did not respond to the first version of this email. Therefore a shorter, second, version was created, leading to a higher rate of potential participants agreeing to an interview (different versions of the emails can be found in Appendix B). Together we reached out to twenty-four potential participants, over the course of two weeks, which led to the scheduling of five interviews.

Walsham (2006) emphasises the importance of timing interviews in a way that is convenient for the interviewees and being flexible about rescheduling when necessary. With this in mind, we scheduled meetings with our respondents in accordance with their own suggestions. The study consisted of five academics from different universities across Sweden - Linnaeus University (located in Växjö), Umeå University, Lund University, Mittuniversitetet (located in Östersund) and Örebro University. Table 5, lists the participants who contributed to our research together with their roles:

Table 5: Interview participants

Respondent	Role
R1	Lecturer
R2	Associate professor
R3	Lecturer
R4	Senior Lecturer
R5	Associate professor

3.3.3 Process of Collecting the Empirical Data

We started conducting semi-structured interviews over Zoom on the 21st of April 2022. Table 6, provides an overview of the interviews on which our empirical data collection was based.

Table 6: Interview summary

Respondent	Interview Date	Duration	Reviewed transcript
R1	2022-04-21	37 minutes	No
R2	2022-04-21	25 minutes	No
R3	2022-04-26	32 minutes	Yes
R4	2022-04-27	34 minutes	Yes
R5	2022-04-28	32 minutes	Yes

The overall structure of the conducted semi-structured interviews can be categorised into five steps - (i) introduction, (ii) initiation, (iii) main body, (iv) final reflections and (v) closure. After introducing ourselves and explaining the purpose of the interview, we informed the respondents about ethical considerations and obtained their permission to record the session. Subsequently, we started the interview with the initial questions about how they experienced the switch to emergency online teaching. The main body of the interview was centred around teaching tools, cybersecurity and IT support, followed by questions focused on any perceived technical skills inequality among the students. Afterwards, the respondents were asked for final reflections on anything they would do differently if they had to conduct emergency online teaching again. Towards the end of each meeting, the participants were asked whether they are interested in reviewing the transcript of the interview and if they wish to be informed about the findings of this thesis. Finally, we ended the recording and thanked our respondents for their participation.

After each meeting, the recorded videos were transcribed from oral to written mode, in order to amenable a closer analysis of the data (Kvale & Brinkmann, 2009). The transcripts were created in a two-step process. First, raw transcripts were generated using the Amazon Transcribe job (Amazon, n.d., a), which transcribed the recorded video into JSON format containing an approximate transcription of voice to text from the video, and other metadata. This file was further stored in a private S3 bucket (Amazon, n.d., b). Secondly, the generated transcripts were manually reviewed by both researchers and corrected due to the fact that the automatic transcription is not 100% accurate. Thirdly, the transcripts were enriched with notes capturing interviewees' body language depicted on the video (such as the interviewee smiled) as well as researchers' notes (for example, the interviewee had a long thinking pause). Lastly, the interview transcripts were sent to the respondents who agreed to review them (shown in table 6). Followingly, the respondents' feedback has been worked into the transcripts. The purpose of this procedure was to allow for the correction of any misinterpretations and provide an opportunity for participants to correct their statements before the data is analysed.

3.4 Data Analysis

The qualitative data analysis is centred around textual data (Bhattacherjee, 2019; Recker, 2013), which in the case of this thesis are transcripts of semi-structured interviews. According to Bhattacherjee (2019), the goal of such analysis is "sense-making" or developing an understanding of the phenomenon, therefore researcher's analytic skills and knowledge of the social context within the field the data has been collected are crucial.

There are different ways of performing the analysis of qualitative data, while the one most commonly used, and also applied in this thesis, is coding (Recker, 2013). As argued by the author, coding helps researchers organise qualitative data in order to identify useful information. The concepts used for coding were defined based on the five areas the interview guide was centred around - (i) overall perceptions of emergency online teaching, (ii) IT support, (iii) cybersecurity, (iv) teaching tools and (v) technical skills inequality. As mentioned in section *3.3.1 Design of the interview guide,* these research areas were derived from the reviewed literature. According to Kvale and Brinkmann (2009), such a technique of developing the codes in advance by the researchers based on existing material is called concept-driven coding.

The codes used in the analysis are described in table 6. The five research areas are marked with colours, which were used for highlighting how respondents addressed them in the transcript (Appendix C-G). Two sub-categories, social networks (SN) and asynchronous classes (AC), were added to the questions regarding teaching tools since they extend this concept.

Table 7: The coding overview

Concept	Code	Colour
Overall perception of emergency online teaching	OP	
IT support	ITS	
Teaching tools	TT	
Social networks	SN	
Asynchronous classes	AC	
Cybersecurity	CS	
Tech skills inequality	TSI	

3.5 Ethical Considerations

The conducted qualitative research required us to be very careful about how we handled the information that we received from our participants. This view is supported by IS research literature. Patton (2015) even argues that researchers intervene in social contexts through

interviews. According to the author, a qualitative interview session provides a unique opportunity to gain insight into an interviewee's perspective at a particular moment in time and such interactions leave an impression on people, whether intentional or not. The discussions bring memories and interpretations to the surface, shed new light on them and change the interviewee's perception of the events as the information is being shared with the interviewer(s) (Patton, 2015). The author argues that it is important to remember that this is the primary goal of the interview session.

Acting as an impartial and ethically responsible interviewer focused on gathering information while impacting interviewees as little as possible is a delicate balancing act and what we bring to the table in terms of personal experiences and assumptions as we embark on this journey informs how we interpret our collected data (Patton, 2015). We perceive this potential for personal bias as a major ethical consideration that must be taken into account when interacting with interviewees and interpreting the information that they share with researchers. Recker (2013) argues that IS researchers must ensure that all participants are fully informed about how the data that they provide will be used and that they approve before any data is collected or recorded. Privacy and confidentiality issues are of the utmost importance and IS researchers are responsible for protecting the obtained information and the people who provided it (Recker, 2013).

Ethical considerations also apply to the outcome of a research process. According to Gregor (2006), it is important to ask ourselves how our findings might be used and whether or not there are any potential ethical dilemmas related to our contributions to the research field. Floridi (1999) refers to computerised information environments as the infosphere and argues in favour of considering how new information contributes to the infosphere as a whole. The purpose of our research is to make a positive and ethically responsible contribution to the infosphere by investigating online teaching experiences and gaining deeper insights that can support socially and technically improved edtech environments.

Walsham (2006), on the other hand, emphasises the importance of not unintentionally compromising the privacy of research participants, which might have harmful consequences for them. According to the author, researchers might not always be able to foresee the impact of their research work on participants. Being transparent about the purpose of the research work and obtaining informed consent are fundamental building blocks of responsible research, but it is also essential to be aware that seemingly innocent pieces of information might enable knowledgeable readers to figure out the identities of the participants to whom researchers have promised confidentiality (Walsham, 2006).

We have strived to adhere to this advice while working on this thesis. In accordance with the ethical guidelines promoted by Patton (2015) regarding qualitative interviews, we aimed to take up as little time as possible out of respect for our respondents' busy schedules. At the beginning of each interview, the respondents were informed that their identities would be kept confidential, since minimising the risk that the research might cause harm to the participants is a fundamental principle of qualitative research (Patton, 2015). Thus, interview transcripts that contain any information that might reveal their names were redacted before being added as appendices to this thesis. The respondents who expressed an interest in receiving the transcript of their own interview were also given the opportunity to review the documents and inform us in case they had questions or objections.

3.6 Scientific Quality

Bartunek, Rynes and Ireland (2006) argue that safeguarding the validity of scientific findings is essential and that in order to achieve this, researchers must ask a relevant research question. Under the condition that these priorities come first, Bartunek, Rynes and Ireland (2006) strongly recommend that researchers find out what might make their findings interesting to a larger audience in order to reach more people to whom they might be useful. Identifying a receptive target audience is an important step on the journey toward making an interesting contribution to the body of knowledge within a research field (Bartunek, Rynes & Ireland 2006).

According to Walsham (2006), developing a suitable theory while conducting interpretive research is a delicate balancing act and developing a theory at the very beginning of a literature review might keep researchers from reading on and reviewing sources that are relevant to their work. The author argues that waiting until the research process is about to be concluded limits the potential of a theory to support the data analysis. While we have not developed a theory in this study, we adapted our theoretical framework and used OL for supporting the influence of IT support, teaching tools and cybersecurity on organizational effectiveness. Keeping an open mind during the literature review and researching existing theories in depth can help interpretive researchers tremendously (Walsham, 2006). In order to lay a solid foundation for high scientific quality, we followed this advice and began our literature review as early as possible.

As argued by Walsham (2006), research work based on data from relatively few organisations can result in generalisable and widely applicable findings. The author claims that researchers can clarify the wider applicability of their findings in their discussion and conclusions and that this is where they need to argue to support their claims that their research work has contributed new knowledge to the research field in question. For years, researchers have hotly debated whether or not it is possible to generalise based on small case studies (Walsham, 2006). In an earlier article, Walsham (1995) emphasises the importance of understanding that interpretivism has its own spectrum of potential generalisations. Klein and Myers (1999) argue that the generalisability of interpretive studies relies heavily on the ability of researchers to present their findings convincingly and apply logical reasoning to put them into context. According to the authors, achieving abstraction by deriving generalisable concepts from specific examples is at the heart of interpretive research.

The type of generalisation that we aim to contribute mostly resembles what Walsham (1995) refers to as rich insight. By analysing the data that we collected from our participants, we aimed to gain a deeper understanding of social, educational and technical challenges faced by university educators.

3.7 Limitations

From the methodology standpoint, this thesis has the following limitations. Firstly, the interpretive nature of the research on which it is based may pose difficulties when generalising the findings (Walsham, 1995). We chose a qualitative and interpretive research approach seeking deeper levels of insight into the experiences of individual teachers who conducted emergency online teaching. However, other research approaches might be applied

to this topic in order to establish a broader level of generalisability of the findings of this research.

Secondly, in order to ensure consistency and reach interviewees from various regions, all qualitative interviews were conducted virtually. This approach can however lead to limitations such as technical difficulties (Archibald et al., 2019; Gray, Wong-Wylie, Rempel & Cook, 2020) and the inability to fully observe some of the interviewees' body language (Cater, 2011).

4 Findings

This chapter begins by outlining the findings of the two pre-studies. Subsequently, the findings of the main study are presented by categories matching the ones in the questionnaire. The outcomes of the interviews are visualised in tables and lastly, the findings are summarised.

4.1 Pre-study

As mentioned in section *3.3.1 Design of the interview guide*, the pre-study was conducted for two reasons. Firstly, to gain deeper insights into the nature of emergency online teaching and to prepare us for formulating an interview guide that promotes the discovery of new angles and potential challenges. Secondly, to test whether the interview guide is well-designed, the wording is appropriate and whether more questions should be added or changes made. The questions included in the pre-study interview guide are listed in Appendix A together with answers from respondents.

4.1.1 Summary of 1st pre-study

The first teacher who participated in our pre-study, PR1, has 23 years of teaching experience within the field of IS. PR1 was not surprised by the official decision to move university courses fully online in the era of emergency online teaching. However, PR1 reported that the university had only expected those conditions to last no more than a few weeks and that the prolonged period of emergency online teaching required enormous amounts of preparation.

When PR1 was first informed about having to conduct emergency online teaching, PR1 had to adapt the course content to the virtual environment and rearrange the schedule to suit the homework assignments and any other activities that were impacted by the sudden change. At the time, PR1 was teaching a blended course featuring both online activities and international travelling in order to participate in F2F sessions. The F2F activities were immediately cancelled, which left PR1 struggling to manage the students' disappointment as well as the actual emergency online teaching sessions.

Luckily, PR1 felt very well supported by the university IT department, which facilitated daily work. PR1 emphasised the need for careful planning when setting up online teaching sessions in general. Regarding the technological issues that PR1 considered when setting up the emergency online teaching, PR1 mentioned lapses in access to the Internet in general and Zoom in particular, the potential of power outages (both for the professor and the students) and access to tools that students need in order to be able to participate in the courses from home. PR1 had not encountered any Internet connectivity issues and was very pleased with the IT support services, to which PR1 had experienced 24/7 access. From a technical point of view, PR1 felt that it would have been necessary to have more time to prepare in order to conduct emergency online teaching more effectively.

Since the university had already adopted Zoom and started conducting hybrid teaching before COVID-19, PR1 experienced a seamless transition to emergency online teaching via Zoom. PR1 did not feel that any of the teaching tools required a higher level of technical skills. On

the topic of asynchronous online classes, PR1 responded that learning in a classroom is more effective from a learning perspective, but online teaching has the benefit of being able to reach a larger number of students, even those located in remote places. PR1 favoured podcasts over wikis and blogs, but had not used social media networks to communicate with students, since PR1 preferred to communicate with them using officially approved university platforms and communication channels.

PR1 did not feel more exposed to cybersecurity threats while working from home and did not experience any attempts to hack or disrupt emergency online teaching sessions. PR1 also reported that a university where PR1 used to work had used moderators to verify that only authorised users participated in Zoom classes. PR1 did not notice any uptick in cybersecurity threats during the era of emergency online teaching. PR1 did not perceive any significant differences between students regarding their tech skills and on the topic of what PR1 would do differently if conducting emergency online teaching again, PR1 would not change anything in particular. PR1 recommends always being prepared to adapt to changes on short notice.

4.1.2   Summary of 2nd pre-study

PR2 has 21 years of teaching experience within the field of Information Systems. PR2 recalled a very rapid switch to emergency online teaching, but felt well-prepared thanks to solid experience with online and blended learning. PR2 claimed to have a more positive view of online teaching in general than many colleagues and considered it equal to F2F teaching. As the university moved the teaching activities online in 2020, PR2 conducted lectures and seminars over Zoom and shared course information and quizzes over the Canvas educational platform. PR2 felt well-informed right from the start of emergency online teaching and praised the director of study, who was very helpful to the staff.

According to PR2, there were lots of similarities between F2F teaching and emergency online teaching. However, PR2 missed being able to make notes and drawings on the whiteboard. In order to counteract misunderstandings, PR2 put more focus on sharing comprehensive written material and ensuring clear verbal communication with the students. Unlike PR1 and the interview participants, PR2 experienced recurring Internet connection breakdowns at the university or at the home office. On several occasions, PR2 had to repeat some course content that was lost when the virtual sessions were interrupted. According to PR2, those interruptions had lasted a couple of minutes at a time. However, PR2 was pleased with the available IT support and once again mentioned the involvement of the director of studies. In PR2's opinion, the university would benefit from having an expert team supporting teachers who need to conduct online teaching.

Regarding the teaching tools, PR2 experienced difficulties with Camtasia and suggested that teachers might need short introduction courses on how to create recordings that are more useful for the students. PR2 would like to see more integration between the different teaching tools, such as recording or video conferencing functionality connected to Canvas. PR2 had a favourable view of asynchronous online classes, but emphasised the need to follow up with activities, such as knowledge checks or seminars, to ensure that students actually benefit from them. PR2 was also positive regarding the possibility of including wikis, blogs and podcasts in emergency online teaching, but had not used them in any courses. PR2 had not communicated with colleagues or students via social media networks.

According to PR2, many colleagues had been concerned about unauthorised students entering Zoom meetings, but personally, PR2 did not feel more exposed to cyber threats while conducting emergency online teaching from home and never experienced any disruptions of virtual lectures by hackers or students. PR2 noticed that some students had trouble managing certain Zoom features, such as screen sharing and pointed out that such issues caused delays during virtual meetings. In order to counteract this, PR2 suggested crash courses to teach students about frequently used Zoom features. If required to conduct emergency online teaching again. PR2 would invest more time in learning to record lectures for the students

4.1.3 Conclusion of pre-study

Besides the alteration to the interview guide (such as reducing the number of questions or providing an explanation of emergency online teaching at the beginning of the interview), mentioned in the section *3.3.1 Design of the interview guide*, the findings of the pre-study indicate that being well-prepared in terms of video conferencing tools helps when making the immediate switch to emergency online teaching. This can be facilitated by access to excellent IT support services. On the other hand, findings of the pre-study also indicate that emergency online teaching requires a level of planning for which there is no time in a situation that requires immediate action. Another key takeaway from the pre-study is that one teacher felt that learning in a classroom is more effective from a learning perspective, whereas the other teacher did not consider online learning inferior to F2F learning.

4.2 Main study

This section summarises the findings from the main study categorised in accordance with the concepts discussed in the semi-structured interviews. The main findings are highlighted in tables visualising how the respondents' answers compared to each other.

4.2.1 Overall Perception of Emergency Online Teaching

In this section, the findings regarding the respondents' overall perceptions of emergency online teaching are presented. The findings have been divided into two subsections where the respondents' answers about prior experience with online teaching and the lack of F2F contact are reported.

Prior experience

Our findings indicate that the teachers who conducted online courses prior to the pandemic felt more prepared and were able to continue teaching with the same level of effectiveness as prior to COVID-19. On the other hand, teachers without this experience faced practical issues. Table 8 shows the relation between teaching online before the pandemic and the reaction to the transition to online teaching. We observed that the preparedness for emergency online

teaching was not binary among our participants, but rather presented itself as a spectrum of values from very low preparedness, to high preparedness.

Table 8: Relationship between online teaching experience and reaction to emergency online teaching

Respondent	Conducted online courses prior to COVID-19	Reaction to the transition to exclusively online teaching	Level of preparedness
R1	Yes (R1:2)	Had a good idea of what to do (R1:2)	High
R4	Yes (R4:2)	Was not greatly affected by the transition. Provided help to teachers without experience with online teaching (R4:2)	High
R3	No (R3:2)	Anticipated lockdown and started considering what hardware and software should be used. Did a lot of experimenting (R3:6)	Medium
R5	No (R5:2)	Felt unfamiliar with the online teaching software. Started considering practicalities such as what credentials are needed (R5:2)	Low
R2	No (R2:2)	Felt alone and unfamiliar with the online teaching software to be used (R1:2)	Very low

Lack of F2F contact

All participants expressed a perceived loss of physical contact with their fellow teachers or students. In the case of the contact with students, the participants primarily pointed out that the lack of feedback regarding the engagement from the students caused degradation of their teaching process (R1, R2 and R5). Additionally, R1, R2 and R4 noted the lack of "unorganised" time with their colleagues, which leads to degraded efficiency when seeking help or wanting to socialise:

"*... [it] was the most striking thing in my daily work all these meetings and also formalised meetings because if you want to meet someone in Zoom you have to send an email, you have to decide upon the time*" (R4:4)

According to R4, emergency online teaching had resulted in an overall increase in meetings in general over Zoom and Microsoft Teams, which forced teachers to spend a lot of time in front of their computers on a daily basis. The spontaneous talks in the corridors and coffee rooms were lost as teachers had to work from home and try to find a balanced way of doing so since their partners and children were also working and learning from home (R4:4).

R2 recalled feeling left to solve any issues individually with no guidance or preparation for emergency online teaching. Having to work from home also deprived R2 of the social

network of peers at the office and R2 specifically recalled having nobody to ask when in doubt about something (R2:2).

R1 also highlighted the fact that many colleagues had felt very isolated while conducting emergency online teaching. R1 emphasised the importance of the short walks and brief talks that they had enjoyed while working from the office. In R1's opinion, the isolation caused by emergency online teaching had detrimental effects on the fragile social fabric that had been built up in the office over the years. In R1's experience, digital coffee breaks had often been futile attempts to keep people connected. The spontaneity of informal everyday chats by the coffee machine could not be replaced by planned Zoom meetings (R1:67).

R1, R2 and R5 noticed that their students were reluctant to turn on their cameras during emergency online teaching sessions (R1:4, R2:12, R2:59, R5:53, R5:55).

R1 suspected that web cameras make some students feel exposed. R1 also observed that not being able to see each other made it difficult to notice if some students were having trouble understanding the topic being discussed. In F2F settings, R1 found it easier to detect if individual students needed further explanations, and was able to involve students who seemed absent-minded. With Zoom, this was a lot harder, especially with students who did not even want to show their faces. Additionally, small cues, such as reactions and body language, were hard to detect and R1 also missed the more rewarding discussions that come naturally in F2F settings (R1:4).

R2 agreed with R1's observations regarding the reluctance among students to turn on their webcams during Zoom meetings. Particularly in one of R2's courses, this affected the communication with students in a negative way, since R2 openly expressed frustration about their reluctance to show their faces. R2 remembered not being able to see half of the class for about five weeks, which R2 found difficult. R2 mentioned the ongoing Zoom interview as an example of how important it is to be able to see each other and how this connects people even though they are not physically in the same location. Without such visual communication with the students, R2 found it hard to conduct emergency online teaching (R2:12).

In order to counteract such issues in the future, R2 felt that it would be helpful to make it clear to students from the start that they were expected to use their video cameras. R2 expressed an understanding attitude towards temporary technical issues that might prevent individual students from turning on their cameras, but believed that the attitudes among students regarding the use of video cameras needed to change in order to improve communication in the virtual classroom (R2:14).

