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Special Issue Reprint

Emergency Remote Teaching during COVID-19 Lockdown and Its Implications for Higher Education Institutions

An International Perspective

Edited by
Elena Makarova and Kerstin Göbel

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Emergency Remote Teaching during COVID-19 Lockdown and Its Implications for Higher Education Institutions: An International Perspective

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Editors

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About the Editors

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Editorial

Introduction to the Special Issue "Emergency Remote Teaching during the COVID-19 Lockdown and Its Implications for Higher Education Institutions: An International Perspective"

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In spring 2020, the proliferation of the COVID-19 virus and the imposition of subsequent lockdowns across the globe demanded that university institutions undertake an emergency transition toward online teaching. To ensure the continuation of university teaching, emergency remote teaching [1,2]—including prompt rethinking and adjustment among university teachers—had to be managed. At least four semesters of online teaching had to be managed and deserted university campuses comprised a normal situation at the time. On the one hand, the abrupt change from in-person to online teaching was associated with the potential of digital, didactical, and pedagogical transformations to adapt to the pandemic-related lockdown. On the other hand, emergency remote teaching (ERT) posed extraordinary organizational, didactical, and pedagogical challenges. Universities and lecturers had to adapt to this challenging new situation via online teaching and learning arrangements, by preparing digital courses and adopting digital tools and programs [1,3]. To maintain contact with students and ensure the maintenance of the teaching mandate, a synchronous or asynchronous teaching format had to be created and the implementation of educational technology had to be intensified, e.g., through the learning management platforms and the use of videos, videoconferencing and other tools (e.g., [4–6]). Even though universities could already reflect on the approximate 20–25 years of development of digital learning media, the sudden extreme requirements and the challenging transition from face-to-face to digital teaching and learning formats found universities mostly unprepared [7]. Lockdowns and online teaching required students to find ways to mitigate the restrictions on their social contact, to reorganize their studies and to work more independently work more independently than they were once accustomed to. The digitalization of teaching and learning represented a complex process with challenges for universities, teachers, and students [8,9]. To understand this complex process from an empirical perspective, it is crucial to ask how university teachers and universities were tackling the coronavirus situation against the backdrop of the goal to maintain high-quality teaching. Furthermore, it is important to understand how students adjusted to the hybrid and distance-learning situations and how they managed their learning and psychological well-being.

This Special Issue provides unique insights into the organizational, pedagogical, and psychological challenges related to the digital transition in higher education institutions in different countries resulting from university lockdowns during the COVID-19 pandemic. It also discusses digital, didactical, and pedagogical potential evolving through the adaptation efforts related to the situation of emergency remote teaching at universities for university teachers and students.

The Special Issue integrates studies from around the world, focusing on university teachers and students in America, Europe, and Asia with a variety of study designs and methods for analyzing the questions. The wide array of studies provides comparative perspectives on the feasibility of ERT and some of the presented studies address comparative perspectives explicitly. The book is divided into three sections; while the first

section presents research on the teaching, learning, and research experience of academic staff during the first COVID-19 lockdown, the second section presents studies on students' perspectives towards remote teaching and digital learning during the first COVID-19 lockdown. In the third section, general considerations concerning digital education after the pandemic are presented.