R1, R2 and R4 pointed out that interaction between colleagues was a lot more formalised due to emergency online teaching from home (R1:67, R1:70, R2:2, R4:14). According to R1 and R4, the isolation caused by the lack of F2F contact also had consequences for the students (R1:73, R4:14). R1 pointed out that it is beneficial for students to have study buddies (R1:79) and that building knowledge is a social and collective process (R1:81). Additionally, R1 was concerned that it might take years to rebuild the social networks that students need in order to achieve good academic results R1:73).

Table 9 summarises findings related to the loss of physical interaction among the study participants.

Table 9: Impact of loss of F2F contact on social interaction

Respondent	Interaction between teacher and students	Interaction among teachers
R1	Noted lack of feedback from students, caused by unwillingness to turn on the camera and asynchronous lectures (R1:4) Experienced that emergency online teaching had made communication with the students more difficult (R1:2) R1 found it most difficult to replace hall exams with home exams (R1:2)	Noted lack of informal meetings with other teachers (R1:67). Pointed out that "digital fika" did not substitute the informal F2F meetings (R1:70)
R2	Students not having cameras on negatively affected the interaction between students and the teacher (R2:12, R2:59)	Noted lack of informal meetings with other teachers, since it was often a source of getting informal help (R2:2)
R3	Noticed a lack of F2F contact with students (R3:6)	–
R4	Lack of contact with students and teachers was mitigated by chatting on Discord. R4 noted a lack of informal meetings which were replaced with more formalised, planned meetings (R4:14)	
R5	Lack of F2F contact impacted the engagement of students in the lecture. Therefore activities, such as playing a video, were employed (R5:57)	Messenger group was created aiming to stay in touch with the other teachers and staff, thus compensating for the informal interaction at work (R5:32)

4.2.2 IT support

This section describes how the respondents perceived their access to IT support while working from home in the era of emergency online teaching. Some of the findings presented here are compared to the respondents' prior experience with online teaching, described in section *4.2.1.1 Prior experience*.

Available IT support during emergency online teaching

All participants had access to some type of IT support during emergency online teaching. R2, R3 and R4 noted there was the usual type of support, while R1 and R4, who conducted online courses prior to the COVID-19 pandemic also reported support for planning remote lectures and support with the usage of different online teaching tools.

For R1, the switch to emergency online teaching was smooth, from a technical perspective. R1 felt well supported by the IT service team (R1:6), but interestingly, R1 felt deprived of many teaching tools by being forced to conform to an environment dominated by technical solutions, in spite of having access to good IT support (R1:4). R4 helped organise a support network for colleagues with less or no prior experience with online teaching. This way, R4 and other experienced colleagues served as an extension of the IT support services (R4:2). According to R4, the fact that the students were learning Informatics and had an interest in IT infrastructure also helped them manage the switch to emergency online teaching (R4:12).

R2 was not in the habit of getting in touch with the IT support team even before the COVID-19 pandemic (R2:2). When R2 needed instant help with something that was not working properly, R2 felt particularly isolated (R2:6). Regarding what it would take to make IT support efforts more effective, R2 said that such improvements work both ways and that R2 might have to become more proactive when it comes to utilising the available resources (R2:8). Thus, R2 felt responsible for getting better at reaching out to any available IT support resources (R2:8).

R3 pointed out that the university IT department did not teach staff how to use specific software platforms, and R3 had personally provided a lot of IT support to colleagues during the era of emergency online teaching (R3:10). According to R3, the departments within the university had to figure out how to manage the situation on their own when the emergency online teaching began (R3:2).

Regarding IT support from the university, R4 perceived an intention to prioritise questions from teachers who needed help with the switch to emergency online teaching. According to R4, the service teams within the IT department started working together more closely in order to facilitate the transition (R4:6). Making sure that everyone had the right equipment to make the virtual classrooms work, was essential. According to R4, the lessons learned during emergency online teaching have resulted in regular inspections in order to ensure that all teachers have what they need to conduct online teaching in general, which was not always the case before the COVID-19 pandemic (R4:8).

R5 recalled experiencing good support from the IT department as the university switched to emergency online teaching. However, R5 had to get into the habit of calling the support team instead of writing emails to them, which had previously worked well. Due to their drastically increased workload, they could no longer answer emails as quickly as they used to. According to R5, being an Informatics teacher made it easier to manage the practicalities of switching to emergency online teaching (R5:6). R5 was impressed by the IT department's response to the dramatic changes required by the COVD-19 pandemic. R5 primarily needed help with remote access, not with the teaching tools as such (R5:8).

Table 10 summarises the support that was available to the respondents. As visualised in this table, teachers with prior online teaching experience felt better supported by their universities regarding IT support services.

Table 10: Respondents with online teaching experience had more extensive IT support

Respondent	Available IT support during emergency online teaching	Conducted online courses prior to COVID-19
R1	"There was a team of support persons that could help us with everything from how to plan lectures on a distance to actually also supporting us with specific tools, how to use them and so on." (R1:6)	Yes (R1:2)
R2	There was no tutorial. (R2:1) "I wasn't really prepared to reach out to that kind of support because it was also often not in the manner of the way that the procedures of the university prepared for it. So, when I needed help it was almost instant." (R2:6)	No (R2:2)
R3	"Not any IT support other than the IT support that it's usually available to me." (R3:8) "... if you have technical issues with any software or platform that is not provided by central ▓▓▓ university, [the IT support] is not gonna help you." (R3:10)	No (R3:2)
R4	"We have one department that is responsible for the IT and infrastructure and then we have another department that can answer the question of how to use those tools when you teach." (R4:6) R4 provided help to other teachers who did not conduct online teaching before. (R4:2)	Yes (R4:2)
R5	The ordinary IT support provided passwords and licences. The otherwise fast response time slowed down due to the high workload (R5:6, R5:8)	No (R5:2)

Internet connection

By and large, the respondents had not experienced any serious Internet connection issues while conducting emergency online teaching. In the case of R1 and R5, the respondents were able to solve the minor issues that did arise on their own and those issues did not have a significant impact on the online teaching sessions (R1:12, R5:10). Personally, R3 preferred a wired Internet connection to wifi, since it was more reliable (R3:16). R2 attributed the overall stability of the Internet connection to the reliable IT infrastructure (R2:10).

On a few occasions, there were brief glitches and R5 was disconnected from Zoom, but it was possible to return to the session as soon as the Internet connection was re-established. At first, R5 was concerned that the session itself would be lost, which would have affected all of the

students, but they were still in the meeting when R5 returned. The minor issues that R5 initially encountered with the router at the home office did not require assistance from the IT department. As an Informatics teacher, R5 was capable of solving those issues independently (R5:12).

Table 11 summarises findings regarding Internet connection among respondents.

Table 11: Perceptions of Internet connection

Respondent	Internet connection	Connection issues
R1	Good (R1:12)	Minor router issues (R1:12)
R2	Good (R2:10)	–
R3	Good (R3:16)	–
R4	Good (R4:12)	–
R5	Medium (R5:10)	Sometimes unstable connection (R5:10)

4.2.3 Teaching tools

The respondents had different experiences and preferences regarding teaching tools. R1 preferred teaching tools encouraging and facilitating collaboration. R1 specifically named Padlets, Google Box, Microsoft 365 and Teams as examples of helpful collaboration tools. Comparing Teams to Zoom, R1 remarked that the file storage functionality in Teams made it more suitable for collaboration between teachers. Such functionality made it a lot easier to manage documentation, which was not possible in Zoom. Thus, R1 considered Zoom to be a more limited tool, but R1 still found it useful for communication with students (R1:16).

R1 highlighted the importance of maintaining good audio quality when conducting emergency online teaching and R1 had invested privately in some home office equipment that improved the quality and reliability of the virtual sessions (R1:14). R1 pointed out that Zoom had become more user friendly during the COVID-19 pandemic. R1 emphasised that virtual teaching platforms had evolved to meet the changing demands of emergency online teaching sessions, such as encryption for improved cybersecurity and self-assignment to breakout rooms where meeting participants could collaborate in smaller groups (R1:6). However, R1 was less pleased with some presentation tools and pointed out that there was no convenient virtual equivalent for writing on a whiteboard (R1:8). R1 also commented that relying heavily on slides had never been a good teaching practice, not even in F2F settings. In R1's opinion, giving a lecture requires more than simply presenting a number of slides and reading their content out loud to the students. R1 called such teaching practices pointless (R1:8).

R2 emphasised the importance of learning the names of students, which R2 actually found easier in Zoom, provided that students had actually entered their real names when they joined the meeting. This made it easier for R2 to direct questions to specific students in order to engage them in active conversations. R2 frequently tried to involve students who were rather silent in the classroom, in both F2F and virtual classes. (R2:53).

R3 mainly communicated with students via email and Microsoft Teams (R3:32). R3 recalled that a lot of hardware, such as microphones, was purchased (R3:12). There was no central university IT support regarding this, so each department had to make arrangements separately. According to R3, not all departments have the required technical skill level to manage such tasks properly, since departments are typically focused on teaching activities. Selecting the appropriate equipment required a certain level of technical knowledge and experience. In regards to what might have been done better, R3 felt that a central university policy guiding and supporting the technical aspects of emergency online teaching would have been helpful. In R3's opinion, the university ended up with a lot of improvised ad hoc solutions, due to the lack of such a central policy (R3:14).

R3 pointed out that neither Zoom nor Microsoft Teams were made for conducting lectures or other teaching activities and that their audio and video quality was so compressed that using a high-end microphone would have been pointless. According to R3, Zoom and Microsoft Teams were simply developed to enable virtual meetings with basic audio and video quality (R3:22). For that reason, replacing them with tools specifically designed for high-end video conferencing purposes would be better than trying to upgrade them, according to R3 (R3:24).

Since the students were no longer able to meet on campus and discuss group assignments or just share ideas, R4 emphasised the importance of having teaching tools that support collaboration between students. In R4's opinion, having the right tool for the right purpose is essential and online teaching, in general, requires access to platforms that enable students to set up chat rooms and communication channels where they can do group work. An instant messaging platform called Discord had been of great use to R4 when communicating with both students and colleagues. Discord enabled students to set up their own servers for information sharing, music, gaming or other activities, so there was a social aspect to it as well as an educational one. In Discord, it was also possible to see who was currently online or offline, which made it easier to communicate (R4:16).

Regarding the improvement of teaching tools, R1 thought that Virtual Reality (VR) tools would become very useful as future online teaching environments and that their interactive qualities would suit the human mind a lot better than the current selection of teaching tools, which R1 considered to be cruder (R1:18).

One challenge that R4 perceived regarding the teaching tools was to enable student supervision (R4:41) and collaboration between students. According to R4, students only accessed those platforms in order to manage their assignments, which was similar to the way teachers formalised their interactions. Having to rely on technical solutions removed a lot of spontaneity from the interactions. According to R4, communication with students made teaching fun and meaningful (R4:14).

According to R5, Zoom was a new tool for many teachers. R5 experienced initial concerns about managing the practicalities of connecting user credentials to the Zoom environment and figuring out how to share digital content, such as PowerPoint presentations (R5:2). R5 found it easy to conduct lectures via Zoom, but faced challenges with facilitating workshops. R5 felt that especially workshops require F2F interaction because the workshop activities are difficult to replicate in online environments. Therefore, R5 tried to set up some equivalent online activities and use the breakout rooms to promote collaboration between the students (R5:16).

Asynchronous online classes

Four out of five participants incorporate asynchronous online classes into their teaching process. R3 and R4 claim that they are popular among students while bringing many benefits, such as the possibility to watch the classes at the student's pace or re-watch them. They also point out that the asynchronous model works best in combination with live lectures. On the other hand, R1 and R5 argue that the lack of interaction between the student and a teacher in asynchronous classes has a negative effect on the teaching process.

R1 and R4, who conducted online teaching prior to the pandemic did not report difficulties with recording live lectures and publishing them to the students for later use. However, R3 and R5 who did not have such an experience noted difficulties such as unfamiliarity with the software - Open Broadcasting Studio (R3:6), not knowing what hardware is appropriate (R3:14), lack of video editing skills (R3:14) or producing large video files, which were difficult to work with (R5:26).

"...[if] I had like an in house audio video consultant and an in house post-production person, that would have helped…"(R3:53)

R3 created course material for asynchronous online classes by recording the live lectures and subsequently uploading them where students could access and download them. At first, R3 expected a sharp decrease in attendance, but about 70% of the students had joined the virtual lectures and interacted with their teacher and their classmates. According to R3, the recordings were much appreciated by the students, both those who missed class and those who had attended the live sessions. Particularly the recordings of programming and database lectures featuring advanced concepts were watched repeatedly by students (R3:26).

Similarly, R4 felt very positive about asynchronous online classes, since they came in handy if a teacher was not able to conduct a live lecture or if students wished to replay the videos after attending a live lecture in order to learn more about a topic. The students really appreciated the flexibility that they got by having access to asynchronous online classes. At R4's university, teachers strived to have all of the instructions and assignments ready at the start of each semester. This way, both teachers and students could be well prepared for the work ahead (R4:22).

At the beginning of emergency online teaching, R5 worked with pre-recorded video lectures in order to make the digital course content more accessible to the students and many other teachers at R5's university did the same. However, this did not work as well for the students as the teachers had hoped it would, since the students preferred live lectures where they could interact with their teachers (R5: 22). In R5's opinion, the switch to emergency online teaching was a very abrupt change for the students who went from collaboration in F2F settings to watching recorded video lectures overnight. Being able to communicate with the teachers during live lectures was appreciated by the students, especially since the era of emergency online teaching lasted so long. According to R5, a combination of live lectures and recorded videos can make emergency online teaching more effective (R5:24), but due to practical issues, R5 replaced the initial video recordings with live lectures after receiving feedback from the students. Since the video files were large, R5 found them difficult to upload and the students had trouble downloading them (R5:26).

Table 12 summarises the findings related to the use of asynchronous online classes.

Table 12: Respondents' experience with usage of asynchronous online classes

Respondent	Conducted online courses prior to COVID-19	Used asynchronous online class model	Noted experience
R1	Yes (R1:2)	Yes (R1:4)	There is a lack of interaction between students and the teacher
R2	No (R2:2)	No (R2:20)	–
R3	No (R3:2)	Yes (R3:26)	Popular among students Effective for complex topics and often repeated concepts Asynchronous classes were used in combination with live lectures Live lectures were recorded and published as well Recording of live lectures can introduce GDPR issues There was concern that students will lose the incentive to join the live class, but attendance did not drop
R4	Yes (R4:2)	Yes (R4:22)	Popular among students Effective for complex topics, since students can play them many times Asynchronous classes were used in combination with live lectures Live lectures were recorded and published as well It is possible to access them after the course is finished in case the lecture is relevant for another course Recorded lecture from last year can be used if the teacher is sick
R5	No (R5:2)	Yes (R5:22, R5:25, R5:26)	The use of exclusively asynchronous classes was not popular among students because of a lack of interaction with the teacher and among students. Recording of live lectures resulted in large files, which were difficult to upload to the teaching platform and download by the students

Use of wikis blogs and podcasts

Usage of wikis blogs and podcasts in emergency online teaching was not overly popular among the majority of respondents. Only two, R2 and R5, incorporated it in their courses, while one respondent - R1 found it interesting to develop podcasts as teaching tools in the future when asked about their usage by researchers (R1:22).

Table 13 shows the usage of these sources among respondents.

Table 13: Respondents' usage of wikis, blogs and podcasts

Respondent	Used wikis blogs and podcasts in emergency online teaching
R1	No (R1:22)
R2	Yes - they were accredited as additional sources, but were not part of the structure of the class (R2:22)
R3	No (R3:28)
R4	No (R4:24)
R5	Yes - different materials were used during the online class to break up the format and increase the engagement of students (R5:28)

Social media

No respondents except R5 used social media during emergency online teaching for communication with fellow teachers or students. R5 used social media primarily at the beginning of the lockdown to compensate for the lack of physical contact between staff aiming to improve the mental well-being of teachers living alone (R5:32, R5:36, R5:38).

Despite not using social media for communication with students, R1, R4 and R5 used instant messaging platforms for communication with students (R1:31, R4:2, R5:32). Especially R4, who conducted online teaching prior to COVID-19, highlighted the importance of fast informal chatting in full-time online education:

"I've done some studies myself interviewing the students and it seems like Discord is one of the things that makes it standable and possible to go to education that is online, for three years." (R4:20)

"It's absolutely necessary if we have students that are either entirely online or partly online to be able to just send over a very fast chat conversation or, finding another student or for the students to set up some chat group for if they are supposed to be doing some kind of group work together." (R4:16)

Table 14 summarises the usage of social media and instant messaging platforms for communication with fellow teachers and students among respondents.

Table 14: Respondents' usage of social media and instant messaging platforms

Respondent	Usage of social media		Usage of instant messaging platforms
	With students	**With fellow teachers**	
R1	No - R1 perceives it as unprofessional (R1:31)		Yes - forums and chats within the study platform were utilised (R1:31)
R2	No - "Text messages, emails, yes, but no interaction on, you know, other social media platforms" (R2:24)'		
R3	No - "I tell students at the beginning of [the] course you have, one way to contact me it's via email", usage of multiple platforms would lead to confusion (R3:32)		
R4	No - social media such as Facebook were unpopular among students because of their privacy issues (R4:20)		Yes - usage of Discord is vastly popular among students and teachers at the department (R4:2, R4:14, R4:16, R4:18, R4:20, R4:22)
R5	No - R5 indicated that usage of social media with students would be unprofessional (R5:32)	Yes - Messenger was used for informal communication between teachers to ease the transition to emergency online teaching (R5:32, R5:36, R5:38)	Yes - the study platform is used for chatting between students and teachers (R5:32)

4.2.4 Cybersecurity and privacy

None of the respondents felt more exposed to cyber threats while working from home during the emergency online teaching than prior to the pandemic. Despite that, R1, R3 and R4 expressed their awareness of the security vulnerabilities of the platforms used, such as Zoom (R3:22, R4:27) or core administrative systems (R1:35). On the other hand, two out of five respondents experienced privacy challenges during live lectures or examinations (R3:43, R5:47, R5:51). R4 also mentioned the possibility of unknown issues that had so far gone unnoticed (R4:33).

R1 mentioned the Zoom encryption functionality as a cybersecurity improvement, but also pointed out that VPN connections should be mandatory for all access to university core administrative systems, due to the sensitive nature of data being stored and shared there (R1:37). R1 highlighted user behaviour as the most important factor from a cybersecurity perspective and R1 felt that there was a need for much more awareness of cybersecurity vulnerabilities in general (R1:39).

R3 preferred Microsoft Teams to Zoom for cybersecurity reasons. Whereas Zoom had to be upgraded step by step due to public concerns regarding cybersecurity and privacy, R3 felt that

Microsoft Teams had been a much more secure environment in the first place. R3 pointed out that nothing confidential had been discussed during the lectures, but that it was still a matter of principle to stick with Microsoft Teams in order to set a good example for the students. R3 did not feel comfortable with the idea of using Zoom for communication with Informatics students in 2020 (R3:22). R3 had not felt more exposed to cyber threats while working from home, but did point out that cyber threats are a very broad concept (R3:35).

R3 mentioned frequent and very obvious phishing attempts in general, but did not perceive those as examples of increased cyber security threats connected to emergency online teaching (R3:37). R3 had heard of Zoom bombings, but had never experienced any attempts to hack or disrupt meetings conducted in Microsoft Teams (R3:43). Professionally, R3 had not experienced any uptick in cybersecurity threats. However, R3 pointed out that recording virtual meetings requires the meeting host to be aware that a participant's voice is considered personal data according to GDPR and that keeping students' voices out of the recordings to protect their privacy was a recurring challenge from a compliance point of view (R3:43).

R4 had heard about unauthorised users entering Zoom rooms but had not felt more exposed to cyber threats while working from home. The teachers at R4's university had discussed such potential issues to come up with a solution in case they encountered them (R4:27). R4 had not experienced any uptick in cybersecurity threats in the era of emergency online teaching, such as students or hackers disrupting the class or sabotaging the virtual environment. According to R4, this might partly be due to the fact that the teachers at the university had used open Zoom rooms and Zoom had been updated a lot since the teachers started using it (R4:29, R4:31). R4 also mentioned the possibility of unknown issues that the teachers simply had not noticed (R4:33).

At the beginning of emergency online teaching, R5 noticed that unauthorised users were entering the Zoom room, which prompted the university to change the process by which people were allowed to join meetings. In order to prevent such intrusions, students were given access codes (R5:47), but some students still kept entering the virtual rooms while teachers were conducting online examinations to which they were not invited (R5:49). In some cases, R5 thought that students had done so by mistake, but according to R5, there had also been attempts to cheat by obtaining information that might be beneficial for the unauthorised students. Thus, the university had to restrict Zoom room admissions even further in order to ensure the privacy of examination sessions (R5:51).

 Table 15 shows the privacy and security concerns experienced by respondents.