The first section starts with a study conducted by Kaqinari and colleagues [10], in which they examined the differences in the use of educational technology for online teaching between university lecturers during the advent of ERT in France, Germany, Switzerland, and the United Kingdom. This study revealed that the differences in university teachers' adjustment to ERT across countries were related to institutional as well as personal factors. Moreover, based on a latent class analysis, four different types of lecturers regarding educational technology use were identified and characterized as 'Presenters', 'Strivers', 'Routineers', and 'Evaders'. A qualitative study conducted by Dorfsman and Horenczyk [11] also found differences between Israeli university teachers, concerning their experience and willingness to incorporate new pedagogical practices that allowed an adaptation to the new virtual teaching environments. These differences were expressed particularly in the capacity of perception (insight), the available repertoire of practices, and the teaching gaze. In their comparative study, Göbel and colleagues [4] showed that university teachers perceived the immediate transition from conventional to online teaching was most successful in German and Argentinian universities. Still, Argentinian university teachers reported a slightly more positive perspective and slightly higher self-efficacy beliefs in online teaching compared to their German colleagues. Individual experience and training as well as supportive institutional conditions seemed to be relevant for the development of digital teaching at universities in both countries. A study from Portugal [12] focused on university teachers' perceptions of remote learning during the pandemic, while Silva and colleagues also emphasize the relevance of former experience in online teaching. The results revealed that younger teachers felt more satisfied with remote classes and remote assessments. Overall, university teachers in Portugal considered the advent of emergency remote teaching as a positive period and were moderately satisfied with their teaching and use of digital tools. In their study on Finnish school teachers, Mäkelä and colleagues [13] showed that the most severely constraining factors in terms of well-being and agency were found to be challenges with the workload, time management, and interactions with colleagues. Difficulties with maintaining a work-life balance, a lack of home office facilities, and the adoption of new technological tools were reported as issues, demonstrating the need of teachers to be supported, particularly when extensive changes in teaching arrangements are expected on a rapid schedule. In Bangladesh, only a few universities began the transition to online distance teaching and learning activities as most of the higher education institutions there shut down their operations completely. Shohel and colleagues [14] report the great challenge of most universities to adopt online teaching and learning at the beginning of the pandemic. Many factors, such as preparedness, limited resources, including financial means, low digital literacy levels, poor internet connectivity, and a lack of suitable physical and virtual infrastructure affected this transition. However, the pandemic also seems to have created new opportunities for educators and practitioners to explore different, new digital teaching activities, leading to better preparedness for future approaches to delivering education in emergency situations. Finally, Naidoo and colleagues [15] studied the impact of the advent of ERT on the academic productivity of health sciences faculty members in a graduate school in the United States. The results show that an increased amount of time was dedicated to teaching and that teaching was prioritized over research, which affected female researchers more adversely than it affected their male peers. Hence, the number of journal submissions with survey participants was decreasing during the pandemic, and faculty members felt a loss of their locus of control, a lack of autonomy, and pressure to help students graduate on time and maintain the quality of teaching while dealing with uncertainty in both their professional and personal lives. The pandemic disproportionately impacted women and junior faculty members as connectedness and mentorship declined.

The second section focusing on students' experiences of ERT begins with a study by Mayers and colleagues [16]. They analyzed the essays of Japanese medical science students in the context of the COVID-19 pandemic and detected an increase in motivation to study. Japanese medical students further reported a desire to help others, contribute to the development of medical science, increase knowledge, and disseminate correct information. Despite the increased motivation, the prolonged period of the pandemic and lockdown measures exacerbated demotivation in online learning and negative emotions associated with lockdown, which was particularly the case for female medical students in Japan. Linnes and colleagues [17] investigated the experiences of students learning at a distance in Norway and the USA. The findings indicate disparities in student experiences in terms of course delivery, health, and overall quality of life. Different digital teaching preconditions in universities are considered an issue. Authors argue that higher education should improve their capabilities to keep their students tied to their universities. Research in South Africa [18] showed the differences in the experiences between students of rurally based universities (RBUs) and those of their counterparts who belonged to urban-based universities (UBUs). Pika and Reddy's findings indicate that home conditions, individual characteristics, pre-COVID-19 blended learning experiences, university training and support, teaching, learning, assessment practices, and policies altogether contributed to the exclusion of low-income students from active teaching and learning, equipping middle-class students with better chances of success compared to working-class students, and distressing female students and lecturers more than it distressed their male counterparts. A study from Spain [19] studied the viability of the online teaching of the subject of applied statistics in health sciences in higher education. Gutiérrez and colleagues showed that online teaching was feasible for the subject under study, although face-to-face learning continued to be reverted to a significant degree in favor of the quality of teaching. Most of the students reported not having technological learning difficulties, whether they were related to their connectivity or technological resources, which did not have a significant impact on their teaching perception. Despite the psychological sequelae of COVID-19, this did not affect the students' teaching satisfaction. In a further Spanish study on engineering universities, Garrido-Gutiérrez and colleagues [20] found that students' acceptance of online teaching was highly influenced by their social context, while the role of professors was also relevant but came only second to the former. Thus, it is important for universities to introduce e-learning with a focus on creating a positive social environment around the e-learning platform, for example, by using social networks or relying on testimonies given by professionals who can confirm the interest in such a platform in a future work environment.