Table 15: Summary of privacy and security concerns experienced by respondents

Respondent	Security concerns	Privacy concerns
R1	R1 is aware of an advanced university firewall, which one does not have at home (R1:35) R1 is concerned about security vulnerabilities of core administrative systems such as the slack of VPN to access them outside of the university's network (R1:37)	None encountered

R2	None encountered	
R3	R3 noticed security vulnerabilities of Zoom, therefore decided to use Microsoft Teams instead (R3:22) R3 experienced several phishing attempt but was able to detect them (R3:37)	R3 faced GDPR challenges when recording live lectures over Microsoft Teams (R3:43)
R4	R4 noticed frequent security updates of Zoom (R4:27)	R4 was aware of the possibility of unknown people joining the Zoom meeting (R4:27)
R5	None encountered	R5 experienced unknown users logging into lectures (R5:47) R5 experienced students logging into individual exams of other students both deliberately and accidentally (R5:51) The issues were mitigated by requiring all participants to use a valid name and by utilisation of waiting rooms (R5:49, R5:51)

4.2.5 Technical Skills Inequality

The experiences varied among the respondents regarding technical skills inequality among their students. R4 noticed some differences among the students (R4:37), but R2, R3 and R5 did not experience any noticeable impact on their teaching sessions caused by technical skills inequality (R2:49, R3:45, R3:47, R5: 61). According to R5, students had even been able to solve any minor technical issues independently (R5:61). R5 also pointed out that conducting examinations online made it necessary to be supportive when students experienced Internet connection issues beyond their control (R5:63).

In case there was a gap between technically skilled students and those who experienced challenges, R2 was aware that more might have to be done to minimise it. However, R2 was not sure how to do that (R2:51). R3 had not experienced any significant differences between students regarding their technical skills. However, R3 pointed out that such differences might be difficult to assess (R3:45). On the topic of technical skills inequality, the answers provided by R1 stood out from the rest.

R1 experienced a significant decline in technical skills among Informatics students over the last couple of years and R1 was also concerned that many students had trouble solving minor problems on their own. Paradoxically, students who had become highly dependent on their smartphones also had difficulties managing information technology solutions that they needed to use for their studies. While pointing out that it is hard to generalise, R1 still felt that many students were not in the habit of reading long texts and that they had a lot of trouble understanding written and oral instructions. In R1's experience, many students seemed to

prefer short video clips explaining what to do and they were reluctant to read texts longer than half a page (R1:45).

R1 thought that the COVID-19 pandemic had a polarising effect on students from a technological perspective. In R1's experience, students with better technical and social skills fared better during the era of emergency online teaching. Not only were they better at managing the technical tools, but they also found it easier to create their own social networks, which was beneficial for their academic achievements (R1:57). R1 felt that many students who struggled with the technology and the lack of social interaction had irreversibly fallen behind during emergency online teaching. R1 had noticed a significant increase in the number of re-examinations and many students had even dropped out completely. This was a matter of great concern to R1 (R1:59).

Table 16 provides an overview of the technical skills inequality among students experienced by respondents.

Table 16: Technical skills inequality among students experienced by the respondents

Respondent	Perceived technical skills inequality	Impact on emergency online teaching
R1	R1 noticed a decline in the tech skills of students (R1:45)	R1 experienced that students could not read longer texts and needed short video clips instructing them about what to do (R1:45) The pandemic had a polarising effect on students. Those who managed the technological and social challenges fared a lot better than students who had already struggled with such skills before (R1:57) R1 had seen a significant uptick in the number of students falling so far behind that they failed to catch up. Many had dropped out and there was also an uptick in the number of retakes (R1:59)
R2	None encountered (R2:49)	R2 had assignments that were not dependent on students' technical skills, which could be a way to mitigate any potential differences (R2:49)
R3	None encountered (R3:45, R3:47)	
R4	None encountered (R4:37)	R4 had set up multiple ways for students to show their skills, for example during seminars (R4:37) R4 pointed out the importance of making different types of examination available (R4:39)
R5	None encountered (R:61)	Students were able to solve minor technical issues on their own (R5: 61)

4.3 Summary of Findings

The findings indicate that the era of emergency online teaching was challenging for our respondents in a number of different ways, for example, social isolation or inability to see the students. Some had prior experience with planned online teaching, others did not and one respondent without such experience was not used to reaching out to the IT support team, which made it even more difficult to find out how to make emergency online teaching work daily. Additionally, there was a lot of uncertainty about how long they would have to work that way as they set up their home offices and most of the respondents found the social isolation from their colleagues and students very challenging. Respondents with more online teaching experience and access to quicker IT support were in a better position to support both each other and their students during this unprecedented era of emergency online teaching. One respondent expressed concerns about the long-term impact of the lack of F2F interaction on the social fabric of the university.

Universities, where online teaching was more established, were also better prepared from an IT support perspective, which was helpful as respondents scrambled to convert F2F course content into digital course content suitable for emergency online teaching. Rapid IT support also helped when respondents had to address privacy issues that surfaced when unauthorised users entered Zoom rooms during lectures and online exams. One teacher found it easier to learn the students' names in the Zoom environment, but several respondents pointed out that there was a reluctance among students to turn on their video cameras. The respondents who encountered such difficulties tried to promote an understanding of the importance of being able to see each other during virtual sessions.

Several respondents pointed out that emergency online teaching required really good audio and video quality, better than what environments like Zoom and Microsoft Teams could provide. According to one respondent, upgrading those environments would be futile, since they were never designed to replace F2F teaching in the first place. Replacing them with platforms intended for online teaching would be a far better option, according to that respondent. Another respondent invested privately in equipment that enhanced the quality and stability of the virtual sessions. That respondent agreed that the teaching tools currently in use are insufficient from a user experience standpoint. Instead, the respondent suggested that VR solutions supporting interactions that more closely resemble real-life environments might be an option for the future of online teaching.

Questions covering different areas were asked separately, but in many cases, the respondents answered more than one question at a time. This indicates that challenges experienced in one area were impacted by challenges experienced in another one. For example, one respondent brought up concerns regarding the attention span among students while answering a question about technical skills inequality and several respondents mentioned the social aspects of working from home when they were asked about their overall perceptions of emergency online teaching. The social aspects kept emerging during the conversations and the findings indicate that even respondents who were more comfortable with online teaching in general and felt backed up by their IT departments experienced a formalisation of interactions with their colleagues. They missed the spontaneous talks that they could no longer have since they were not in the same location.

One teacher experienced an increase in the number of meetings and several respondents felt the strain of spending so many hours in front of their computers every day, especially without

the social interactions that used to be essential parts of their workplaces. Some respondents had tried to set up support networks online in order to stay in touch with their colleagues on a more regular basis, but those sessions could not replace the daily F2F interactions that were no longer possible due to public health concerns and official government policies. Overall, the respondents faced many different types of challenges all at once and learned a lot during the era of emergency online teaching. In hindsight, one respondent pointed out that it would be useful to dedicate more office hours to support the students in case an emergency online teaching would ever be required again.

5 Discussion

This chapter aims to discuss the empirical findings in relation to the theoretical framework and the existing body of knowledge. It is structured in accordance with the concepts presented in the Findings chapter, while the organizational learning perspective is discussed at the end.

5.1 Overall Perception of Emergency Online Teaching

5.1.1 Prior experience

Even though digitalisation has spread to the education sector long before COVID-19 (Beckman et al., 2018; Gillett-Swan, 2017; Gunawardena & McIsaac 2004; Harasim, 2000; Klein et al., 2018; Palvia et al., 2018; Roddy et al., 2017; Volery & Lord, 2000), majority of educators in our study had not experienced teaching online prior to the pandemic. Literature conveys that not all educators felt comfortable with emergency online teaching at first, while some, who had their teaching materials digitised, felt more prepared than others (Marek, Chew & Wu, 2021). Our study confirms that educators who conducted online teaching prior to the COVID-19 pandemic were not greatly affected by the transition to emergency online education.

5.1.2 Lack of F2F contact

The respondents recalled being impacted by the loss of F2F contact with both colleagues and students. These findings are in line with research by Hofer, Nistor and Scheibenzuber (2021), who emphasise the abruptness of the switch from F2F teaching to virtual teaching sessions. As argued by Hofer, Nistor and Scheibenzuber (2021), emergency online teaching required teachers to utilise unfamiliar digital teaching tools and students had to manage their own learning much more independently than they usually did. Le et al. (2022) also highlight the rapid switch to emergency online teaching, which impacted interaction between teachers and students.

Virtual communication channels removed spontaneity from the teaching activities (Le et al., 2022), which is also supported by the findings of our study. The respondents felt that being limited to using digital communication tools made interactions with students less spontaneous, as mentioned by (Le et al., 2022). However, our findings additionally reveal that the communication between colleagues has been formalised as well.

Moreover, the findings indicate that even when students attended virtual classes, many of them did not turn their cameras on, which left the teachers looking at largely black computer screens. Several respondents made efforts to maintain as much contact as possible with their colleagues, such as digital coffee breaks and technical support sessions at the outset of emergency online teaching. However, the teachers found the lack of F2F contact very challenging and the social aspects of not being able to meet colleagues and students onsite weighed heavily on them. Hofer, Nistor and Scheibenzuber (2021) point out that students and

teachers alike had to learn how to instantly adapt, in spite of being completely unfamiliar with the situation.

5.2 Teaching tools

5.2.1 Asynchronous online class

As Rusu, Virca and Popa, (2021) explain in the literature that asynchronous online classes should be combined with classes promoting online collaborative learning to achieve an optimal learning experience. This is also supported by the empirical findings of our study, which indicate that the combination of asynchronous and synchronous classes was deemed effective and popular among students. Two of our respondents expressed that pre-recorded classes proved to be very suitable for teaching complex concepts, such as databases or programming since students could watch them multiple times at their own pace. This is also partly in line with research by Le et al. (2022), who point out that asynchronous online classes can serve as a useful backup in case students miss virtual lectures.

However, the findings of the empirical study indicated that whether or not students liked asynchronous online classes depended strongly on their access to live lectures. Some teachers conducted asynchronous classes exclusively in the form of pre-recorded videos, which was reported as unpopular among students. The respondents expressed that this type of education prevents students from asking questions and that it also prevents them from interacting with each other or with the teacher. It can be concluded that effective online education requires a combination of collaborative learning in the form of synchronous classes and asynchronous classes such as pre-recorded videos, which students can watch at their own pace.

The majority of the respondents also recorded their live, synchronous classes and published them for the student afterwards. Teachers who had experience with conducting online teaching prior to the pandemic did not report any problems with this process. However, respondents lacking this experience indicated difficulties related to the recording of the sessions such as producing overly large video files. This finding indicates that teachers with prior experience with online teaching are more prepared in terms of teaching material as mentioned by Marek, Chew and Wu (2021), and also in terms of technical skills.

5.2.2 Usage of wikis blogs and podcasts

Harris and Rea (2009) noted that the use of collaborative web 2.0 technologies such as wikis, blogs, and podcasts has the ability to enhance the learning and teaching experience. Despite that, the majority of our respondents did not utilise these technologies during emergency online teaching. One respondent indicated that such tools were not used as part of the F2F teaching, prior to the COVID-19 pandemic either and therefore were not considered in online settings. On the other hand, one of our respondents indicated use of videos, which were played during emergency online classes to break up the format of a contextual lecture, increase the attention of the students and initiate the discussion.

5.2.3   Usage of social media

Literature conveys that the joint communication of teachers and students via social networks has a positive effect on collaboration and knowledge sharing (Klein et al., 2018). Despite that, none of our respondents utilised social networks for communication with students. Some teachers reported they perceive it as unprofessional to use this means of communication with the students. On the other hand, our findings demonstrate that the majority of the respondents are aware of the benefits, such as fast and informal means of connecting with students or other teachers, facilitated by instant messaging platforms and their positive impact on the effectiveness of online education, such as students being able to easily connect with each other while doing group work.

Therefore, the majority of the respondents utilised other instant messaging platforms such as internal study platforms or Discord for a quick chat with students, leading to similar experiences as noted by Klein et al. (2018) in their study of social media use in education. This leads to the conclusion that usage of instant messaging platforms other than social networks during emergency online teaching is an effective means of facilitating communication between students and teachers.

5.3   IT Support

5.3.1   Available IT support during emergency online teaching

Hofer, Nistor and Scheibenzuber (2021) argue in favour of promoting a combination of organisational readiness and IT support in order to make it easier for teachers to adapt quickly to online teaching environments. According to the authors, IT infrastructure and technical support are only some of the prerequisites for online teaching. Two of our interviewees did not experience the switch to emergency online teaching as a dramatic change and they claimed that their universities were well-prepared to conduct emergency online teaching, particularly in how their IT departments operated. One university even had dedicated IT departments for different types of support. Moreover, teachers who were accustomed to online teaching were able to provide assistance with emergency online teaching tools to other teachers who did not have such an experience. These findings are in line with research conducted by Hofer, Nistor and Scheibenzuber (2021). Contrary to these experiences, teachers who had no prior experience with online teaching before being forced to conduct emergency teaching experienced technical difficulties and felt that the IT departments at their universities responded slower due to the rapidly changing situation.

5.3.2   Internet connection

By and large, the respondents agreed that they had experienced reliable Internet connections while conducting emergency online teaching. Having reliable Internet access was identified as a CSF by Yudiawan et al. (2021) as the COVID-19 pandemic made emergency online teaching a necessary long-term solution. However, even though the respondents enjoyed the benefits of relatively stable Internet connections and did not face reliability issues like those discussed by Saha et al. (2021), the findings of the pre-study and the interviews serve as

reminders of the fragile nature of online teaching in general, since teachers and students may be impacted by Internet connectivity issues regardless of their geographical location.

5.4 Cybersecurity and privacy

The data obtained from the respondents do not reflect the cybersecurity challenges and threats described in the research literature (Karanasios, 2021; Stamp, Alazab & Shalaginov, 2021). The respondents expressed varying degrees of awareness of cybersecurity concerns in general, but only one of them had experienced being targeted. However, answers provided by two of the respondents stand out from the rest.

One respondent pointed out something that had not specifically been mentioned in the literature that was included in the theoretical framework of this thesis. The respondent recalled that some students had entered Zoom rooms when they were not supposed to. According to the respondent, those intrusions had been attempts to obtain information that might benefit the students during online exams. In addition to the cybersecurity upgrades that were made to the Zoom platform (Mahr, Cichon & Mateo, 2021), the university found it necessary to modify students' access to Zoom rooms in order to prevent misuse of the virtual environment. This is an example of convergence of the realms of cybersecurity and teaching tools. Depending on what is being discussed in a virtual session, a data privacy breach may occur if students misuse the teaching tools by joining meetings at the wrong time.

Another respondent expressed concern regarding the lack of an official VPN policy, which left the university vulnerable, according to that respondent. This is in line with research by Karanasios (2021), who points out that many organisations struggled to manage the cyber threat challenges with which they were confronted as online activities surged during the COVID-19 pandemic. The respondent who expressed deeper cybersecurity concerns than the others also emphasised the individual responsibility of each user to adopt behaviours that promote better cybersecurity. This view is supported by Bulgurcu, Cavusoglu and Benbasat (2010), who emphasise the importance of building an organisational culture that promotes increased cybersecurity awareness.

5.5 Technical Skills Inequality

The majority of our respondents felt that their students had sufficient technical skills to participate in online learning in general. However, one respondent expressed significant doubts regarding the students' technical knowledge as well as their ability to form social networks that support learning processes. While we can argue that the younger generations are skilled to use technology, and are considered tech-savvy (Eberle & Hobrecht, 2021), the short attention span caused by the way the young generation chooses to use technology (Kang, 2022) suggests that they are not necessarily prepared to use technology in a professional capacity. According to Kang (2022), constant use of technology enabling instant Internet access is a potential pitfall for users of all age groups, since it is distracting and frequently interferes with individual attention spans and learning processes. People who rely heavily on external storage devices, such as smartphones, undermine their own ability to remember what they have learned (Kang, 2022).

5.6 Organisational learning

Concepts affecting organisational effectiveness - (i) IT support, (ii) cybersecurity and (iii) teaching tools (previously identified in chapter *2.4 Organisational Learning Theory*), have been further developed by the empirical findings (visualised in Figure 2). Firstly, from the IT support standpoint, the technological infrastructure and online culture influence the overall organisational effectiveness. Secondly, cybersecurity in the scope of protection against intrusion as well as online culture likewise influences overall organisational effectiveness. Thirdly, from the perspective of teaching tools the organisational effectiveness is influenced by a combination of different teaching techniques and online culture.
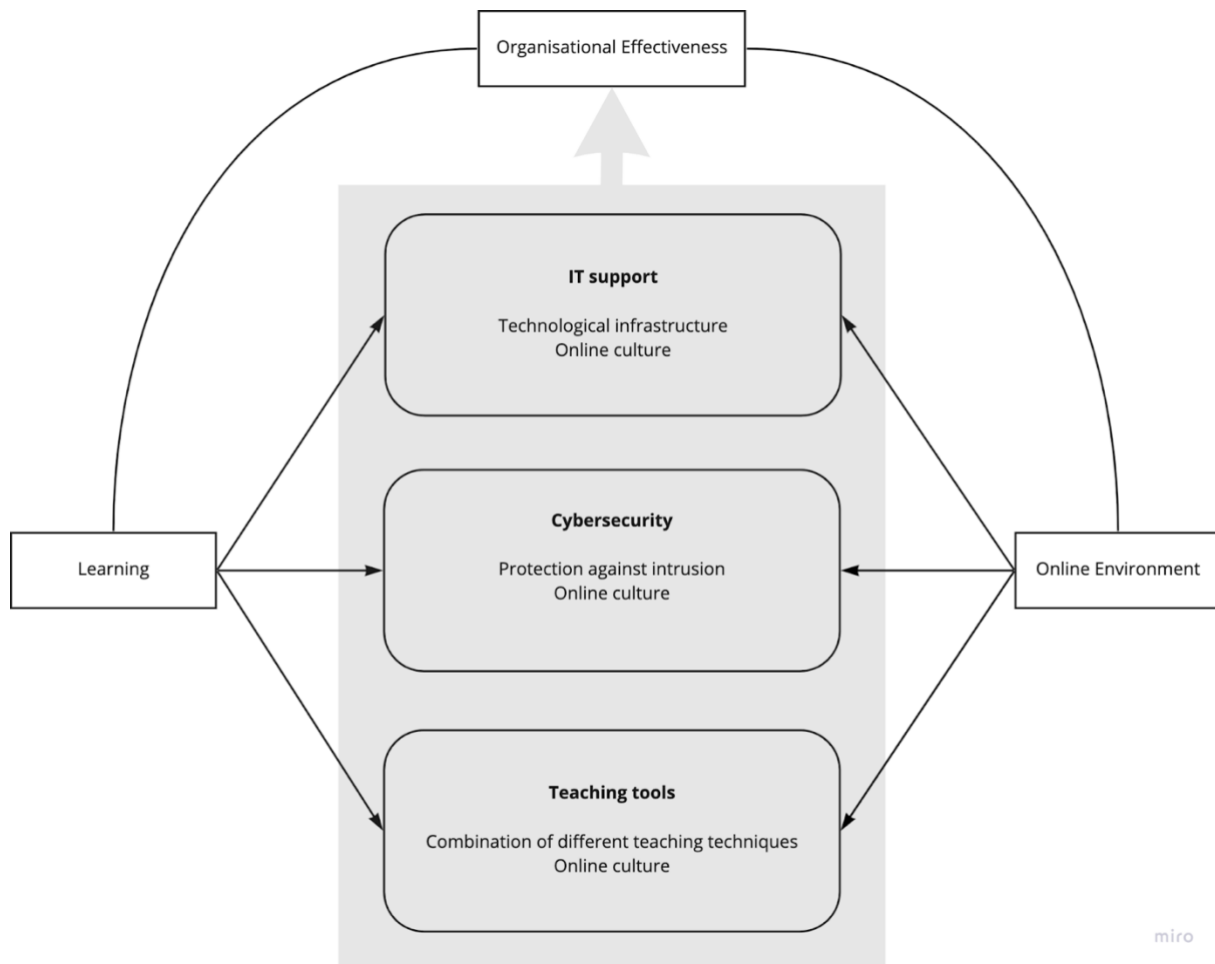
Figure 2: Impact of IT support, cybersecurity and teaching tools on organisational effectiveness

As stated in chapter 2.*4 Organisational Learning Theory*, to obtain the organisational learnings, the learnings pass through four processes: (i) intuiting, (ii) interpreting, (iii) integrating and (iv) institutionalising. In line with OL, the initial learning (intuiting) "takes place at the individual level" and it does not become organisational learning until the processes of integrating and institutionalising occur (Castaneda & Ríos, 2007, p. 364). However, our findings indicate that the intuiting process has been often omitted at the early stages of the rapid transition to emergency online education and has been blended into the interpreting phase.

Our study participants reported on several such organisational learnings. Some of the learnings were already institutionalised in the organisations, while some of the observed learnings were still in either the interpreting or integrating phase. Thus, the educators are still in the process of understanding the learnings gained during the emergency online teaching (on an individual level) and how these can be implemented in the post-covid era.

It is important to emphasise that each such identified learning and its state is strictly evaluated with regards to the individual organisation, as OL cannot be generalised across organisations. Despite that, our findings indicate similarities across the reviewed universities. The following table (table 17) summarises our findings in relation to organizational learning process.