In the last section, Kerres and Buchner [21] reflect on the impact of experiences in ERT on the general development of higher education. Regarding the use of digital technology, they assume that two contradictory visions for the role of educational technology in education after the pandemic may be possible: a view that implies fundamentally different perspectives for the future of education and a return "back to normal". The authors argue for a consideration of experiences of ERT for a consequential reformation of education.

In conclusion, this Special Issue offers unique insights into the challenges which occurred during the COVID-19 lockdown and the almost overnight shift from in-person to ERT for universities, teachers, and students globally. Referring to the perspectives of university teachers and students, the studies contribute to a deeper understanding of the processes underlying ERT and form a basis for further studies and educational reforms concerning digital teaching and learning in higher education. It is recommended that further research refines the understanding of differences among university teachers and students in their methods of adaptation to online teaching formats. The presented studies have strengthened and enriched international collaborations, as shown in comparative studies, which might also provide a foundation for future international comparative research on online digital technology in higher education.

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Article

A Latent Class Analysis of University Lecturers' Switch to Online Teaching during the First COVID-19 Lockdown: The Role of Educational Technology, Self-Efficacy, and Institutional Support

Tomas Kaqinari [1,*], Elena Makarova [1], Jacques Audran [2], Anna K. Döring [3], Kerstin Göbel [4] and Dominique Kern [5]

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Abstract: The switch to emergency remote teaching (ERT) due to the first COVID-19 lockdown demanded a lot from university lecturers yet did not pose the same challenge to all of them. This study sought to explain differences among lecturers (n = 796) from universities in France, Germany, Switzerland, and the UK in their use of educational technology for teaching, institutional support, and personal factors. Guided by the Social Cognitive Theory (SCT), lecturers' behavior (educational technology use), environment (institutional support), and personal factors (ERT self-efficacy, continuance intentions, and demographics) were examined. Latent class analysis was employed to identify different types of lecturers in view of educational technology use, while multinomial regression and Wald chi-square test were used to distinguish classes. The largest latent class were *Presenters* (45.6%), who focused on content delivery, followed by *Strivers* (22.1%), who strived for social interaction, *Routineers* (19.6%), who were ready for online teaching, and *Evaders* (12.7%), who evaded using technology for educational purposes. Both personal factors and perceived institutional support explained class membership significantly. Accordingly, *Evaders* were older, less experienced, and rarely perceived institutional support as useful. *Routineers*, the *Evaders'* counterparts, felt most self-efficient in ERT and held the highest continuance intentions for educational technology use. This research suggests that universities engage lecturers in evidence-based professional development that seeks shared visions of digital transformation, networks and communities, and design-based research.

Keywords: COVID-19; educational technology; higher education institution; university teaching; faculty; self-efficacy; technology-enhanced learning; professional development; institutional support; Social Cognitive Theory

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1. Introduction

The lockdown of universities had an immediate impact on the digitalization of teaching and learning at universities. Strict measures were implemented to flatten the epidemic curve. As a result, educational practices changed dramatically in terms of teaching and learning. For conventional—brick and mortar—universities, the lockdown meant that teaching and learning had to be spatially distanced. Shortly thereafter, the term "emergency remote teaching" (ERT) became established in this new educational context [1,2].

In this research, the empirical focus lies on lecturers, who had to fulfil the difficult task of transforming their teaching norms into a new online format—within days. Many of the lecturers were inexperienced in online teaching and had likely only previously used

Learning Management Systems (LMS) in combination with their conventional teaching. Although the rapid transition to ERT allowed for continuity of education, preparing a high-quality online course would typically have required much more preparation time and pedagogical and technological thought [1,3]. For example, lecturers for whom teaching in an online-only environment was new, used educational technology trying to replicate their conventional teaching. The need for more student-centered approaches to teaching and the benefits of educational technology to enhance learning was not visible or attainable to the initial ERT [3–5].

As Achen and Rutledge [4] aptly noted in their research on the transition from ERT to quality online teaching, institutional efforts to achieve this particular leap in instructional performance within a short period of time are far-reaching. The role of lecturers shifted from probably being skilled and experienced educators in the conventional teaching setting before the pandemic to novices in online teaching. Now lecturers lacked a set of competencies and attributes for quality online teaching [6]. However, in the new ERT reality, lecturers were faced with new demands as they suddenly had to incorporate academic, technical, guidance, social, and organizational functions related to online teaching. In addition, a new set of pedagogical, cognitive, technological, communicative, and personal skills was necessary to convey quality online teaching [6]. Overall, studies showed that lecturers were able to adapt to the new situation by adopting new and expanding the usage of already known technologies for the initial ERT [7,8]. However, lecturers from conventional universities had different personal and institutional prerequisites for the switch to ERT [1,9]. Looking at personal factors, a positive attitude towards digital technologies in teaching [10,11], as well as a strong self-efficacy expectancy for online teaching [12–14], facilitated the switch to ERT. Besides that, studies showed that especially lecturers with prior experience with digital technologies had an advantage for a successful shift to ERT [15–17].

In fact, lecturers experienced ERT differently, as studies with person-centric approaches show. A mixed-methods study identified three types of lecturers during the first lockdown, namely *Experienced*, *Enthusiastic*, and *Cautious* lecturers. The researchers conclude that the most influential factor for profile affiliation was prior experience and competence with educational technology in teaching [17]. At the same time, surprisingly little research applied person-centric approaches such as cluster analysis, latent class, or latent profile analysis to investigate different patterns of lecturers' adaptation to ERT [18,19]. Rutherford et al., for example, also identified three groups of lecturers during ERT: *Highly supportive*, *instructor-centered*, and *more detached*. The latter group accounted for more than half of the participants. According to the results, the more detached lecturers reported educational technology use on a low level. The instructor-centered lecturers focused on conveying teaching material and lecturing, whilst the highly supportive lecturers also made sure to enable social interaction in the digital space [18]. Overall, recent research suggests that lecturers approached ERT differently depending on their prior experiences with educational technology use. However, it is evident that there is a research gap in person-centric approaches that focus on additional personal (e.g., self-efficacy, continuance intentions) and environmental factors (institutional support) in the switch to ERT.

Even before the pandemic, empirical research on educational technology use with person-centric approaches was sparse. Using latent profile analysis, Yukhymenko-Lescroart et al. [20] found five types of lecturers in relation to educational technology use: *Technology enthusiasts*, *knowledgeable adopters*, *knowledgeable skeptics*, *prospective adopters*, and *non-adopters*. The researchers used the constructs of the Technology Acceptance Model (TAM) [21] as latent profile indicators. In another person-centric study, although using a K-12 teacher sample, researchers distinguished between four evenly size-distributed groups of lecturers using latent class analysis: *Dexterous*, *Presenters*, *Assessors*, and *Evaders*. The first and last group of lecturers contrasted the most regarding educational technology use in teaching. Dexterous lecturers were flexible in using it and did so on a high level. Presenters focused on conveying the teaching content, and assessors used the benefits of educational technology to assess student achievements [22].

Following the person-centered approaches, the present study seeks to analyze data from lecturers during the first COVID-19 lockdown to classify them based on how they used educational technology for ERT. Qualitative studies have shown how differently faculty members have experienced the transition to ERT [4–6,23]. In this study, we use quantitative data and analyses to enrich these research findings and highlight the importance of individual experiences and progress related to digital transformation in higher education. By identifying unobserved groups in our data, we seek to explain correlations between these and personal, institutional, and technological factors.