Table 17: Empirical findings concerning the organisational learning process

Learning	Area	Current Process
Centrally managed hardware and software	IT support	Institutionalised
Securing Zoom meetings by password	Cybersecurity	Institutionalised
Employing different methods of teaching in order to capture the attention of students	Teaching tools	Integrating
Improving the visibility of the teachers' online availability across different channels	Teaching tools	Integrating
Facilitating informal IT support among teachers and university staff	IT support	Integrating
Substituting the informal socialising needs virtually, among both teachers and students.	Teaching tools	Interpreting

5.7 Summary of discussion

The findings of this thesis have implications for both theory and practice as the discussion has shown how the findings about increased formalisation of interactions between teachers are different from prior knowledge in this area. The literature review revealed a loss of spontaneous communication between students and teachers, which was confirmed by this study, but the empirical data also indicated that teachers experienced a need to schedule their interactions in the era of emergency online teaching.

Another finding that stands out from the existing body of knowledge is the responsibility that respondents with more online teaching experience took for providing support and guidance to colleagues who had not taught in online environments before. This study also shed light on the importance of the technical support that a highly technically skilled respondent was able to provide in order to facilitate the transition to emergency online teaching as many colleagues required quick access to increased IT support. These findings differ from the existing body of knowledge, which mainly discusses IT support as services provided by dedicated teams within the organisation. The findings of this study indicate that teachers have

played a much more important part in the technical support that facilitated the switch to emergency online teaching.

The findings provide insight into what teachers have learned on an individual level while conducting emergency online teaching within organisational contexts. How such lessons learned during extraordinary circumstances will inform future teaching practices and theoretical assumptions about organisational learning processes remains to be seen. The findings of this study indicate that ensuring that teachers are familiar with the digital teaching tools that they must use in case of more emergency online teaching is an important step towards improving organisational readiness for crisis response at universities. Allocating resources to the IT department and setting up dedicated support teams that can provide quick assistance are other preparations that educational organisations can make in light of the lessons learned in the era of emergency online teaching.

Teachers with prior experience had more time to focus on the students rather than spending time managing various online tools, which helped them notice technical skills inequalities among students. In contrast, teachers who lack such experience are at risk of getting overwhelmed by the challenges as they try to adapt to the requirements of emergency online teaching. The findings of this study also indicate that there is a technical skills inequality that might be difficult to detect among students and that all of the challenges that students experience as they participate in emergency online teaching might not be directly connected to technical skills as such. Research conducted within the field of psychology indicates that constant use of technology impacts human learning processes negatively, which is relevant to researchers investigating perceptions and outcomes of emergency online teaching. Additionally, the isolation caused by emergency online teaching left some students struggling to build everyday social networks, which one respondent considered absolutely essential for learning processes.

The findings of this study also support existing research about the isolation experienced by teachers in the era of emergency online teaching. As teachers struggled to manage the teaching tools and convert F2F course content into online content, they were also trying to figure out how to adapt their teaching methods to fit the new circumstances that forced them to interact virtually with their students. Some of the respondents found it frustrating to not even be able to see their students since many of them left their cameras off. The lack of social support from colleagues and the train of isolation added to their challenges. The findings of this study indicate that much of the isolation described in the existing body of literature was due to the loss of all of the brief conversations that teachers were used to having in the corridors or around the coffee table.

6 Conclusion

The purpose of this thesis was to study the measures contributing to the effectiveness of the online teaching propelled by the COVID-19 pandemic, which led to the following research question: *What measures do teachers think contribute to the effectiveness of emergency online teaching?*

In regards to the reviewed literature and presented findings, it can be concluded that the main effectiveness measure for online education is ***readiness***. This is in line with OL as it explains how the educational organisations adapted to remain operational amid the rapid and unexpected shift to remote education during the pandemic. Furthermore, readiness for online education can be decomposed into the following sub-measures:

Prior experience

Overall, the findings of this study support what the introduction to this thesis mentions about the challenges of switching to remote work and emergency online teaching simultaneously. The findings are also in line with what the existing body of literature states about the significant differences between planned online teaching and emergency online teaching.

Additionally and different from the previous research, the findings of this study indicate that teachers who have taught online before and feel well prepared for emergency online teaching find it easier to facilitate the transition for their colleagues as well as for their students. Teachers with former experience also had more time to focus on the students rather than spending time managing various online tools, which helped them to notice deficiencies and inequalities among them. In contrast, teachers who lack such experience are at risk of getting overwhelmed by the challenges as they try to adapt to the requirements of emergency online teaching.

Technological infrastructure

The findings indicate that universities, where online teaching is well established, have developed more sophisticated IT support services that can quickly provide teachers with the required information and hands-on assistance.

The findings of this study also indicate that teachers feel better about the available IT support and teaching tools at universities with a higher level of online teaching readiness. This readiness manifests itself in better planning of online lectures, which are managed by dedicated support teams. It is also important to have access to appropriate hardware as well as audio and video editing software when producing asynchronous online learning materials.

Online culture

The ability to socialise online is deemed beneficial among the teachers. Utilising instant messaging platforms is an effective means of facilitating such communication because of its informality and fast speed. When instant messaging is employed among teachers and staff, they feel less isolated during emergency situations. There is a room for "chit chat", thus they discuss work as well as non-work-related matters and as a result feel more engaged and are able to provide help to each other.

On the other hand, when instant messaging is employed among students it betters the collaboration. When prompted by the educational institution, students are able to set up dedicated chats for group projects. It allows them to connect with fellow students. There is room to discuss non-school related topics and in a relaxed setting, students feel less exposed to express that they do not know something.

Lastly, employing instant messaging for communication between students and teachers can be beneficial for both actors. It allows for less formal communication, teachers have an opportunity to get to know the students better and feel more available to them. On the other hand, similar effects could be achieved with virtual office hours, which students could join on a drop-in basis.

Combination of different teaching techniques

In the online teaching setting, it is harder to engage students and maintain their focus than in F2F teaching. Therefore teachers need to employ various techniques to achieve these goals. Presenting a "flat" slideshow in an online teaching environment is not engaging. This, however, can be improved by inserting different kinds of content into online classes, such as videos. Moreover, employing small group exercises by utilising f.ex. breakout rooms also helps.

Apart from the content of the lessons, it is important to strike a good balance between synchronous and asynchronous classes. Synchronous classes give students the possibility to ask questions and engage not only with the teacher but also with each other. Moreover, the teacher can monitor whether students understand the presented material and can interactively try to engage students who appear to lose focus.

Asynchronous classes, often in the form of pre-recorded videos, are available to students 24/7, thus allowing the students to learn at their own pace. They are suitable for more complicated concepts since students can rewatch the materials many times. Additionally, the materials can be used in a case of the teacher's absence and once created, can be re-used throughout several years.

Protection against intrusion

Students have the right to a safe and secure education. Therefore, this study sheds light on a cybersecurity grey zone - the occurrence of intrusions by other students during virtual exams for the purpose of obtaining information from which those students can benefit. This example serves as a reminder that intrusions are not always committed by external hackers and that the purposes of those intrusions may vary. Such incidents highlight the importance of online culture fostering cybersecurity and privacy awareness among users. The measures taken in response to these learnings led to safeguarding the virtual meetings in which online teaching is conducted. Examples of such measures are requiring a password to enter the meeting, utilising the waiting rooms or requesting participants to enter valid names.

This study also raised questions about the need for a stricter overall cybersecurity policy for universities, since very sensitive personal data is stored and processed in internal university systems on a daily basis. Mandatory VPN networks might be a step towards making it more difficult for intruders to access information shared in digital university environments,

especially when teachers and students are connecting to the online services over their home networks.

6.1 Future Work

The study outlines several measures that contribute to the effectiveness of emergency online teaching. However, it does not assess the impact of each of such measures. Therefore, future research could be conducted as a qualitative study in order to investigate each measure's impact on the effectiveness of emergency online teaching and rank them from the most impacting to the least impacting. Furthermore, the study focuses on the teachers' point of view. In the future, the research could be conducted from the students' point of view in order to investigate whether there is an intersection between the students' and teachers' perceptions of such measures.

Regarding cybersecurity, teachers' perceptions of vulnerability to cyber threats do not seem to depend on the university's overall emergency online teaching readiness. By and large, the teachers who participated in this study expressed no deeper concerns about cybersecurity, but one teacher pointed out that there may have been cybersecurity issues that had simply gone unnoticed so far. This raises questions of interest for further research and it also highlights the fact that cybersecurity issues may be very difficult to detect unless intruders are caught in the act.

We applied OL from the context of individual learning and how that impacted fast changes as well as changes that were determined by the complexity and dynamism of the environment driven by the COVID-19 pandemic. The long-term implications of emergency online teaching from an organisational learning perspective can not be evaluated yet. This is another potential topic for future research.

Appendix A – Pre-study interview guide

Question number	Question	Answer (Participant 1)	Area
1	How long have you been teaching and what subjects do you teach?	Been teaching since 1999 and I teach different Informations Systems-related courses.	Overall Perception of Emergency Online Teaching
2a	When you were informed about the need to immediately switch to emergency online teaching, what was that day like from your perspective?	It was being anticipated for a couple of days,so when the final decision was handed down, it was not a surprise. However, at that time in March 2020, the belief was that it would be for 2 weeks only, so the duration for which we had to continue with online teaching was definitely a surprise, and needed an enormous amount of preparation.	
2b	What specific tasks did you perform?	Getting the content into online mode, rearranging homework assignments and other deliverables. The course I was teaching at that time was a study abroad course where half of it was in-person on campus, and half would be through travelling to another country visiting companies, etc. So for me,the shift was not only from in-person to online, but also needed me to figure out how to make up the travelling part of the course through online content since the travel part was cancelled as well. Managing the course, and managing student disappointment were my main tasks.	
2c	Did you know who to contact in order to get the required information about emergency online teaching?	Yes, our IT department was very proactive.	

2d	Could you describe a typical day in an online emergency teaching setup? How does it compare to F2F teaching?	Much of online teaching preparation has to happen before. There is no room for improvisation on the spot. So it really needs a lot of planning and thinking from ahead of time.	
2e	What technological issues did you consider?	Lapses in internet access and getting kicked out of zoom, loss of electricity (both for the professor and the students), access to tools students need for the courses from their homes, etc.	IT support
3a	Could you describe the IT support that was available to you during emergency online teaching?	The IT support was excellent and they worked 24/7.	
3b	What could be done to facilitate more effective emergency online teaching for you from a technical point of view?	Time to prepare is the only thing I can think of.	
4a	Have you experienced any Internet issues during emergency online teaching?	None so far.	
4b	If so, were you able to solve them yourself, or were your teaching activities	N/A.	

	impacted by technical issues beyond your control?		
5a	Have you faced any challenges with utilisation of emergency online teaching tools?	No. Luckily, our university had switched to zoom prior to COVID and we did do some hybrid teaching so the switch was seamless.	Teaching tools
6a	Have you experienced a need for a higher level of technical skills in order to utilise the emergency online teaching tools?	Not yet.	
6b	What improvements could be made to the emergency online teaching tools to ease the transition from F2F to online teaching?	N/A.	
7	How do you perceive the effectiveness of asynchronous online classes (available to students on-demand 24/7)?	Learning in a classroom is more effective from a learning perspective. However, online teaching has a higher reach 9even those in remote setting can access) so definitely has those benefits.	
8	How do you perceive the usage of wikis, blogs, and podcasts in emergency	I find podcasts useful.	

	online teaching?		
9a	Have you experienced any joint communication between teachers and students via social networks?	None.	
9b	If so, how did that impact the efficiency of emergency online teaching?	N/A.	
9c	If not, why?	I prefer to restrict communication with students through the university approved official platform or channel only.	
10a	Did you feel more exposed to cyber threats while working from home?	No.	Cybersecurity
11	Have you experienced any security concerns related to emergency online teaching, such as students or hackers disrupting the class or sabotaging the virtual environment?	I have heard of imposters joining virtual classes but have not experienced it myself. In my prior university, we used moderators, whose role (among others) was to verify identity of all participants in a zoom class.	
11a	Have you noticed any uptick in cybersecurity	None.	

Question number	Question	Answer	Area
	threats in the era of emergency online teaching?		
11b	If so, what were they?	N/A.	
12	Did you experience any significant differences between students regarding their tech skills?	None.	Tech skills inequality
12b	If so, how did that impact the efficiency of emergency online teaching sessions?	N/A.	
12c	What can be done to minimise the gap between the students?	N/A.	
13	Looking back on your days of emergency online teaching, is there anything that you would do differently if you had to do it again?	Nothing as such. Being always prepared to switch at short notice is the best one can do.	Overall Perception of Emergency Online Teaching

Question number	Question	Answer (Participant 2)	Area
1	How long have you been teaching and	I have been teaching since 2001. I teach in Informatics/Information Systems and the most frequent course	Overall Perception of Emergency

	what subjects do you teach?	topics throughout the years have been project management, change management, research methods and thesis courses on basic and advanced level.	Online Teaching
2a	When you were informed about the need to immediately switch to emergency online teaching, what was that day like from your perspective?	The change in itself was very rapid, which was hard to handle. On the other hand, I have been teaching online and blended learning courses since 2005, so I am acquainted with how it is done and I don't think that online learning is an inferior way of learning (as many of my colleagues do).	
2b	What specific tasks did you perform?	I performed lectures and seminars on Zoom and Teams. I used Canvas to provide course information and quizzes.	
2c	Did you know who to contact in order to get the required information about emergency online teaching?	Yes, all staff at our department contacted our director of study, who took a great deal of responsibility for the change. He did it very well.	
2d	Could you describe a typical day in an online emergency teaching setup? How does it compare to F2F teaching?	It is in my opinion very much like going to a classroom, but the classroom is virtual instead of physical. I used to have lectures and seminars in the same format regarding time and content as in the classroom, but perhaps I was more careful that my written and spoken materials were comprehensive and clear in order to avoid misunderstandings. The only thing I missed from the F2F teaching was the opportunity to spontaneously draw and write on the classroom whiteboard.	
2e	What technological issues did you consider?	Sometimes the Internet at LUSEM or in my home went down during lectures and seminars.	IT support
3a	Could you describe the IT support that was available to you	Our director of studies helped us with both planned course development, such as recordings, how to set up	

	during emergency online teaching?	Teams seminars as well as emergency errors.	
3b	What could be done to facilitate more effective emergency online teaching for you from a technical point of view?	I think that LUSEM needs an expert team to help teachers with online teaching so that it will be more professionally produced.	
4a	Have you experienced any Internet issues during emergency online teaching?	Yes, the Internet is not so reliable neither at LUSEM nor in the house where I live.	
4b	If so, were you able to solve them yourself, or were your teaching activities impacted by technical issues beyond your control?	The Internet came back in a couple of minutes and the things we had talked about during the break had to be repeated.	
5a	Have you faced any challenges with utilisation of emergency online teaching tools?	It was hard to master Camtasia on my own. When it comes to recordings, I think that some short introduction courses are needed, not only in how to record, but also on how to orchestrate the recording so that it will be a pleasant experience for the students.	Teaching tools
6a	Have you experienced a need for a higher level of technical skills in order to utilise the emergency online teaching tools?	Yes, see the answer on question 5.	
6b	What improvements could be made to the emergency online teaching tools to ease the transition from F2F to online teaching?	More integration between tools - it would be nice to be able to reach a conference system or a recorder from inside of Canvas for example.	
7	How do you perceive the effectiveness of asynchronous online classes (available to	I think that it is a good tool that enhances learning and reflection. However, they need to be clearly integrated as activities in the course (followed up by quizzes or seminars	

	students on-demand 24/7)?	for example) so that students really take part of them.	
8	How do you perceive the usage of wikis, blogs, and podcasts in emergency online teaching?	Good tools that can enhance learning. I have not used them in my courses, though.	
9a	Have you experienced any joint communication between teachers and students via social networks?	No.	
9b	If so, how did that impact the efficiency of emergency online teaching?	N/A.	
9c	If not, why?	N/A.	
10a	Did you feel more exposed to cyber threats while working from home?	No.	Cybersecurity
11	Have you experienced any security concerns related to emergency online teaching, such as students or hackers disrupting the class or sabotaging the virtual environment?	No.	
11a	Have you noticed any uptick in cybersecurity threats in the era of emergency online teaching?	Yes.	
11b	If so, what were they?	Many of my colleagues were scared that students not belonging to the class should enter in Zoom.	

12	Did you experience any significant differences between students regarding their tech skills?	Yes. Some students had difficulties handling Zoom features like sharing screen etc.	Tech skills inequality
12b	If so, how did that impact the efficiency of emergency online teaching sessions?	Things took longer time than they would have otherwise.	
12c	What can be done to minimise the gap between the students?	Organise crash courses for students in the tools that are frequently used.	
13	Looking back on your days of emergency online teaching, is there anything that you would do differently if you had to do it again?	I would take more time in learning to record lectures.	Overall Perception of Emergency Online Teaching

Appendix B - Interview Requests

These emails were sent to staff at several Swedish universities. There were templates for teachers that we could contact directly and for other university staff members (such as program or course coordinators).

Interview request for teachers

The first version of the interview request email, included details about the study and semi-structured interviews such as confidentiality and recording of the session, resulting in a lengthy message. We experienced that the potential participants did not respond to the first version of this email, therefore a shorter, second, version was created, leading to a higher rate of potential participants agreeing to an interview.

Interview request for teachers version 1

Hi!

We are currently completing the last semester of the Master's Programme in Information Systems at Lund University. For our Master's Thesis, we are investigating how to make online teaching more effective from the perspective of university teachers and we would like to get in touch with teachers who conducted emergency online teaching within Informatics/Information Systems during the pandemic. We plan to interview teachers from Swedish universities via Zoom and each interview will take 30-45 minutes.

All interviews will be conducted in English. If our participants approve, we would like to make audio and video recordings of each interview so that we can base our data analysis on the recordings. Each interview will be transcribed and shared with the participant for final approval before we use the data in our study. Our teachers might want to know who we interviewed, but other than that, the identities of our participants will be kept confidential. If it is convenient for you, we would like to invite you to participate in our qualitative study. If you are not able to participate, we would really appreciate it if you could forward this request to a colleague.

Best Regards,

Amina Borafia & Klaudia Huzova

Interview request for teachers version 2

Hi X,

I am writing to you because I am completing the last semester of the Master's Programme in Information Systems at Lund University. As a topic for the master's thesis, me and my classmate Amina are investigating how to make online teaching more effective from the perspective of university teachers.

We would like to get in touch with teachers who conducted online teaching within Informatics/Information Systems during the pandemic.

We would really appreciate it if you could find 30-45 minutes of your time for a Zoom meeting where we would discuss this topic in further detail.

If you are not able to participate, we would appreciate it if you could forward this request to a colleague.

Best Regards,

Amina Borafia & Klaudia Huzova

Interview request for an administrative member of staff

Hi!

We are currently completing the last semester of the Master's Programme in Information Systems at Lund University. For our Master's Thesis, we are investigating how to make online teaching more effective from the perspective of university teachers and we would like to get in touch with teachers who conducted emergency online teaching within Informatics/Information Systems during the pandemic. We plan to interview teachers from Swedish universities via Zoom and each interview will take 30-45 minutes.

All interviews will be conducted in English. If our participants approve, we would like to make audio and video recordings of each interview so that we can base our data analysis on the recordings. Each interview will be transcribed and shared with the participant for final approval before we use the data in our study. Our teachers might want to know who we interviewed, but other than that, the identities of our participants will be kept confidential. We would really appreciate it if you could help us get in touch with a teacher who would like to participate in our qualitative study.

Best Regards,

Klaudia Huzova & Amina Borafia

Appendix C - Interview 1

Organisation: Swedish university

Date: 2022-04-21

Interview length: 37 minutes

Language: English

Participants: Respondent 1 (R1), Klaudia Huzova (KH), Amina Borafia (AB)

Row	Speaker	Questions and answers	Code
1	KH	Let's start with the questions about the overall perception of emergency online teaching. So when you think back at the time when you were first informed about switching to exclusively online teaching, what was that day like? Were there any specific tasks that you performed or people you contacted or some technical issues you've considered?	
2	R1	Mm. It's still so many years ago now. It's difficult to remember the specific day. I think it became a more gradual…. We had some preparations in place long before we… we… have this obligation… obligation not to… to have any… any… teaching on campus. So we… we had some time to make some preparations And we are also not completely… yeah, unaccustomed to doing teaching online. We have had this blended classroom model. Quite a lot of flipped classroom models and stuff like that. So we… we… we are… we were not completely surprised and we had quite a good idea of how to do it. So I think the most important, the most difficult thing was to replace the hall exams with home exams and… and… and different other kinds of examination forms. That… that was the biggest challenge. And it is still a very, very difficult thing to manage.	OP
3	KH	Yes. So could you describe a typical day in this online emergency setup? And how does it compare to the teaching before the pandemic? You mentioned a little bit of these exam complications. But was there anything else?	

4	R1	Well, a typical day and teaching is not that different actually from how it was performed before. The main difference is of course that I… I'm not at campus in a… in a lecture room and having a physical presence there. I can't see people in their eyes. Most people, even if you nag at the students please turn your cameras on, most people, they say that, oh I have no web camera, blah blah blah. Come up with all kinds of stupid excuses. I think, I mean every, every phone has a camera so, well that's not a valid… I think people don't like to expose themselves on webcam. Many people don't. So that's the truth of that. But the end result is that I feel that I have a much um… reduced feedback from the students. When I'm lecturing in a hall, I can see, okay, that guy, he didn't quite get this, I can see that so I can elaborate on that particular thing, or I can see that some people, they're doing something else that I can directly go to them and ask some questions to get them activated. I don't have those opportunities when I'm lecturing through Zoom for instance, and of course nor when I'm doing pre-recorded lectures. I mean that's really something totally different from having a lecture in a… in interactive mode, in a… in a… in a room where you have people listening and asking questions and… and reacting in different kinds of small cues. So I feel that I have lost lots of my tools for teaching by being channeled through those technical means of video recordings and so on. So it's… it's really different.	OP, TT, AC
5	KH	Mm-hmm. Yeah, thank you. Let's now move on to our next category which is IT Support. So could you describe the IT Support that was available to you during this emergency online teaching?	
6	R1	Yeah. In fact they… they put some resources to… to that, so we… we got the information that we had. There was a team of support persons that could help us with everything from how to plan lectures on a distance to actually also supporting us with specific tools, how to use them and so on. Uh, I mean if you take this platform Zoom here, during the pandemic, it has actually evolved quite a lot. Lots of things that weren't needed so much before has been added like encryption for instance and the ability for people to self assign to breakout rooms and so on. So the platforms themselves have also evolved to meet the… the new demands.	ITS, TT
7	KH	Mm-hm. And can you also think of something that you find would be good to further implement within these teaching tools to increase the efficiency of them?	

8	R1	Mm. Well, ehh…. There are so many tools, also some tools that I don't use so much, but I mean look at this white border function for instance. In a lecture hall I have the possibility to have a… a pen and writes on the whiteboard and that's not so easy to do in… in this if I sit by a computer. Okay. I have arranged so that I can use my iPad and a pencil and write stuff there, but I seldom use it because it's kind of awkward. So those presentation tools, I think they are in need of development and it's… it's not only software functionality, it's also hardware functionality that I think is needed to uh… well, provide a kind of support that I would like to have. Of course, we have all those possibilities of showing slides and so on. But that is a rather tedious way of contacting teaching, I think, just showing a bunch of slides and comment upon. No, no, no, that's not good teaching and it never was. It wasn't good in the… in the classrooms either. It was just as bad. And then when we have a boring lecturer just showing some slides and reading what it says on the slides, I mean that's pointless.	TT
9	KH	Mm-hmm.	
10	R1	That's not a lecture.	
11	KH	So moving on to our last question within this category, can you think of any Internet issues you've faced during this emergency online teaching?	
12	R1	Well, well, not so much Internet issues. I have very good connectivity here at home. I had some occasional issues with… with a router that in some very special modes of operation with lots of things going on the route. Thought that we were under attack, under DOS attack so it shut… shut my client down. But that… no, no, no, no major problems.	ITS
13	KH	So, any problems you came across you were able to solve yourself?	
14	R1	Yes, and I I have been also very mm-hmm, very careful to try to make the best sound that is possible for this platform by investing privately actually in some kind of… some some some equipment that is useful, like I think that when you get used to it, it's almost mandatory to have a compressor, expander, gate enhance or DSR and all those stuff. Those could help tremendously, especially if you are conducting, like I also do in	TT

		my work, conducting some interviews and stuff like that. Lots of interaction with students and so on. So it's very important that audio must be absolutely perfect. That's my… my lesson.	
15	KH	Mmm. Thank you. So, now we are moving on to the next area which is teaching tools. So have you faced any challenges with the teaching tools during this online emergency teaching?	
16	R1	We have an assortment of different kinds of teaching tools that can be used Padlet, different kinds of interactive tools that we are occasionally using posting. We can have a little brainstorming session, an idea session and to make everyone contribute, writing little notes and stick them up on this Padlet or whatever. There are lots of different kinds of tools like that. And we have… we have also possibilities in some occasions we are writing texts collaboratively. And that is actually quite simple to do nowadays with many different things like Google Box and also Microsoft 365 have a very, very good functionality in those regards. And we also used, sometimes, the Teams. I think one major difference at least as it was between Teams and Zoom is that Teams that you have also a little file repository where it can keep the current files that are uh… used. I mean we are using Zoom, not only for… for interacting with students, we also use it quite a lot almost exclusively nowadays when we are meeting with our colleagues in different kinds of projects and so on and there are lots of documents that needs to be organised in a in a good way and you can't only use Zoom for that. You need additional platforms like Teams is one and I think it is rather good. So we … we use Teams and so, in Teams more in the collaboration between colleagues and Zoom more towards students, I would say.	TT
17	KH	And is there anything that you wish there was uh… in the realm of these teaching tools to make the teaching experience better?	
18	R1	I think you're in a few years, I think we will perhaps have the opportunity to use more of like virtual reality kind of environments. I think that could be a great addition actually to be able to move around in virtual rooms and organise your stuff in those rooms and I mean, we are… our brains are not really wired to… to work very well with the kind of crude tools that we use today. We are more analog in our way of working. And it's also one… one other aspect that is very important and I… I found that during those, that's a… it's not the answer to your question here. But you see one of those things that I had to invest in. Sorry, that	TT

		was to reorganise my desk a little bit here. Mhm. I hope it doesn't thump too much in your speakers.	
19	KH	No, it's fine.	
20	R1	Yeah, I had to get one of those standing desks because my back was actually starting to act up really, really bad from all this sitting. We are sitting so much and that's really dangerous for our… our bodies, really, really dangerous. So I mean tools, tools for teaching and so on. It is not only electronic tools, it also is necessary to organise their physical workplace. You're… you're I mean, my desk is sort of a tool as well. So but what… what… what… what… What are you thinking about when you say tools?	
21	KH	Um… I… we were thinking more about for example wikis, blogs or podcasts. Have you used any of those in the emergency online teaching?	
22	R1	It was quite many years since I used wikis in activity in… in… in teaching. But yeah that… that… that's a… that's one kind of tool that they can be good for for some things, um…podcasts? No, I haven't used podcasts, I have been thinking about it. It could be a nice way of well… breaking up with a usual format. I mean if we say we are two teachers involved in the course, it could be a nice touch too that we both sit in the same room and we have a discussion about some… some stuff that is uh… we elaborate on stuff in literature and so on and have a discussion. So those formats… I wish I had more time to… to develop those kinds of things.	TT
23	KH	And how do you feel about the effectiveness of the asynchronous online classes? So something that is available to students 24 hours, seven days a week.	
24	R1	Um…We have used those platforms for very… for… for decades, actually, in many different variations of Blackboard. I think it was something that was called… Our latest since 7, 8 years perhaps is Moodle and I must say it starts to feel a bit dated and awkward to work with. Lots of integrations that would be obvious. I think it was two when I great things in Moodle. I would like there to be a direct coupling to the Ladok study record system but there isn't, so lots of manual work involved. That is	AC

		quite unnecessary. I don't know are you working with Moodle or something else?	
25	KH	Oh yeah, we are using something else. It's called Canvas.	
26	R1	Canvas. Yeah, we are actually, I've heard now that we will probably go over to Canvas rather soon. And I think in some respects, it is a better platform.	TT
27	AB	It works well.	
28	KH	So now let's move on to our last question within this category. Have you communicated with other teachers or with students via social networks?	
29	R1	Uh, could you repeat that?	
30	KH	Yes. Sorry. So have you communicated with teachers or with other students via social networks?	
31	R1	Okay. No, no. Okay. And it is actually quite deliberate that I don't want to do that. I would like to have… It's… I mean, this is what we were doing teaching here and academic teaching and my view is that all study related instruction and so on… It should be available at the official platform which is my model in this case. So yes, in some, in some way we have some forums and there are chats and so on within this uh… study platform, but I haven't used other platforms like Facebook or LinkedIn or Twitter or something like that. No, I'm not a Twitterer regarding the professional work.	SN
32	KH	Okay, thank you. So now we move on to our next area about cybersecurity.	
33	R1	Yes.	
34	AB	And that really brings us to what we were just talking about, because I was going to ask you, did you feel more exposed to cyber threats while you were working from home?	

35	R1	Ehh… Actually, no, I don't. Perhaps I should but I'm aware that… I mean, in the university they have much more advanced firewalls and… and different kinds of systems and as a private person, I don't have time or hmm, knowledge enough to… to really tweak all those settings that could be done in a, in a professional firewall. So I have an ordinary consumer class, a good one. But it's still a consumer class firewall at home. And… I don't think that it is a problem really.	CS
36	AB	Okay. So you haven't really noticed any uptick in cybersecurity threats in the era of emergency online teaching then?	
37	R1	No, I haven't had any hijacking of my Zoom rooms and stuff like that. And… and as I said earlier, uh… the Zoom platform has introduced this encryption and different kinds of measures, waiting rooms and you can, you can really secure your environment really, really easy and I can do that at home and I can do it also on… on campus of course. But I realised also that we have a problem here. One thing, actually I spoke with my wife yesterday about it, in the car. I was amazed, actually, that we don't have any requirements of the employees connecting through the core administrative systems. I mean, really sensitive systems at the university through a VPN. There are no such security in place and I think that's sort of amazing really, it's a, it's really easy to… to break into very, very sensitive systems.	CS
38	AB	Okay. Is it your personal feeling that there should be something like a VPN solution in place?	
39	R1	There should be something and there should also be a much more active… I mean, security. Okay. There are some… some technical stuff that can be implemented. But the most important security measure is the behaviour of the users. And I… I would like to see much more of that in… that it was an active discussion and we have now updated our security policy. You should now do this and this because we have detected this and these kinds of threats nowadays, but I don't see such a discussion unfortunately. So I think we are weak. We are vulnerable, vulnerable, vulnerable. That's what we are.	CS
40	AB	But you personally have not then experienced any security or privacy issues while you were doing Zoom meetings with your students and nobody has been disrupting the class or sabotaging your virtual environment or anything like that?	

41	R1	No. Nothing whatsoever. I'm surprised, but well, nothing.	CS
42	AB	And that brings us to the last category that we have today. Other questions. Did you experience any significant differences between students regarding their tech skills?	
43	R1	Tech skills?	
44	AB	Yes.	
45	R1	Um- hmm. Well, I'm, I must say that I have seen a declining level of tech skills the… the last… last years, I don't know why, but it seems like the ordinary students. I mean we are… we are talking about Informatics students here, but I find them less and less uh… aware of how the information technology works and I find them also less and less able to solve minor problems by themselves. And I think that's rather surprising given the fact that they are now required to… to master those things in order to take part in… in the… in the teaching. So I can absolutely not say they have improved their skills. But it's difficult to generalise. It's very difficult to generalise. We're talking about different generations of students. Also, the latest generation of students have… they are brought up with smartphones and many of them. They do everything on their smartphones, reading the instructions from the course platform on their smartphone. I mean, are they serious? It's not okay. I'm… I'm old. Maybe… maybe they are doing something that I prefer not to. I prefer not to do work on my phone like that. I find the screen much too cramped for doing any practical work whatsoever. But maybe people are thinking differently nowadays. I don't know. But I see the… the… it's not so much the technical skills. That is the main problem. I think the main problem nowadays is that our students are not used to read longer texts. So they are… have harder and harder to understand the instructions. You have... You almost have to record an oral instruction in order to get the message through. So… so it's a switch in the preferred media. I think, um… they prefer video clips. They prefer short video clips, shouldn't be too long either short, short chunks of text. If it is longer than say half … half a page, they don't read it.	TSI
46	AB	Mm-hmm. That's interesting.	
47	R1	Yep, interesting. It's sad also.	

48	AB	Yes it is. I agree with you. Maybe it's a generational thing and I'm probably more your age, so I see what you mean.	
49	R1	Yeah, perhaps.	
50	AB	Did you feel like…	
51	R1	You seem young so… Well, anyway. You know what I mean?	
52	AB	Yeah.	
53	R1	They haven't been more, more technically skilled over the last five years.	TSI
54	AB	No.	
55	R1	Definitely not during the last two pandemic years.	
56	AB	No, no. I meant more like, you know, differences between individual students. That you have some students that are more technically skilled and other students are less technically skilled. Did you feel that there was such a difference?	
57	R1	Yeah, we have such a difference. And I think I see perhaps more profound, um… differences between those who are weakest and those who are most skilled and most the best students. So maybe the pandemic has become kind of a polarizer. to… to… to people become… people that were already good at making social context, they continue to be good at making social contacts also during the pandemic with all those restrictions. But those who weren't that good, they were left behind. I think.	TSI
58	AB	I see what you mean. Did you feel that that impacted the efficiency of emergency online teaching sessions? That difference between your students.	
59	R1	Yes, I have seen, uh, I have no statistics on it. But I have a gut feeling that I have had much more students that were falling too far back in the class too early to be able to catch up. So we have	TSI

		had tremendous amounts of re-examinations and also quite a lot of dropouts, I would say.	
60	AB	That's unfortunate.	
61	R1	Mmm. I think it is partly because of the… the challenges that this uh… emergency total lockdown of physical teaching and… I think it could be.	
62	AB	Mhm. What did you feel could be done to minimise the gap between the students?	
63	R1	I think it would be very good to have some kind of a um… workshops or something for students to… to get up to speed when it comes to handling the different kinds of digital tools that were used in… I mean setting up a good audio video environment, very important, selecting the right piece of equipment. Uh, don't be held back by not being able to connect a webcam or a microphone or when things happen, you know, when you have a Zoom meeting, you never really know which microphone is actually connected and the one that you thought was connected is not connected. So it's all those small things. And also, I mean some kind of tech… teaching tech course, teaching tech workshop, something like that.	TSI
64	AB	That makes a lot of sense. And looking back on your days of emergency online teaching, is there anything that you would do differently if you had to do it again?	
65	R1	Mm-hmm.	
66	AB	Anything that stands out to you, what you know now that you didn't know when you were informed about this originally, that you had to go fully online?	
67	R1	Well, it's a difficult question. I wish I had got my… my… my… my desk, my standing sitting desk earlier because then my… my back would have been better right now. So that's one thing, you can't really imagine, the physical toll it takes on your body to be sitting all days. I mean, when… when we were teaching at the university and we still haven't really come… come online with that totally. It's not at all back to where we were. Not at all. So, I mean the workday typically for let's say three years ago, it	OP

		involves quite a lot of small walks, small talks with people in the corridor at the coffee machine. All those small things. I mean, I don't book a meeting in Zoom in order to just small talk, it's always a specific topic. Always a planned meeting. So all those small things have been neglected. You don't recognize it so much. Perhaps in the beginning of this. But in the long term I would have made that different. I think to…. Um… set up some kind of a… we have had that also. But nobody showed up, digital fika, you know the Swedish word fika, we had those, but nobody showed up. Okay. Some people did. But not the people I would like to talk to. So I didn't show up either. So... Well, yeah, you have to somehow organise this, um… informal contacts when… if and perhaps when a new pandemic is arising. Ehh, we are maybe not through with it forever. I don't think so. I'm afraid so. That's one lesson. I think the social… the fabric is… is fragile, takes a long time to build and it takes… it wears down during these kind of circumstances, I think. So. That is something that could be done.	
68	AB	I think a lot of people can recognize themselves in what you just said about that.	
69	R1	Yeah.	
70	AB	Other than that...	
71	R1	So we…	
72	AB	Sorry?	
73	R1	We tend to become rather lonely, I think. And… and… and the… the students also become lonely. And the studies, social contacts that it is so important for… for the success of their studies... Mm-hmm. I'm afraid it will take years before we are even back to something that slightly resembles where we were, if ever, because the social contacts here… they are not what it was before.	
74	AB	No. Maybe that takes us back to what you just said before when you said that the students who were already struggling, were struggling even more during this time.	

75	R1	That's my opinion. Absolutely, yes.	
76	AB	Maybe they were missing that social support as well, just to have someone to chat with and maybe...	
77	R1	Yeah.	
78	AB	Just someone to catch up with them.	
79	R1	Some study buddy.	
80	AB	Yeah.	
81	R1	Some… some… some… some friend that you can, well, you can't really develop deep knowledge all by yourself. You need to relate to someone else's opinion about it. And someone else's viewpoints. Otherwise it becomes some kind of just repetition of the text that is in the book and that's not knowledge.	

Appendix D - Interview 2

Organisation: Swedish university

Date: 2022-04-21

Interview length: 25 minutes

Language: English

Participants: Respondent 2 (R2), Klaudia Huzova (KH), Amina Borafia (AB)

Row	Speaker	Questions and answers	Code
1	KH	Let's start with our first category, which is overall perception of emergency online teaching. So, when you think back on when you were first informed about switching to exclusively online teaching, what was that day like? Were there any specific tasks that you performed? Did you know who to contact? Have you thought of any technical issues?	
2	R2	(Interviewee smiled) Yeah, these are the things that I guess my management team should've asked me about. No, on most of your questions, it's a no. Oh no, I was so alone and I was also hmm returning back from having a more managerial position to teaching position. All the systems were new and the assignment of the classes that I was tasked of doing the teaching in… I was assigned to courses that I hadn't really been part of before. So everything was new to me, yep. And no tutorial. And since we were then obliged to stay at home, so my peers often, otherwise, you know, we speak to each other in the 'fika' room, in the conference at the lunchroom. Uh there was… I mean of course I could call people but that's a bigger step than just walking into the 'fika' room and ask, you know, "panic", I need this, you know, does anyone know about how to do this and this? So no, no, no, I wasn't prepared at all, hmm…	OP, ITS
3	KH	Could you describe a typical day in this online emergency teaching setup? How does it compare to the teaching before the pandemic?	
4	R2	Well, for once um… We have used Zoom most of the time. But also we switched educational platform from Campbell to Canvas during this time. Yeah. So, there was like, two different systems, or actually three. Because then we also during the same time	OP

		needed to as teachers learn about how to grade in the formal system for grading students Ladok. So it was actually three that it was… Actually three various systems at the same time. And also again, the fourth item for me was that I was new. Again, even if I'm a senior lecturer, it was new for me to do all of it online. Mm hmm. Okay…	
5	KH	Yes. So let's move on to the IT Support section. So, could you describe the IT support that was available to you during this online emergency teaching?	
6	R2	Hmm… I guess… I guess the university has it. Okay. So there was a preparation or preparedness for supporting teachers in this situation. However, my hmm.. habit, or my, incline into using that support wasn't really there. So, I wasn't really prepared to reach out to that kind of support, because it was also often not in the manner of the way that the procedures of the university prepared for it. So, when I needed help it was almost instant, it… something broke down. Okay. Now we break down, something happens when we are speaking and who to call, who to ask. I'm on my own. I'm in my flat here and there's no support around and I can't go to the coffee room at all. Right. But… but yes, in terms of a support system for university teachers who perhaps are more prepared, maybe that's also part of my experience. Is that okay? I might not be as prepared as I should for every teaching session. Right? So when things break down in the session, I can't get the support. Uh, if it breaks down in a situation face to face, I can just rush and someone will be there with some good advice at the department.	ITS
7	KH	Mm hmm. So, would you find this to be something that could be improved about the IT Support to maximise the efficiency to ensure that they have prompt responses and their availability?	
8	R2	I don't know, maybe it's an improvement on my behalf as well. So I don't, I think it works both ways. So, preparedness for teaching online now that I have had the experience, I guess, I prepare better than starting it. Okay. So I do check. I do check that I have the connection. I do check, still. Okay, lightning might not be really great today, but it is like okay, I do check, I do check that I have the secure line so that we can meet and we can discuss it. This didn't work from the start because I also didn't know about how Zoom operated. It was a new system. So I could invite people to one Zoom meeting and then I will hook up to a different	OP, TT

		Zoom meeting myself. So, it was confusion in the beginning. Yeah.	
9	KH	And can you think of any internet issues during these emergency online teaching?	
10	R2	Well, actually no. I would say. I think we are in a hm... In that respect, I think we are in a privileged position of having really good internet connections. So no, no major breakdowns due to technical breakdowns. No.	ITS
11	KH	Okay. Thank you. So, moving on to our next area about teaching tools. So, have you faced any challenges with teaching tools during the emergency online teaching? You've mentioned already some complications with the Zoom.	
12	R2	Well, I would… I would then put forward uh.. Not a total experience, but part of the experiences I have done through the pandemic. Which has almost been two years. I had one class where I would say the majority of the students resisted to put on the cameras. Hmm… Even though I told them that I would prefer that we saw at least each other this way. Yeah, but they didn't. And then I guess maybe I had words, bad wordings… Um… Maybe I uh… shamed those who didn't put on the cameras, which didn't improve the situation at all. So, for one full class of five or so weeks, half of the class didn't put on the cameras. So, I haven't seen them. That I think was troublesome. We (interviewee points at researchers) have seen each other. So, I mean, we have, I mean, yeah, we have met at least somehow, we have met this way. Yeah, we haven't met. So we haven't physically touched or you know, sat in the same room. But these students for some reason refused to put on the cameras which was for me, really a tricky situation to deal with as a teacher. Hmm...	TT
13	KH	And do you see any improvements that could be done to these teaching tools to make the teaching experience better?	
14	R2	Well, I guess that I tried to but it didn't work. But I guess if there was some kind of also… overall agreement on, okay, we have a pandemic and now the situation is as and then if we need to participate, the camera needs to be put on. If for some reason it can't be, because for some reasons for some persons with some kind of technical facilities it can be problematic, I do appreciate and understand that, but not as a default to just choose not to.	TT