Therefore, lecturers self-reported use of eight technologies will serve as indicators for a latent class analysis (LCA). Based on the assumptions of the *Social Cognitive Theory* (SCT) [24], which describes the interaction between a person's behavior, personal factors, and environment, it is assumed that the lecturer's educational technology use (behavior) depended on the institutional support (environment) and lecturers' self-efficacy, etc. (personal factors). This study is therefore intended to complement an existing research gap in person-centered approaches in university teaching [20]. In the following sections, the three factors mentioned above will be explained from an empirical perspective and then consolidated in a theoretical framework.

1.1. Educational Technology to Close the Spatial Distance

Educational technology was the means for lecturers that ensured the continuity of education during the COVID-19 lockdowns through teaching and learning in an online environment. In a more traditional sense, technology is used for educational purposes in order to achieve teaching and learning goals. Educational technology consists of "a broad variety of modalities, technologies, and strategies for learning" [25]. To highlight the importance of educational technology for ERT, Moore [26] stated that "distance education is not simply a geographic separation of learners and lecturers, but, more importantly, is a pedagogical concept." However, as Hodges et al. [1] rightfully point out, ERT was the first response of universities to the political and social demand for continuing education at all costs. The theoretical and empirical foundations of online teaching, which had been built over decades, were largely left aside. Therefore, "ERT is a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances" [1]. Educational technology as a practice "involves the reasoned and effective integration of technology to support or facilitate learning, performance, and instruction" [27]. It is, therefore, essential to differentiate digital technologies or simply technology, such as computers, smart and wearable devices, software, and applications, from educational technology, which includes the integration of such digital technologies in a pedagogical context to enhance learning. For example, in a comprehensive second-order meta-analysis, Schneider and Preckel [28] have shown that educational technology in higher education has the strongest effects on learning when it complements classroom-based teaching and learning. The results further revealed that only very advanced, subject-specific, and high-cost digital technologies such as virtual reality games had high effect sizes on learning outcomes. On the contrary, when human instruction was replaced by computer instruction, academic performance decreased. In the end, educational technology use should improve the quality of teaching and learning by providing stimulating activities that are adapted to learners' individual needs and enable social learning [29].

Puentedura's [30] substitution, augmentation, modification, and redefinition (SAMR) model categorizes educational technology use. The SAMR model consists of four levels in consecutive order; hence, with each step, learning is enhanced and teaching digitally transformed. The lowest level, substitution, corresponds to technology integration that substitutes an analog teaching method, such as reading an online lexicon instead of a hardcopy version. On the augmentation level, technology augments a learning opportunity, e.g., watching an educational video on portable devices for each student and the possibility to stop and rewind rather than on the pace for all the students at once. One step upwards, modification means that technology allows the substantial redesign of a task, for exam-

ple, writing and editing a text simultaneously as a group on an online pad. At last, the redefinition level accords to technology integration that creates a unique and interactive learning environment in the form of software, virtual game, or an app that, for example, allows self-directed learning and an individualized learning experience [31]. Manifold digital technologies are not only openly accessible, often at no monetary cost, but also often include multiple use cases. Consequently, the extent to which learning is enhanced through digital technologies greatly depends on how well it is integrated and what subject-specific and pedagogical goal the lecturer wants to achieve by its integration [3,32]. A qualitative study [33], which was conducted during the first lockdown period in 2020, has shown that lecturers' initial reaction to ERT was to keep students informed and guarantee access to content. More so, lecturers zealously tried to enable social learning through digital technologies such as synchronous collaboration tools (sharing of audio-video, chat, text discussion) or asynchronous collaboration tools (forums, note taking, document creation). However, as shown in a systematic review study, "recreating physical learning spaces in cyberspace was a common approach to dealing with in-class engagement issues. Zoom featured as a popular tool for replicating F2F instruction online" [34]. Alternatively, to put it into the perspective of the SAMR model [30], during ERT, digital technologies have been integrated to substitute conventional classroom practices in the online space rather than enhancing learning [32].