		Yeah, if we can just say, okay, well if you're participating in this class, you're supposed to put the camera on so I can… So, we can see each other. Yeah, that would be an improvement. I don't know what, where this is going. But anyhow, this is my experience…	
15	KH	No worries. It is very helpful. So, how do you perceive effectiveness of asynchronous online classes? So, classes available to students on-demand, 24 hours seven days a week.	
16	R2	Hmm. Broad question. Let me think it through a little bit. Well, is that in comparison to face to face interaction?	
17	KH	Oh, yeah.	
18	R2	Yeah, okay. If I would meet with you guys and you were in my class, I would have prepared for and I did also in online that you also engage in the manners or whatever we are talking about. And again, then I need to, hmm, I guess even further if I'm in the physical body in the classroom saying, okay, now I would like you to engage in the topic by an exercise and I prepare the exercise, well here we have in Zoom we have breakout rooms, right. And then I just distributed and whatever goes on, goes on. It's almost the same as if I say to the class in the classroom, okay, I want you to discuss something and come back and share. Um, and, and the question again was about efficient.	
19	KH	Yeah. And what about asynchronous online classes. So, that means for example, that there is some video recorded?	
20	R2	No, Okay. I didn't, I haven't tried that at all. Oh, okay.	AC
21	KH	And how about wikis blogs or podcasts? Have you tried to utilise that in the emergency online teaching or what is your point of view on that?	
22	R2	I haven't… I haven't involved in terms of formal items. How do you say this now? Neither online nor on campus. It's mentioned, but it's not… I haven't utilised it as a tool. It's not formal but it is mentioned and it's… Um… How do you say… It's accredited that these resources are there, available to use, but they are not used in terms of the structure of the classes that I teach.	TT

23	KH	Okay then we have a last question in this area which is have you communicated with teachers or with students via social networks?	
24	R2	Well not really. If we are speaking about social media as text messages. Okay. Text messages, emails, yes, but no interaction on you know other social media platforms.	SN
25	KH	No WhatsApp or stuff like that?	
26	R2	No. Mm-hmm.	
27	KH	Okay. Thank you. So now we are moving to our next section about cybersecurity	
28	AB	Yes. So I would like to ask you, did you feel more exposed to cybert hreats while you were working from home?	
29	R2	No.	CS
30	AB	No, not at all?	
31	R2	No	
32	AB	Okay. And you didn't notice any uptick in cybersecurity threats in this area of emergency online teaching then?	
33	R2	No.	CS
34	AB	Okay. That's easy. Have you experienced…	
35	R2	Sorry. No. Again, maybe I should but I haven't. So, no…	
36	AB	That's okay. You haven't seen or heard anything. You haven't noticed anything.	
37	R2	No.	CS

38	AB	Okay. And maybe this is pretty close. But I'll ask you anyway. Have you experienced any security or privacy issues during emergency online teaching?	
39	R2	No.	CS
40	AB	And there were no students or hackers disrupting your class or sabotaging the virtual environments?	
41	R2	Actually, no. I have actually started to prefer to use my personal Zoom room always. Um… I also posted... I also post that to the official schedule. The schedule that all… I mean it's available for everyone. You know, I'm aware of it, but I haven't experienced it. So as far as is, fingers crossed, no bullying, no attacks. No nothing.	CS
42	AB	That's excellent news. And then we have some questions that we have called other questions here because we weren't really sure what to call them. Did you experience any significant differences between students regarding their tech skills? Like one student being a lot more tech savvy than another student in your class?	
43	R2	Mm-hmm. Can you explain that a little bit more? Are you thinking that there are some students that are more eloquent in writing than in taking more room?	
44	AB	No, not really. I was thinking if you have, like, a class of any number of students say they're 30 or 40 people and some of them are more technically skilled than others. Has that been true in your classes?	
45	R2	Oh, shoot. I don't know.	
46	AB	That's okay. We really want your honest opinion.	
47	R2	You know, it's a really good question. And how do I assess my students then?	
48	AB	Yeah. I mean, if you've noticed that some people are just not understanding from a technical point of view that they find it hard	

		to do things because they're not technically skilled enough for this.	
49	R2	I think I get the question and… Alright… I would, uh haha… Then the formal answer will be, alright I do have 4 or 6 assignments for them to put in and most of those are written assignments. So it doesn't really matter how they perform in the classroom. But, at the same time I do ask them about it in evaluations because it of course matters how things are hmm… perceived or… What do you say taken in by the students? I mean, I wanted it to be a good class, besides the assignments, but I would say no.	TSI
50	AB	Okay, well then the next question is irrelevant. And do you feel that there is anything that needs to be done to minimize such a gap between students? Or do you think that it's okay the way it is.	
51	R2	(Interviewee is thinking and stays quiet for 5 seconds) That's also a really good question. And I guess, I'm not hmm… I do think yes, there can be much more improvements in that respect. I don't think I have the answer to how that improvement can be…	TSI
52	AB	Okay.	
53	R2	What else… Um.. Both in class in physical interactions and in Zoom I try to… What you do then if someone is more silent than others, others are more fine with speaking this way or not. Even if it is in a classroom, physical face to face, I try to actually ask. Pinpoint. Okay, What do you think? What do you think? And in Zoom, I guess the good part of that is that even if I, maybe if I do a view of you in gallery, uh, I can get your names. Yeah, I do get your names. So I could pinpoint Amina or Klaudia in a way that I couldn't in a classroom. So then I just have to do (interviewee points at researcher) to a person, and hopefully I know the name. I have… I pay tribute to trying to learn the names of my students quickly so that we can have such an encounter. So, that I can actually put you in the situation, Amina, that it is now I want to hear your opinion. All right. And I don't know, perhaps in Zoom, because that's what I've used mostly that helps. I've used it. I've pinpointed.	TT
54	AB	That's an interesting point you bring up because nobody else has mentioned that so far that in Zoom or another tool, maybe you get	

		the name of somebody you don't have to struggle and say, hmm. Was it Lisa or was it Karen? Who am I speaking to?	
55	R2	Exactly. No, no Klaudia. What is your opinion about this matter? (Interviewee points at one of the researchers) And I would, you know… I have all the names in the gallery most of the times. But sometimes they put awkward names as well.	
56	AB	Yeah.	
57	R2	And then it's harder.	
58	AB	Of course, of course. I mean it takes some user input for that to work. I mean when, when you log on, I mean you can write any name you like.	
59	R2	Exactly. And I guess then for some other questions that you had, hmm maybe that will be like an item to help a teacher too. I mean put in a real name at least. I mean the name, or another name that I can address you with, that you're that you're comfortable with. And okay if no camera, at least a name that definitely helps because that's the way I operate in a physical classroom as well. Then I do try to learn the names and I do want to address them because the quiet ones otherwise don't get a say. So I tried to bring them to a voice.	TT
60	AB	Exactly. And that's valuable input that you might otherwise miss out on because sometimes the silent people have a lot to say once they learn somebody's interested.	
61	R2	Yeah, definitely. No, no, no. Yeah, exactly. No, it's just that they either are tired or hungry or whatever or just shy. Yeah.	
62	AB	Yeah, that could be it too. So we're looking back on your days of emergency online teaching, is there anything that stands out to you? Is there anything that you would do differently if you had to do it again?	
63	R2	Definitely haha…	
64	AB	Tell us.	

65	R2	Oh shoot, I'm not that kind of a good teacher that maybe you expected to talk to? Oh definitely. No, I need... I think, I need to recess it with my colleagues and get good comments from them on how to do it. And you asked me about, what was it? Synchronous and asynchronous…	OP
66	AB	Asynchronous.	
67	R2	Yeah. So I'm thinking yeah of course I could have done some lectures, but normally I don't do that many lectures. I want to… I want to have a dialogue with my students. They think. I want to talk to them. So, I don't do lectures that much but they also often like that from me. So yeah, of course prepare lectures, which could be good otherwise as well.	OP
68	AB	Definitely. So you're more like a seminar kind of teacher. You want more student involvement.	
69	R2	And uh ah I mean most of the times there are some readings and they 40 or 30 or 20 people have read something even if they haven't read much, they have read in some more and have more ideas than me and I want to hear those ideas rather than mine. Okay. But of course sometimes, I mean students asked me to, you know, structure it up, telling me what is important or not. And of course, I can do lectures about it and that can be through Zoom. No problem. I haven't done it. (Interviewee smiles)	
70	AB	No.	
71	R2	No.	

Appendix E - Interview 3

Organisation: Swedish university

Date: 2022-04-26

Interview length: 32 minutes

Language: English

Participants: Respondent 3 (R3), Klaudia Huzova (KH), Amina Borafia (AB)

Row	Speaker	Questions and answers	Code
1	KH	Let's start with the questions about overall perception of emergency online teaching. So when you think back, when you were first informed about switching to exclusively online teaching, what was that day like? Um… were there any specific task that you performed or did you know who to contact? Were there any technical issues that you considered?	
2	R3	So there's a few things that you should know and it's that I have three roles, but there are two that are relevant for this. So, first I am a lecturer, which means that I teach. Difference between a lecturer and a senior lecturer is that the one doesn't have a PhD, but I'm a teacher essentially, but the title is officially lecturer. The second one is that I'm ███████████████ ███████████████████████████████ ██████████████████████ So in mid March, I believe it was of 2020, the government, the former Prime Minister, basically ordered all the Swedish universities to uh.. cease operations on campus and move all teaching to online. And it was pretty much… So this order basically came down all the way from the government and it was pretty much up to the departments to implement this. And since since ████████████████ ████████████████████████ ████████████████████████ Um… So, but this, which was pretty, it was… It was not that bad because it was in the middle of the spring semester and that is a semester, luckily for us where we don't have as many courses running as we do during the autumn. So, it was… It was not as many courses that needed to switch and the teachers that had to switch, we're able to do it pretty quickly, because I mean, it is not that terribly difficult to switch a course online. It doesn't mean that… I mean if you	OP

		take a normal campus course and suddenly it has to go online, it does not mean that it now looks like a Harvard mooc. You know? It means that we can run the course online. Um… and we were… and that's what we did and then as we went along we had to figure out how to also be able to up the standard of the education we deliver online, but that's a separate issue I think.	
3	KH	So, could you describe a typical day in this emergency online teaching setup? How does it compare to the teaching before the pandemic?	
4	R3	So from the teacher's perspective?	
5	KH	Yes.	
6	R3	Well, the… so, if I put ▮▮▮▮▮▮▮▮▮▮▮▮ aside, because there were a lot of stuff that I had to do in that role when it comes to the whole situation. But if I'm just thinking about myself as a normal teacher, I mean, the… the main difference is that you don't… You don't have any contact, physical contact with students or face to face contact, so… um… obviously all the teaching had to be done online, so I use Microsoft Teams. There was a lot of… Um… well since now… So that I… You know, immediately you have to start searching for what sort of software should be used for recording um… you know, what hardware do you need for recording like all of these things in order to produce education that is sort of in line with the… Worthy of a ▮▮▮▮▮▮▮▮▮▮ institution. Like we are. So, those things, that was kind of like a pretty big startup cost or however you want to face it. Uh… and the actual execution of it. Well, I mean, so there's a lot of experimenting going on in the beginning, like with Open Broadcasting Studio or not Open Broadcasting Studio and how to make it look professional and all of this stuff. Um… but it's basically delivering lectures over Teams. My office hours I also moved to teams. So, I didn't cancel those, but students could contact me for two hours per week by Teams and I would call them and help them. We had to move the entire… because that's a bit ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮, but we had to move the entire um teaching assistance business to Teams as well. But that's something that because you're in the master program, you don't come in contact with this, but we have teaching assistants, ▮▮▮▮▮▮▮▮▮, is one of them and they basically run all the labs on the undergraduate level and uh... computer labs are impossible to do with social distancing because you're basically sitting in somebody's knee when you're helping them. So, all of that had to be moved online. So we essentially had to put up an IT	OP, TT

		support organisation of accounts ad hoc from one day to the next. But we… I was actually… I had a bit of foresight, so I kind of saw this coming. So we actually had that up and running like a few days before we got the order. But when it comes to the teaching part, no is just putting everything online and starting to think of like… Okay, how am I gonna record the materials like am I gonna give lectures live? I'm gonna record them at the same time as I gave them live, which is what I did and so on and so forth. And a lot of technical challenges and stuff like that as well. I don't know if you have any specific questions about it.	
7	KH	Um… Thank you. I think we should now move on to the next part which is about IT Support and that you've mentioned a little bit already but could you describe the IT Support that was available to you during this emergency online teaching?	
8	R3	Not any IT support other than the IT support that it's usually available to me but you have to understand like… Okay so IT support about what? IT support of what? About, like, the LMS platform like Zoom like Team? I mean these things they're just up and running, they don't… It's rare that you would have IT support questions regarding these platforms unless there's a bug, unless it goes down or something like that, but it's… it's just a standard issue IT support so there's nothing extra. Um… so, when it… when it comes to I don't really know what you're after but when it comes to for example people having to learn uh… new software and new ways of doing things then the central university IT Support is not where you go.	ITS
9	KH	Okay what we were aiming for in this question was that when someone is experiencing for example technical issues, who can they reach out to? What help is there available to them?	
10	R3	Depends on which technical issues you mean if you have… If I'm trying to use Open Broadcasting Studio which I did a lot of recording and also to livestream lectures and stuff like that. If I had technical issues with that, then nobody's going to help me, if you have technical issues with any software or platform that is not provided by central **** university is not gonna help you. Even my computer is not central ▮▮▮ university one, it's uh it's not provided by IT department. If I have issues, they not gonna help me, but I'm fine with that because I was an IT consultant for three years. I can find my way around operating systems. I don't have issues with this stuff. But when it comes to, for example, you know? Yeah. But I mean when it comes to recording software that's not provided by them, we got our own recording software	ITS

		when it comes to hardware. Like the one I'm speaking to you through right now. Uh, I mean nobody… Nobody is going to help you with that. So, I did a lot of informal IT Support because I had… ██████████████████████████ ████████████████████████ So there was a lot of purchasing hardware which was actually very hard to do in the beginning of the pandemic because obviously everybody had the same idea and realised that we needed webcams. We need microphones and stuff. So that was a bit of… It was interesting. But no, I mean, it's the.. You know, the usual IT support… so, but it's up to the departments to sort of figure out how to… how to handle the situation.	
11	KH	So, regarding these equipment, were they provided by the university or was it up to the teachers to sort of get themselves up and running and get these facilities on their own?	
12	R3	Well, that depends on what you mean by the university. Everything was provided by the department of Informatics. So it's not like people went out and used their own money to buy microphones and stuff like that, █████████████████ But I would do all the… ███████████████ and so on and so forth, that we would do a lot of testing and you know, all this stuff. It's not that that was not managed centrally by ████ University, but in the sense that ████████████████████ it was provided by the university because it was provided by the department.	ITS
13	KH	Since you mentioned that you yourself provided a lot of this support for the other teachers as I understand it. Do you see something that could be improved to maximise the efficiency if this situation was to come again?	
14	R3	Well, that depends on what you mean by efficiency. And also, if this situation… situation was to come again, we are prepared. So it's not the same thing. But I mean you have certain things because the departments are the units that do all the work, right? It's not the faculties, it's not the university, they don't give courses, believe it or not, it's the departments that give all the courses. So I asked them this several times because what do the departments… Departments are good at teaching, but there are certain other things that the departments have no competence unless you happen to be in the department of film and media and you know, whatever they're called, post-production, editing… Mhm. I don't know much about editing. I did it for fun when I was a teenager, doesn't know that I'm a pro at editing all of this recording, audio	ITS

		video stuff. Like I had to learn all this stuff at the same time as I was doing everything else. So this is something that could have been managed centrally in the in the university, like recording studios. What camera should be used? What mikes do you use? How should they be set up? So on and so forth. That is something that could have been managed centrally. I saw… Because otherwise you have all these like amateurish attempts at it popping up. Uh, people using. I mean, I saw all kinds of horror shows where people were using conference microphones to recording and they tried to use Zoom as a recording tool and it's like it's just really bad and not recommended and it's not… That's… that stuff does not really up to like ███████ standards. No, that's what you get… You get a lot of ad hoc stuff when you don't manage it centrally.	
15	KH	Okay, so let's move on to our last question within this category. Can you think of any internet issues during this emergency online teaching?	
16	R3	No, not for me personally. But I don't trust eduroam. So that's why I don't have internet issues (interviewee smiles). So, but I mean… I think that probably depends on who you ask the… and where they're sitting and so on and so forth. But that's… uh that's… uh ████ building design issue. I mean the wifi in my room is crap, which is because I don't have a wifi booster in the ceiling, but that's fine because right now I have a wired connection, so… and that one never goes down. So, and if it goes down then I have the wireless one. But you know, the eduroam dies every now and then. But I never notice because I'm on a wired connection as well. So that depends on who you ask if they had internet issues on and so on and so forth. Eduroam goes down all the time, but I never notice in my teaching.	ITS
17	KH	And in terms of the emergency online teaching, did these internet issues influence the teaching anyhow?	
18	R3	My teaching? Not at all because I never had those issues because I'm prepared.	
19	KH	Okay, excellent. Alright. So let's move on to our next category about the teaching tools. So have you faced any challenges with the teaching tools during the emergency online teaching?	

20	R3	With what teaching tools, you mean?	
21	KH	Teaching tools such as you mentioned that you've used Microsoft Teams or perhaps you did the lectures as presentations, any issues with that? Or if you've used any video material?	
22	R3	Yeah… Okay. So I think I know what you're after. So, I use Microsoft Teams and I could add also that because everybody uses Zoom. So I use Microsoft Teams on principle because if you look back in 2020 Zoom had so many like blatantly obvious security issues, like it was really easy to crash peoples Zoom calls um and so on. So, and I mean my lectures are not confidential, it's there's no nothing confidential being discussed in those lectures, there's nothing even remotely sensitive, it's databases and programming. But on principle, I used Teams because I didn't… I didn't want to sit on Zoom with information system students and pretended that… that was a good way to work. So I used Teams on principle because of that. Now, I think they fixed all the security issues, but back then it was pretty bad. So it didn't feel like a serious thing to do. So I've used Teams. Did I face challenges? Well, um what's… One thing is these video conferencing apps are not made for lecturing in case you didn't know. So Zoom and Teams are not made for lecturing neither of them are. So if you have a fancy microphone like this (interviewee point to the microphone), it doesn't matter because Zoom will compress the shit out of the audio. So it doesn't matter if you have a really nice microphone, you will get the same quality as someone with, like, a $2 microphone. So, whatever nice hardware you have doesn't matter. Same with the camera, it will compress the video as well. And so, I thought I was gonna be clever. So I don't know if you know what Open Broadcasting Studio is, but it's basically the software that all the gaming Twitch streamers use. It's also a great recording tool and you can switch between different scenes. Now, I… unfortunately, I can't show you. No, but you can essentially switch between different scenes, you can show yourself the PowerPoint, you can show only the PowerPoint, you can show two windows at the same time where you can show your virtual machine and yourself and you know, or your IDE, your programming environment and yourself. So you can switch between all of these things and that's great for video recording. I've used that a lot. And you can also do it by… You can make your…You can create a virtual webcam. So you can… I can take my webcam here. So right now you're looking at me. I'm thinking I might actually be able to do it. (interviewee starts demonstration of Open Broadcasting Studio) So right now you're looking at me through my webcam, the one that's sitting on top of my monitor. But if I start my virtual webcam and I'll just say…	CS, TT

		Yeah that's something here… Firefox Windows… window here… And then we will switch to video source to virtual webcam. And there's you uh and there is also you in the sense that you see that's a window and I can… I can just switch to webcam only, desktop webcam, see, there's only you and me and so on and so forth. (interviewee finishes demonstration of Open Broadcasting Studio) So you can do all of this stuff and it's great and that's how… that's how streamers work. I should switch back to. Yes, so that's how… that's how the streamers do it because they make a living out of this stuff. So they have a whole bunch of different sections of the screen and they have to show their donation counter and you know what not. So I took inspiration from that. But of course this doesn't work. Why? Because if I tried to show programming code in this way it will be too low resolution. Why? Because much of Teams and Zoom compress the video because their priority is not for people to see as long as they can see that it's kind of you. It doesn't matter if it's, like, really high resolution. So they don't they don't prioritise webcam quality and they don't prioritise audio quality either. It's sort of… Sort of prioritise that it sort of, kind of works its way it's way different than if you're looking at someone who is live streaming. And I was actually… I actually looked at the live streaming platforms. So I was like, okay, I'll use Microsoft stream because we have that one inside office 365. No, there's a 30 second delay. So that kills all interaction attempts with students and 30 seconds was the lowest one… Others would have even worse delay, so that didn't work and the youtube one, I don't remember what the problem with that one was. I think it was much better delay wise but I didn't go for that one either and then it was you know sort of like… Yeah I think it was because I then I would have students make google accounts in order to be able to interact with me and it would be stupid. So then I would have had to go to Zoom and Teams… Well I've used Teams. So I guess you could call those challenges but it does depend… You know.	
23	KH	So, do you see any other improvements that could be made to these tools? You've already mentioned the video quality and the sound quality?	
24	R3	Yeah, but it's, like, it's almost like you need a tool that is… that is made for this. Like it's like we would need a proper streaming platform. If you want to stream lectures properly because these tools, they are video conferencing tools and they have to be seen as such. It's not like you improve the videoconferencing tool and it becomes like a live lecture tool. No, because it wasn't one to begin with. So stop trying to make it into one is the… The whole… whole Zoom thing and the whole lecturing over Teams that is a result of what you could call a state of emergency. It's not	TT

		something that is when advised. No, I don't think you should improve them to the point where you can have live lectures is instead we should have an actual streaming platform that is made for that. I've considered having my lectures on Twitch actually but that would probably also turn into a crab fest. So I decided against that…(interviewee smiles)	
25	KH	Um… Okay let's move on to our next question. How do you perceive effectiveness of asynchronous online classes? So those are the classes that are available to students 24 hours seven days a week. Have you… Do you have any experience with that?	
26	R3	Yes, because I did all of my classes like that. Um What I would do is I would have my lecture and I would record it at the same time so I would have a live lecture and recorded at the same time and if they would ask questions then they would raise their hand, I paused the recording because of GDPR. And then they would ask a question and I would unpause and answer it. So yeah it's pretty silly, like, but that's what we have to do and so I did that and I thought in the beginning like okay but if I do this and that is why OBS. Is such a good tool because that's how I record my lectures, fantastic tool actually And I thought okay but if I do this then my attendance is gonna drop to zero because nobody can be asked to go to the live one and everybody's gonna look at the recording but let's see what happens and that didn't happen. I had like 70% attendance or something or like close to normal ratios actually. So people actually like the interaction and of course there's not as much interaction as in the live lecture on the campus lecture, it's not the same thing, you know of course, but it worked very well. Students were very positive towards the recorded lectures because programming concepts and database concepts and database theory and stuff like that can be pretty difficult to grasp on the first listen, you know, so they really liked being able to go back and you know, they can rewind and play my examples and you know the stuff I say as many times they want. So that was… And I have to say I've got a great feedback from that in course… On course evaluations, they said it should always be like this and that's a challenge. Making campus lectures like that. Then you need infrastructure. But that's a question which is out of your scope. But no, that worked very well as asynchronous was extremely popular among students.	TT
27	KH	And what about usage of wikis, blogs or podcasts in this emergency online teaching?	