In another qualitative study by Chiasson et al. [35], lecturers reported that online courses take more time to prepare than face-to-face ones. Furthermore, the involvement of instructional designers is perceived as helpful for the effective integration of technology and that colleagues could deliver pedagogical support. The lecturers increasingly took an accompanying role in the lessons, which was paralleled by the perceived loss of control over students' learning. Especially lecturers who primarily taught synchronously during ERT reverted to substituting conventional teaching methods. Lastly, studies display that those lecturers were worried that the quality of teaching suffered due to the sudden switch to an online environment [11,36,37].

Taken together, educational technology use is meant to enhance student learning. However, in the case of ERT, the purpose switched to ensure continuity of education in an online space due to the spatial distance between lecturer, learner, and the classroom.

1.2. Self-Efficacy in Emergency Remote Teaching

According to Bandura (1986) [24], a person's performance is mediated by self-efficacy, as "perceived self-efficacy is defined as people's judgements of their capabilities to organize and execute courses of action required to attain designated types of performances." In the context of teaching, a positive appraisal of teaching capabilities corresponds to the lecturer's confidence in creating an effective learning environment to promote learning outcomes [38]. In addition, perceived self-efficacy is a significant determinant of performance that operates partially independently of underlying skills [24]. In other words, a person's belief in his or her capabilities also influences actual performance, to some extent, independently of previously acquired skills, which was the case for a lot of lecturers during the switch to online teaching due to COVID-19. Four sources of self-efficacy beliefs have been postulated, namely mastery experiences, vicarious experiences, social persuasion, and physiological and psychological cues [38]. Mastery experiences have the greatest effect on self-efficacy beliefs. Successful performances, therefore, increase self-efficacy beliefs, whereas failures decrease expectations of a person's ability to master a specific task to succeed.

As displayed in a recent meta-analysis [39], a large body of studies exists that describes a positive correlation between teaching self-efficacy and students' academic achievements. Furthermore, the positive relationship between teaching self-efficacy and the quality of teaching and learning in a classroom has been researched and confirmed extensively [40]. Reverting to the self-efficacy theory, people who believe they can integrate educational technology into their teaching to reach instructional goals are more inclined to integrate educational technology [41,42]. Especially in difficult times such as a pandemic, lecturers

with high self-efficacy beliefs in teaching are more persistent and remain flexible to alter their plans and surmount emerging obstacles [43,44], such as immediately switching to ERT [45].

Numerous studies have attempted to explain the role of self-efficacy in teaching for face-to-face but also online learning and teaching. According to Klassen and Chiu [46], teaching self-efficacy beliefs become more positive through experiences in teaching. However, the relationship is curvilinear, meaning that the positive correlations peak after 20 years of experience and begin to decline. In this research vein, Chang et al. [47] have found that female professors had greater self-efficacy than males and greater self-efficacy among professors from educational disciplines or social sciences [42,46]. Besides demographic factors, also attitudes towards online teaching have been researched. Horvitz, Beach, Anderson, and Xia [42] found that the perception of learning in an online environment influenced several dimensions of teaching self-efficacy, such as student engagement, instructional strategies, and class management. Moreover, lecturers' intention to online teaching in the future also influenced the self-efficacy score positively.

Another prominent research branch around has evolved around lecturers' *Technological Pedagogical Content Knowledge* (TPACK) framework introduced by Mishra and Koehler [48]. It assesses lecturer competence to successfully integrate educational technology into their teaching and thereby evaluates lecturers' knowledge in terms of digital technologies, pedagogy, and subject matter. More importantly, it highlights the intersection of these three areas to identify factors that are central to teaching quality and students' academic achievement. Applying the TPACK framework, studies reported a positive correlation between teaching self-efficacy and TPACK [49]. In a recent study, researchers have found that lecturers' who had greater self-efficacy and held positive attitudes towards online teaching during COVID-19 measures were less psychologically strained. In terms of ERT, the lecturers with higher scores perceived their teaching as more successful and felt more confident in their teaching abilities [50]. In the context of ERT, Ma, Chutiyami, Zhang, and Nicoll [13] have found that, while lecturers' self-efficacy did not increase, the extent to which lecturers integrated educational technology did. In the qualitative part of the mixed-methods study, lecturers reported the lack of experience with educational technology as a barrier to the transition to ERT. Moreover, the assessment of student achievement and time for preparation of ERT were negatively reported. For ERT, studies showed that prior experience with online teaching and educational technology was beneficial [12,16].