28	R3	I didn't use any of that. I have a very simple model. I had pre-recorded videos. I have pre-recorded videos and those are of course much better production values than my live lectures. Because the recording in my live lectures, I'm like " Uh… Yeah… What was I going to say… Uh…" You know, this stuff doesn't exist in a pre-recorded video because I sort of have a script in my head and I'm more prepared. So, live lecture is a lecture but I have pre-recorded videos on stuff that I know that I often repeat. So if you ever taken a database course in your undergraduate studies, I don't know. But there's like the normal forms, 1st, 2nd, 3rd normal forms, me explaining 3rd normal form, I can package that as a video and then they can watch it 1000 times. They did it like I've seen in the YouTube statistics. I've put it up on YouTube but it's unlisted. Uh, so, so, I would package those kind of things as pre-recorded videos. And then in the lectures I would try to give more examples. I would of course explain things to people who would ask questions and stuff like that. So that sort of different… differentiation worked really well. But that was kind of, that was it. That was all I did. I've had pre-recorded videos and I had my live lectures that were also recorded and apparently that made for really good courses. And of course I had, we had the lab, whole lab thing with the teaching assistants running around and they will be able to have to listen to them and doing lab hours and so forth.	TT
29	KH	And our last question within this category. Have you communicated with teachers or with other students via social networks?	
30	R3	Social networks such as…?	
31	KH	For example, Facebook or WhatsApp.	
32	R3	No, I keep my… When it comes to students, I keep my communications very much via email. I tell students at the beginning of course you have, one way to contact me is via email. Well, that's not really true because I did my office hours via Microsoft Teams. But for normal communication, that is not like dropping office our type stuff, then I would have everything by email because if I have like five different channels, then I'm gonna go crazy. So, no.	SN
33	KH	Okay, thank you. So now we can move on to our next category about cybersecurity.	

34	AB	Thank you so much. Did you feel more exposed to cyber threats while you were working from home?	
35	R3	No, but I mean, okay, so what cyber threats then? Because cyber threats is a huge umbrella term.	CS
36	AB	Yes, it is. But any… any that you can think of?	
37	R3	Yes. Okay. But no, not really. Because I mean we get phishing attacks all the time. People, I mean, they're really crappy and low effort and yeah, no, not really. I mean, they tried to phish me and no, not really. I mean, I use Microsoft Teams, I cannot trust Microsoft when it comes to cybersecurity. I never doubled into Zoom stuff and um it's… it's funny because I have uh…bachelor's students. I'm supervising bachelor students on this topic right now. Like are you more exposed at home to social engineering attacks and stuff like that, but I… I never felt any of that.	CS
38	AB	Okay, so you didn't notice any uptake in cybersecurity threats in this era of the emergency online teaching then?	
39	R3	Well, I mean are you asking a general question or are you asking me personally?	
40	AB	Well, if you noticed it while you were conducting emergency online teaching?	
41	R3	No, I mean not not in my work. Of course I read the news. So in that sense. Yeah, of course I would notice people bombing Zoom meetings and stuff like that but never have had that at the meeting, because I don't use Zoom.	CS
42	AB	And how have you experienced any security or privacy issues during your emergency online teaching such as students or hackers disrupting the class or did you feel well protected while you were using Teams instead?	
43	R3	Yeah. So nobody got into my Teams lectures. Um so the… the… the only there's a privacy challenge, it's not really a privacy challenge because it's a compliance challenge because you have to comply to GDPR, which makes the whole thing very stale because you know, I can't have a discussion with somebody. They	CS

		have to raise their hand to quote unquote in Teams and then I pause recording then they can ask the question, you know, because like, if… if they even sneeze on my and that ends up on my recording and that's personal information according to GDPR. Your voice is a personal recording. So even if you don't read out your social security number or something that's still personal information. So everything is personal information. So keeping that stuff out of the recordings was a challenge. Yes. But I wouldn't say that there were any information security challenges or anything like that. No.	
44	AB	And that's excellent. That brings us to the other questions which is the last category we have for you today. Did you experience any significant differences between your students regarding their tech skills? Tech skills in general? The tech skills that influenced how well they could absorb emergency online teaching?	
45	R3	Not really. I mean but that's also very hard for me to answer because I haven't quizzed them on this. But I mean it's in order to… In order to take partake in my classes, you need to know how to start Microsoft Teams. It's not that hard, especially not for IS graduates. I don't even think if you go to business administration you will find people who struggle to start Microsoft Teams. Um… No, so I mean the issues were more… there are all kinds of issues from Microsoft Teams but that… that's not challenges for them, sort of sort of, I mean I teach them databases and programming. If they… if they have problems with Microsoft Teams then they have different issues. You know.	TSI
46	AB	Yes, of course. So you didn't really see that there was anything impacting the efficiency of emergency online teaching sessions from that point of view that students had problems with the tools that they were required to use.	
47	R3	No, not problems stemming from their use. There can be problems stemming from the application itself and how it compresses audio and video and stuff like that, but there's nothing that there are no challenges or problems related to their use of application because it's basically you start to think and you stare at the screen so there's not much that can go wrong in my opinion.	TSI, TT
48	AB	Okay, well then, looking back on your days of emergency online teaching, is there anything that you would do differently if you had to do it again?	

49	R3	Well, I mean if you would put me again in like February of the 2020 and I would know everything then of course, ██████████████████████████████████████. So I mean if I had um If I had 20/20 hindsight, like of course ████████████████ webcams ████ ███████████████████ microphones and I would know to not use the streaming platforms and I would know how to use the OBS and I would know that it would compress the crap out of my videos and stuff like that. So yeah, I mean there's… <mark>there's a whole ton of lessons learned that I still used,</mark> by the way, because I mean I still have recorded video recordings and stuff like that in my courses. Um um Yeah, I mean there are just tons of things. I think if you… if you want the proper answer you could have been more specific.	OP
50	AB	No, we just want your take on it, your experience. So this is very valuable to us.	
51	R3	But you're asking a huge question because you're asking about the whole pandemic response and I mean is there any specific part obvious that you're curious about?	
52	AB	Well, if there is anything you feel that would have made the outcome of your emergency online teaching activities more efficient from, like, an IT Support point of view, cyber security point of view, teaching tools point of view?	
53	R3	Well, I mean but but it's a question of like yes if I would have 20/20 hindsight I think I would know everything done that. <mark>I know today of course I could just start much much more easily.</mark> But it's but it's like a question of that scenario will never happen because I mean I don't know there's no time machine and stuff like that. I mean you end up in scenarios like this and you have to sort of work your way out and uh it was basically just a lot of learning for me as an individual. So I had to learn new tools such as Open Broadcasting Studio which is pretty good, you can use it to record interviews among other things. <mark>So you know there's just a lot of personal learning for me and of course if I didn't have to learn anything and I was already an expert at these things or I had like an in house audio video consultant and an in house post-production person, that would have helped</mark> but I don't think I would get that regardless because that would cost money.	OP

Appendix F - Interview 4

Organisation: Swedish university

Date: 2022-04-27

Interview length: 34 minutes

Language: English

Participants: Respondent 4 (R4), Klaudia Huzova (KH), Amina Borafia (AB)

Row	Speaker	Questions and answers	Code
1	KH	So, let's start with our questions about overall perceptions of emergency online teaching. So when you think back at the time when you were first informed about switching to exclusively online teaching, what was that day like? Were there any specific tasks that you performed? Did you know who to contact? Have you thought of any technical issues?	
2	R4	Um… Well, um… I work as a teacher as you might know, but I also work as a researcher within the area of online teaching and I'm a teacher on a program where we have both campus students and online students. Uh and this was a setting also before the pandemic hit us. So when it comes to our program, we sent out a few messages to our students. We're using a tool called Discord. I do not know if you're aware of that tool? (researchers nodding 'yes') Saying you're from now on, you're not allowed to come to campus. Ah, but also before we have sent all our um… classes in Zoom and recorded them. We send the link out to the students and we continue to do that in the same platforms. Using the same tools as we did before was for us kind of easy to switch to this emergency online. Mm-hmm. But at our university, we have a lot of people and teachers and students that was not used to online emergency online teaching. So what we did was that we gathered, I sent a message to teachers that I know had the same experience as I and asked them if they wanted to help other teachers that did not have this experience. So, we set up a network. Um… and could ask the question of in… both in… by email. But also we set up. I think it was once a day, one hour had some kind of office hour in Zoom and then we had um shifted… So I was there one day, another of my colleagues another day. So we could ask the answer questions from other teachers that was kind of new for how to use Zoom or how to use other kinds of tools that you were supposed to be able to use when… when we	TT, OP, ITS

		shifted to online. So, in that perspective, I also um said to our support division if you need some help. I also could be part of the support staff. And then I was added to a system where we could answer a question from staff all the way from the university. So in that sense, my work situation changed from meeting my own students to meeting other teachers. Mm-hmm.	
3	KH	That is a great approach that you have there. And could you describe a typical day in this emergency teaching setup? How does it compare to the teaching before the pandemic?	
4	R4	Hmm. In a general, I think that the main thing that differed was that we were sitting in front of our computers all the time staring to… (interviewee smiles) Your own face teaching and meeting. And… and that there was more meetings than before. So a lot of both Zoom meetings Teams meetings. Both with the students but also other colleagues. Um your nearest colleagues that your earlier met when you grab a cup of coffee or seeing them in the corridor just ask something. So it was, I think, that was the most striking thing in my daily work all these meetings and also formalised meetings because if you want to meet someone in Zoom you have to send an email, you have to decide upon the time, blah blah blah. So that's something I think, um… changed a lot um… because everyone also… so, at the university starts to work at home, of course. So there was also some practical issues. My… my husband is also… is also a teacher and our daughter went to gymnasium and she was supposed to sit at home. So we had some problems initiating problems. Where should we sit? How could we use the house in the best way… ah… to be able to find a way… this is my working place. This is your working space. So I think that's. Uh huh. The most thing that… So during this period we have a lot of um I'm a supervisor for, uh… thesis on B Level and often I use I used to meet those students in Zoom, so from that perspective was no change actually.	OP
5	KH	Thank you. So let's move on to our next category questions about IT Support. So could you describe the IT Support that was available to you during this emergency online teaching?	
6	R4	From former perspective, the university did not have the um… Did not have any extra support to give. So that's why the teachers tried to you know actually I think that the IT Support also um uh try to prioritise this type of question. So I think they put aside some other projects and try to I remember now, put more people in helpdesk answering questions so there were more people that could answer question, possible question from… from teachers.	ITS

		Um So from that and we have… we have one we have one department. I don't know if you have questions about that. We have one department that is responsible for the IT and infrastructure and then we have another department that can answer the question of how to use those tools when you teach. But both those departments also work more together and try to involve more people in… in the sport um… stuff.	
7	KH	Have you experienced anything that could be improved about this? IT Support to maximise the efficiency of the online teaching.	
8	R4	I think that's at our university. Slowly slowly the IT support have tried to go from support campus students to online and hybrid formats and this pandemic situation has put focus on that it's very necessary to um make sure that we have the right equipment in our classrooms and and so on. So… so I think that it's, it had brought some things that have been better than before. One very practical and concrete example is that IT support is not sure what it's called in English, but it… they have, yes, for example, on Tuesday, I visit those three classrooms just to make sure that everything is working. They did not do that kind of rounds before and that is something that, oh, they will see that one teacher, you know, teachers are very… they're doing… they're having their class and then, oh, just move on and then they have moved uh what is called the power supply slab (Swedish) What it's called in English?	ITS
9	AB	Cables.	
10	R4	Yeah, cables. So they left the cables or they forgot to put things that have to be loaded at the right place and… and infrastructure personnel see this. So making sure that we have minimised those kinds of problems.	
11	KH	Okay. And have you experienced any internet issues during this emergency online teaching?	
12	R4	No, it's been amazingly stable. Both Zoom and Internet been extraordinary. But we have a good internet at home and that was necessary of course. But we also thought that maybe some students will have some problems but not… not any wide extent. We also have a… Working on a program ah… The students are	ITS

		interested in IT and infrastructure by themselves because they study Informatics program.	
13	KH	Great. So let's move on to our next category about teaching tools. So have you faced any challenges with teaching tools during emergency online teaching?	
14	R4	As I said, we already have found some tools but… but I but I I think that most teachers find out that um if you have ordinary of course maybe you meet your teacher… your students (interviewee corrects the statement) about… What do you think? What is your average? Two or three or four times a week? (researchers are nodding) And it's some hours each time? And if you meet them on campus, the student meet, meet, meet up maybe before they go and have lunch together or catch a fika, a… or whatever. But meeting the students online means that that's the only time when they meet the teacher and each other and you set up a meeting in Zoom and then we meet after. How should students be able to contact each other? What kind of tool can they use to be able to find someone? "Oh, I'm struggling with assignment one. Is there anyone else struggling with assignment one?" So I think this type of tools and so I think that we have found that we have a learning management system of course everyone has this nowadays. But it's more, like, ah… people don't go in there all the time to find someone else. They're using it to find their assignments and receive their assignments. So what we see is that you have to set up again more formalised meeting. Maybe you can just come in here if you have any type of questions. I'm there as a teacher if you want to talk about your dog, come and to talk about your dog, whatever or an assignment or have a question about the content of the course just to be there. But I also think that a lot of teachers found out that using Messenger or Facebook or as we do, Discord, is very necessary to be able for the students also to find other students and yeah, to be able to communicate with other students and as a teacher communicate with your students of course. Um, I got a lot of messages on Discord. That's what's making my day as teacher fun and worth being a teacher.	OP, SN,
15	KH	So can you see any improvements that could be made to these teaching tools that would make the teaching experience better?	
16	R4	I think this type of tools using, for example, Discord our university now have, have set up so that all students can use Microsoft Teams. And I think it's absolutely necessary if we have students that are either ah, entirely it online or partly online to be	TT

		able to just sent over very fast chat conversation or um, finding another student or for the students to set up some chat group for if they are supposed to doing some kind of group work together. So that's one thing um, a lot of people discovered Zoom that's necessary of course together with the learning management system. We also use when you're working with different kinds of group work. So if the students are supposed to put up code together, they will have to use the Github or whatever… Some kind of similar to… But also if you want to write together, you either have to use Teams or Google Drive or something like that. It's totally impossible otherwise. So, so what we've seen for some years is that we use, ah… we need a lot of tools. I also have colleagues using Padlets. It's to make sure that classes you give are more interactive and you can work with the students, maybe put up a pull Padlet or questions and you can vote for something, you can divide them into breakout groups just to make sure that there is not just some kind of monologue for hours and hours. Um so that's, I think you need a lot of different tools because you want to do different things in different courses. You have to choose, um… a number of tools to be able to do what you want to do. And I think that the university is finally starting to, and the support organization, finally see that this is what we need. So we have to have this broad plateau of tools.	
17	KH	I would like to ask you a bit more about the use of social networks. Uh you mentioned that you use the Discord. Did you use that to communicate with other teachers or only with students? And have you used anything else other than Discord?	
18	R4	Um… We used Discord to my nearest colleagues, all the teachers involved in our bachelor program is also used in Discord. So I used Discord also to discuss things with my colleagues and the students.	SN
19	KH	And how do you think that impact efficiency of the online teaching?	
20	R4	Oh it's I've done some studies myself interviewing the students and it seems like Discord is one of the things that makes it standable and possible to go to education that is online for three years. Those students also connect on their own, I don't know if you Discord but they put up their own servers. One server where they can go if they want to listen to music together. And the other one if they want to play some computer games. And the third one this we only use on Fridays when we're having a beer. So it's very kind of the social networking hub or the things that put	SN

		things together. So I think it's very necessary. But I also think that all the tool that I mentioned is very valuable. But I think that Discord is the channel where if someone… It's easier to send an message on Discord both of your teacher or another student. "Oh I didn't understand that. Do you.. Can you please explain, or…" Sending a mail is more formal. You have to start with: Hi, I'm my name is blah blah blah and I'm taking this course with you blah blah in Discord they know that I I will know them. So that's kind of as you ask in a direct message in your phone you don't sign with: "Oh, sincerely ▮▮▮▮▮▮" You just write whatever you want. So it's kind of a shorter and faster way to to communicate everything. We have very good experience in using Discord also because I think a lot of our students have used Discord before but we also tried using Facebook and we also always have a student that don't do not want to use Facebook because things are recorded. You share data, you can see what people are doing in their private life. Discord isn't like that. You can see if people are playing some kind of, I can see listening on Spotify but you can turn that off so otherwise I cannot see anything about a student. We don't even have to be friends on Discord. So…	
21	KH	Thank you. That is very valuable insight. Um next we have some questions about asynchronous online classes. So those are the classes that are available to students on-demand 24 hours, seven days a week. So do you have any experience with this? How did it impact the efficiency of the online teaching?	
22	R4	Um Yeah I think that we try to find ways of both using asynchronous and synchronous techniques and tools when we set up a course and as I said we record all classes or lectures and the student can use them both during that course, but they can also use it two courses later if they found out: "Oh that was something that the teacher said in another lectures", they can go back and use and see it and we can see that some of our lectures, especially within programming databases, they have thousands of downloads. Students use them all the time, so they're very, uh… appreciated from our students. And also we also have, it happens sometimes we have a teacher that is sick or something, then we can use the lecture from the last year. So it's a very good thing also to in terms of efficiency to be able to use older material. So that's one thing then the forum both and Discord and in Moodle as we use are open all the time, people could um put up a question whenever they like. A good thing with Discord is also that it's possible to… with those signs to see which one that are online and which ones that are offline. So it's easier to find someone else that want to to talk with you. But otherwise I think	TT

		we've worked a lot with synchronous um seminars discussions but we let the students choose the time that's the best, in Doodle for example, or um so we have since our program is 100% full-time studies and online. Um It is important for us to meet the students several times a week and then it's synchronous of course. But we also put up a lot of other material. We try to really have all the assignments ready when the course starts. I am an examiner of… of a thesis course and even the instructions for… for um… for some of the seminars are already when the course starts. So even if it's seven weeks ahead, you can read what you're supposed to do in seven weeks. And that's, that's good for me and good for the students. So that's also the way you're working with it.	
23	KH	And what about usage of wikis, blogs or podcasts have you tried to use and utilise those?	
24	R4	Um, I have not. Um mm hmm. And then I know I have a colleague that used to record himself when he… To deliver the feedback to the students. So that's some kind of maybe some kind of um blog. Video blog you can say. But it's only sent to the student that have done his assignment of course. It's not open for everyone. The students like that. He's uh, he's working in courses in programming and he's sharing his screen and talks at the same time: "Oh no, I try to do this." And… and the students really see that: "Oh, now I understand what is working". Because if you try to type that in text. It's very hard for the student to understand. "Oh, is that really a problem with why, why? What did you do to make the program crash?" So otherwise I have not tried. I've tried some forums with a lot of.. In a PhD course we have a forum where students are supposed to… Obligated to answer each other's messages and so on and then you have some kind of… Yeah, but it's not a blog, so…	TT
25	KH	Okay, well then I guess we can move to our next category about cybersecurity.	
26	AB	Thank you so much. Did you feel more exposed to any cyber threats while you were working from home?	
27	R4	No, personally I did not but… but it kind of… we soon got this news about people coming into Zoom room so that was kind of obvious. We discussed it in… in… in among colleagues. How does it happened? What should we do about it? And we have no personal experience. Ah but then it was very obvious because	CS

		Zoom has this um updates all the time. And that's… most of them were connected to security, so… No.	
28	AB	Okay, so you didn't notice any uptick in cybersecurity threats in the era of emergency online teaching?	
29	R4	No, but it could be connected to the fact that we shared our recorded lectures before that we were used to let our Zoom rooms be open. Ah So no. Mhm.	CS
30	AB	Have you experienced any security or privacy issues during emergency online teaching? Such as students or hackers disrupting your class or sabotaging your virtual environment.	
31	R4	No, not even on on Discord because in our ordinary systems like in uh um Moodle for example, this is not uh yeah, if you're a hacker, maybe you will be able to to come in there. Otherwise the students, it's controlled by other units at the university that only the students that are admitted to this course are on could access all the files and so on. But um no, I didn't notice anything.	CS
32	AB	Um That sounds very good	
33	R4	Or, or it happens a lot and I'm not aware of it. (Interviewee smiles) I'm not sure, but we didn't see anything, so. Mhm.	CS
34	AB	Well that brings us to the other questions. Did you experience any significant differences between the students regarding their tech skills?	
35	R4	Their tech skills?	
36	AB	Tech skills in individual students, like one student is a lot more tech savvy than another. And did that impact the effectiveness of your online teaching efforts?	
37	R4	What we have seen during the years is that, I don't know how the classes you have have had, we have around 40 students and if you have most of them online, it's easy to think that all the students are as active, um and that everyone is active based on and that is maybe connected to their abilities to put questions and	TSI

		using the chat to do that and that's some kind of tech skills. Right? Yeah, so, but what what we have noticed is that often you have, it could be five or 10 students that are very active putting up questions a lot of questions but then we have a group of students then there are students, they don't have any questions, they are fine anyway, they know how to solve the assignments but then we have a group of students and there are some students in all classes I think, that maybe don't have the skills to add the texts, or how to approach, how to formulate the question. Um… So, and what we have done about it is to… we also have other types of seminars in small groups. So we also have a lot of talking session and where the students can talk because I think that we can see that… that we have some students, I think it's very problematic when we have long written assignments but they are very good at presenting things like this. So what we're trying to do is to have both to be able to have several ways for them to show their skills in the content because that is what we want to know if they have learned how to program or if they have learned how to understand something or but the way to do it is either through text or some practical task or by presenting something. So there are some and maybe that will be more you see I never thought about it in that perspective that it will be even more invisible if you have them in the classroom because I think that something that is very common when you go online and especially emergency and in the beginning you have more written assignments because you want to control if the students or control or help them or I think that's different, but you put up more assignments just to make sure that they are with you and understand. And it could be also some kind of um feeling, I think as a student at this year, I really want to control and then there's a lot of written assignments of course. So, mhm.	
38	AB	What can be done to minimise the gap between the students?	
39	R4	Um… we have worked a lot with uh not thinking or making presumptions of what the students have and know before they come to us. So we did it as I said, we use, I don't know if you're familiar with Github. (researchers nodding yes) Do use that in your program? It's a very complex software that you used to share code. And what we do is to also have lectures in how to use Github, to make sure that everyone know how to use it. Because what we see before we did that was that some groups found Github and shared code and everything went fine. Others find for example Dropbox and what happened? They mixed it up for each other. So a couple of days before they were supposed to present this, they have erased the code for each other and just a messy the situation. And that's not fair that some students finds	TSI

		adequate tools and others do not. So that's what we're trying to do. Finding ways of also present to that: "This is a tool you can use". Our recommendation is that you use… We use Figma probably you know that tool as well (researchers nodding). This is our recommendation. Please choose other tools if you want. But this is what we recommend and… and then it's not connected to whether or not you know this in beforehand. So that's one thing I that I think that we do and the other one is to have a variation in in in in in types of examination, sometimes it's group based, it suits some of some students better. Other times it's individual, it suits others better and uh written assignments, it could be workshops, very short written assignments, more of a power point maybe… So we try to have a variation. I think that's the two strategies. Yeah, maybe. But I also think that being present as a teacher will help you also to… so that it doesn't feel like you really have to be on your knee and be very kind to… to make the teacher help you were there for all our students and sending a message… Uh To only the teacher is maybe easier than putting on a post in the forum saying: "hello, I don't understand anything. Please help me?" Yeah.	
40	AB	And looking back on your days of emergency online teaching, is there anything that you would do differently if you had to do it again?	
41	R4	Maybe finding ways. And that's also… it's connected also to the students. But there was a lot of meetings and maybe we should have found time to have more office hours… um Where you meet several students together, some group supervisioning or something like that, but also together with other colleagues because I thought that it was talked a lot with 1-1 and I think that's not efficient. And it's also made… made you feel more lonely maybe.	OP
42	AB	So as teachers, you also felt socially isolated when this happened?	
43	R4	Yeah. And a lot of the teacher did so and… and… I and my colleagues were used to work with this. Yeah. Yes we did. And… and and when it went on and depending on your personality, of course you start to almost forget how is feeling to meet people on campus and… and the energy that it could be in a room that never really happens in the Zoom room. Right? So yeah, I think also the teachers felt kind of isolated.	

Appendix G - Interview 5

Organisation: Swedish university

Date: 2022-04-28

Interview length: 32 minutes

Language: English

Participants: Respondent 5 (R5), Klaudia Huzova (KH), Amina Borafia (AB)

Row	Speaker	Questions and answers	Code
1	KH	So let's start with our first category. So, questions about overall perception of emergency online teaching. So, when you think back, when you were first informed about switching to exclusively online teaching, what was that day like? Were there any specific tasks that you performed? Did you know who to contact? Did you thought of any technical issues?	
2	R5	Um… That very first day I believe that there were many things that came up together. So, the first thing, of course it was okay, "what is that Zoom"? We have not used Zoom before in our teaching. So we have to try and find our codes how we can enter with our university uh credentials. So that was the first thing uh and uh I think it was practicality is the first day. So I was thinking how we're going to adapt and how we can try to learn these different um the tools how we can um use better PowerPoints or other types of teaching that we have by only using this platform. So I think it was practicalities mostly.	OP
3	KH	And could you describe a typical day in this emergency teaching setup? How does it compare to teaching before the pandemic?	
4	R5	At the beginning, it was a lot of preparation uh to find the right place in… Uh… Because we were at home. So, to find the right place at home, to schedule that everyone that it is still at home, children, husband that everyone would be at the right room, to be quiet. So at the beginning there were many many practicalities. But I have to admit that as the time passed and we found our balances. I think it was very easy. I knew that now I have a course, a lecturer meeting or whatever and then I needed uh less	OP

		time preparation even from the physical meeting when the physical meeting accused then I needed much less time.	
5	KH	Okay. Thank you. Uh so let's move on now to our next category about IT Support. So could you describe the IT Support that was available to you during this emergency online teaching?	
6	R5	Okay. Um… I think at the beginning of our IT support was very good. They are usually answering emails very fast. But I remember at the beginning that was uh not always happening because of the huge workload of course. But I remember that I had to… to change a tactic not to send an email but to call them and when I was calling them then I had always respond and help from their side. So it was not that difficult. And of course since we are at the same on the… on that field, the informatics field, it was a bit easier also for… for us to solve these practicalities… Uh.. quicker.	ITS
7	KH	And have you experienced something that could be improved about the IT Support to maximise the efficiency?	
8	R5	Mm hmm. No, I believe that it was a very, very special case. And they were… Um… They suddenly… They have a huge workload from so from 5 they went 100 in 2, 3 days. So I believe they handled it quite well. Maybe again maybe for us as an informatics, it was not that difficult. We needed help with passwords and with the lycenes we didn't need support with the actual tools. So maybe that's why it was easier for us. Mhm.	ITS
9	KH	And can you think of any internet issues during this emergency online teaching?	
10	R5	Uh… That's true. Uh… because we were working from home, I used to have really good uh internet at home but during that period I had to move to another place and in that place, uh… router was a bit far from the room that I was working in because of that um balance that I said. So we had to split the rooms and then uh sometimes I noticed that I had a very small problems like I had unstable connection sometimes. But I was lucky because one or two times during those 1.5 year that I had to work with that internet connection, I've lost connection with Zoom. But it came uh very… It came fast uh again back and I didn't lose the students. So the only problem that I had it was that I lost connection, I was disconnected but connected at the same time	ITS

		and the students were there. So I didn't have to start the session again. That was the only thing that I was very afraid of that I will lose the students and that I would have to start the session again.	
11	KH	So even if you came across any internet issues you were able to solve them on your own and it didn't have large impact on the teaching experience.	
12	R5	No. Yes and again because of our field, some bigger problems so to start the router… I could do that by myself, so I solved them by myself.	ITS
13	KH	Okay, thank you. I think we can now move on to our next category about teaching tools. So have you faced any challenges with the teaching tools during this emergency online teaching?	
14	R5	Uh what when you're referring to teaching tools, what type of tools, you mean? They're available ones, the ones that we used to use before online teaching?	
15	KH	For example, you've mentioned that you've used Zoom or you've perhaps had any PowerPoint presentations, any material that you used with the students…	
16	R5	Um… I didn't have any problems to be honest, it was quite the fast learning curve. So with Zoom I could um use all the material that I was using before. Only the only problem, let's say it was with the workshop. So when we have workshops, the personal contact is at the first place. So that was at the beginning, I was looking how we can use it, all the different techniques that we use in the class, like um we used to play cards or to have some planning games. But I was looking if there are online corresponded to those. So I have tried to use the online version of the different techniques that teaching techniques and with the breakout rooms we could, let's say I try to make it even that it was like the person… the in person teaching.	TT
17	KH	And do you see any improvements that could be made to these teaching tools to make teaching experience better?	
18	R5	Uh, everything was through Zoom. So Zoom provided… Seems we had the full license provided us with a large number of students provided us with breakout rooms. We have the white	TT

		board. I think I was satisfied. But I… I have not used the other tools. I have used only Zoom. So I was quite satisfied.	
19	KH	Okay. Um and do you have any experience with asynchronous online classes. So those are the ones that are available to students 24 hours seven days a week. How do you find effectiveness of these?	
20	R5	Um, No. You mean that um the students have a task or how you mean they are asynchronous? They have a task and we are available for them through Blackboard lets say?	
21	KH	For example that there is a video lecture prerecorded and uploaded somewhere and then they should watch it.	
22	R5	Yes, yes. Thank you. Yes. We had At the beginning we started with video lectures because we thought that it was better because the students have always um, you could always have access to that. But uh, later at least the in our field for our students, we have noticed for many courses that the students were not that happy. So they didn't like the video lectures. So they preferred uh to have not flipped classroom, they preferred to have live lectures and um uh to have time with us to answer their questions. So they at least in our courses and with other colleagues that we have discussed, they did not like the video lectures. Maybe a combined, maybe if we combined with the lectures with the live lectures, but they did not like of course to be only video lectures. Uh…	TT
23	KH	Could you please elaborate a little bit on what were the reasons that the students gave, why they didn't like these asynchronous online classes?	
24	R5	I believe because this is completely my personal view, but I believe because at the beginning uh it was at the very beginning of the pandemic. So they were we were going from the completely uh campus um teaching to online teaching and there was no something in the middle. So one day they saw us in the lecture and the other day they were watching the video. So that was I think something very strange and they didn't like, I think we had to have a period like to go from one place to another. So that's why at the beginning they were complaining that online that they did not like the video lectures. But then um with the, with and I believe that with the online with the live lectures at least they feel that the teacher is there and we can actually ask questions or even	TT

		if they don't ask they have the feeling that it is an actual lecture. So and maybe later after the two years because it was a long period, maybe later. Um I always be I believe that a combination of those two that would work even better if we have life lectures and then some parts to be recorded. I think that would be even more effective for our students.	
25	KH	And when you were conducting the live lectures, did you also record those and then published for the students?	
26	R5	Uh… I have tried to, you… to do that at the beginning but it was.. I think it was a long… Practicalities again. It was long file, difficult to upload then students have difficulties to download them with Blackboard, they were not working together very well. So we… I didn't do that. The students had always access to the lecture slides, to the material, to everything that we have done. So then we said that okay, this is like a live lecture.	TT
27	KH	And how do you perceive usage of wikis, blogs or podcasts in emergency online teaching?	
28	R5	In some cases I think that they were really useful to wake up the students not to be in their beds sleeping and just listen to someone into their ears talking. So sometimes when I have used okay, now we will listen something. We will watch something. They were more acting. At least some of them. So I believe that in that case it was useful.	TT
29	KH	So you've used them only within the class? Or have you also provided some sources for them to watch on their own time?	
30	R5	Watching, no, to be honest. But even though when we have live at campus, campus teaching, we always give the students material from different sources. So that was, that didn't change. They had access to different sources anyway. In that period, they have tried to use them into the teaching in order to uh for them to be more active.	
31	KH	Okay. So this brings us to our last question within this category. Have you communicated with other teachers or other students via social networks?	

32	R5	Uh no. With social networks. I prefer never to use them with students. Maybe… Um… and that's why we have the Blackboard. So we… we… we were using Blackboard for chat. But with colleagues. Um… Yes, that's true. At the beginning of the pandemic, uh we tried to use Messenger. So all colleagues, we had a group at Messenger and send each other messages. But it was not completely work related. Maybe it was some work related issues but not completely. It was mostly to feel that okay, everyone is here. So there.. If there is a problem or something, we can put it here. But also with other staff to discuss. Just to make sure that we are here and we can communicate. But with students no, I try to use only formal channels of communication.	SN
33	KH	Just a follow up question here. How do you think this impacted the efficiency of emergency online teaching?	
34	R5	Ah you mean by not communicating?	
35	KH	I mean the fact that you were able to connect with your colleagues via Messenger. How did that impact the efficiency?	
36	R5	Uh, in relation with teaching I think that we had that… It was.. The impact was positive, definitely. Because we had some… we were exchanging tips between us like um but not completely teaching related. Like: "Okay, tomorrow what you will teach?", but uh tips like: "Okay tomorrow you can go and pick up some assistance from the university" this type of tips. But of course it was a positive, always positive impact. Even if it was small to our teaching. Uh um it was affecting our teaching it was positive, definitely.	SN
37	KH	So I imagine it also had a positive impact on the social aspect. Um… Because sometimes one can feel a bit isolated working from home.	
38	R5	Yes. Mm-hmm. And that was also the purpose for creating that group. Because we had many colleagues that were living alone. So they were completely isolated. And we had… we… we wanted to know that everyone is uh okay. Not only healthy but also not only physically but mentally that they don't feel completely alone. So that was also another purpose for having that group.	SN

39	KH	Thank you. I think we can now move on to our next category about cybersecurity.	
40	AB	Thank you so much. Did you feel more exposed to cyber threats while you were working from home?	
41	R5	Cyber threats? Um, specifically?	
42	AB	In general. Cyber threats.	
43	R5	No. To feel more exposed and to feel that everything that we say is recorded now, it's… We are filmed. Uh we are more exposed in general. But not to cyber threats. I cannot say that.	CS
44	AB	Nothing specific?	
45	R5	No, I don't feel that we were more exposed. At least in our field because we work with computers anyway. So we are exposed anyway (interviewee smiles).	CS
46	AB	Yes. And have you noticed any uptick in cybersecurity threats in the era of emergency online teaching?	
47	R5	Um, cyber threat? Well, I don't know if that considers a cyber threat because I'm not an expert in that area, but sometimes at the beginning we had the students or users, that they were trying to enter our live sessions. Um and uh it came… I think in some cases it came up that they were not at least students or they were not relevant people that they could enter those sessions. So for that moment we have asked all the students to have their name and surname fully written in order to be accepted. But of course again, you understand that since we have a large number of students, more than 120 students, we cannot check manually one by one and then we try to give a code to the students uh to enter uh the the rooms in order not to have people that they're not allowed or um people that they were there to… I don't know to… For any reason that they were not supposed to be there...	CS
48	AB	Have you experienced any security or privacy issues during emergency online teaching? This might be an example such as	

		students or hackers disrupting the class of sabotaging the virtual environment. That's something close to what you just said. Right?	
49	R5	I didn't have experience with hackers, that they were disturbing my course, but I have experienced different students, that they were entering rooms when I was examining other students. So, and that was at the very first, at the very beginning when we didn't have the waiting rooms. So that was a learning curve to know waiting rooms, use passwords and then it um it was much easier, but at the beginning, yes, I have to admit that one or two times I've noticed students jumping in that they were waiting for their turn to be examined, but they were coming into the room and living so that I think that there's a disturbance in what I have experienced.	CS
50	AB	Did you experience that this was more like a mistake on the part of the students that they had done so without intending to disrupt anything? Or was it intentional?	
51	R5	Ah I believe that at the beginning for the students, it was by mistake. But then I believe that they could… Some of them they did it intentionally to get some information, about how it's only examinations, right? But then, I believe that we acted very fast and we didn't let them and the rooms… Especially with the examinations when we have waiting room and it's difficult for them to enter.	CS
52	AB	So, you felt that these measures were effective, that it worked what you did?	
53	R5	Yes, I felt that later. It was easier with, we used only three types of measures that I said, asked the students to have their full names. I asked them to have opened the camera and microphone when they were examined. Always. If they did not have the camera, we asked, we told them that you are not eligible to be present at the examination. It can be anyone else. Uh And then um using passport and waiting rooms at the examinations. At the lectures, I couldn't, to be honest, take every student that was coming in. At least I could see full names.	CS
54	AB	And in the ordinary lectures, did you experience any reluctance on the part of your students when it came to turning on their cameras to show their faces?	

55	R5	On live lectures, I have to admit that we were not um asked the students to open their cameras. Mhm. So I have to admit that at the majority of the times it was me talking to 130 black screens (interviewee smiles). Uh so at live lectures because they were they are not uh obligated to be there, we cannot ask them to open their cameras to be there. But at the examination that they are that are mandatory their presence is mandatory. We were asking to open their cameras and sometimes they were reluctant, especially at the beginning and we have had many different types of excuses but uh that "I do not have camera, camera is not working, I'm using the desktop" and always uh we as a practice at our department said, okay, you have a mobile phone, everyone has a mobile phone, open the camera from the mobile phone. So this is the tactic that we used as a department and it seemed that it was working then no one said that we do not have a camera on the computer (interviewee smiles).	
56	AB	Did you feel that this looking into the black screens, like you said, that it impacted your communication with your students negatively?	
57	R5	Well, at the beginning, I have to admit that it felt strange and because all the microphones were also closed, so it was talking to a black screen to talk to myself or it was quiet and no, but yeah, at the beginning it felt strange and as I said, the purpose were then to forced them to be more active. So I tried to enter some… of course we had to do some traditional lectures but then I had to uh stop the lecture for a while and for 10 minutes to make them do something, split them to break out rooms or show a video or um listen and then I started to feel that there is a movement…	OP, TT
58	AB	This brings us to our last category for today. Other questions. Did you experience any significant differences between your students regarding their individual tech skills?	
59	R5	Uh… What… What do you mean about tech skills?	
60	AB	I mean if it impacted your ability to teach online effectively, that some students were more tech savvy than others. Did any students share any information about having technical difficulties connecting or managing the tools that they were required to use to participate?	

61	R5	Um… Maybe at the beginning some small small small issues. But I believe that again, because our students are informatics students, they could solve those small technical issues by themselves. Yeah. In other departments, I have heard that they had students were facing more problems, but I cannot say that they had technical issues.	TSI
62	AB	Did you feel that this impacted the effectiveness of emergency online teaching sessions in any way?	
63	R5	Of course, when you are examining a group of students and one member of the group is, um… suddenly offline and cannot connect again. That's always difficult for you as a teacher to be fair to the other students to that student that was disconnected. So of course it affected.	TSI
64	AB	And what can be done to minimise the gap between students in your opinion?	
65	R5	Always… You are discussing about online?	
66	AB	Yes. Emergency online teaching.	
67	R5	Uh… It depends, I guess, on the situation. It depends if they have a lecture, it's a different approach if they have a lecture and different approach, if they were at the group examination. The group examination, they could choose maybe to be all together in one computer to make sure to make sure that everyone is there too um connect but then probably it's not possible for them to meet. So ah I think that the good organisation as I said to be sure to have you done that again, what we say all the time to check your equipment to check your connection to have your mobile phone stand by with data with mobile data in order if you need to, if everything crashes on your computer to have your mobile phone and then connect through your mobile phone. So to be prepared, I think this is what the only thing we can do in those cases. Yes.	TSI
68	AB	And looking back on your days of emergency online teaching, is there anything that you would do differently if you had to do it again?	
69	R5	Of course I have learned a lot of experience. Uh I have this learning curve even though if it was quick but I have learned a lot	OP

how to use all those tools. So um I would probably do smoothing the transition, have more life uh lectures maybe. Um I would have used more time like sitting in my computer and have the door open let's say to my Zoom room. Then, every some students come in and ask questions. I would use that more often to make them feel that it's I am close to them. I think that what I have done at… at the end when I have learned from all this situation I would have tried to do that from the beginning. But of course it was uh completely strange for… for all of us to do that emergency from one day to other. So I think that now we have learned a lot from this process.

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