Overall, teaching self-efficacy is influenced by prior experience in teaching with and attitudes towards educational technology and, to a lesser degree, by demographics and institutional support [42,45]. More important, teaching self-efficacy is a predictor of teaching quality, students' academic achievement, the integration of educational technology, and intentions to integrate educational technology in the future [39,42]. Seetal et al. [51] argue that teaching self-efficacy is a primer for ERT and online teaching in general. A basic prerequisite for a self-effective approach to educational technology is the digital maturity of a university and the associated digitization strategy. However, the availability of technology is not enough. Implementation must be guided and sustainable. This is the only way to improve the quality of teaching and strengthen student learning [29]. However, research on teaching self-efficacy is primarily conducted within the K-12 context. There is a need for more quantitative and qualitative research in higher education [52].

1.3. Institutional Support

Lecturers' efforts and successful technology integration depend on personal and institutional factors. The latter contains types of resources, such as infrastructure, time, professional development, and technological-pedagogical support. Each factor can vary based on the digital maturity of a particular university. According to Ertmer [53], who labels these potential resources as "first-order barriers", a lack of sufficient pedagogical and technological support as well as access to soft- and hardware can be frustrating, especially when lecturers face multiple problems at a time. Therefore, even if a lecturer

wants to implement modern technology and create new learning opportunities, the advancement can be disturbed due to first-order barriers. However, studies have shown that the perceived usefulness of institutional support depends on lecturers' readiness for online teaching. Comparing three different types (high, low, and inconsistent online teaching readiness) of lecturers, Scherer, Howard, Tondeur, and Siddiq [45] have found that lecturers with low competencies for online teaching also perceived weak support from their institution, whereas lecturers who were ready for online teaching perceived sufficient institutional support. Especially for ERT, which had to be conducted by both trained and inexperienced lecturers, the availability of directed technological and pedagogical support combined with strong leadership was crucial for a successful shift from conventional to online teaching [10,54,55].

In a qualitative study, Guilbaud et al. [56] have identified three sources of institutional support for lecturers: professional development, collaboration with colleagues, and administrative support and encouragement by the institution. More specifically, the interviewed lecturers wished for individualized professional development, the opportunity for social learning and sharing, reasonable expectations, more time for preparation as well as recognition for efforts. In many studies, the same problem areas, or issues of resources for online teaching recured, namely professional development, technical and pedagogical support, access to technology, and time [10,57–59]. These findings were also displayed in a study by Marek [36]; results showed that lecturers who had to learn to teach online benefited from time and financial compensation for preparation, pedagogical and technological support from the institution, formal professional development, and support through colleagues. Furthermore, the value and shared vision of online teaching at a university was crucial for educational technology use in teaching [11]. In contrast to the studies above, Weidlich and Kalz [60] found in their cross-sectional study during COVID-19 restrictions, no evidence that institutional support played a significant role in ERT.

In short, institutional support can be available and still useless to the cause of quality online teaching if it remains unused. Lecturers' wish for individualized support is a sign that a one-support-fits-it-all is not sufficient [58]. This accords with studies that found types of lecturers that differ regarding their experience and competence in educational technology use [17,19,20].

1.4. Conceptual Framework and Research Questions

So far, extraordinarily little attention has been paid to what facilitated lecturers' shift to ERT and the role of educational technology, self-efficacy, and institutional support. We assume that these three factors interact with and influence the lecturer's capability for ERT reciprocally [24]. Therefore, the conceptual framework of this study is derived from Bandura's [24] *Social Cognitive Theory*, which explains the interaction between a person's behavior, environment, and personal factors.

First, in the present study, behavior corresponds to the lecturers' use of educational technology for ERT. Second, the university environment corresponds to the lecturers' perceived usefulness of institutional support. Third, personal factors correspond to online teaching self-efficacy, continuance intentions for educational technology use, and further covariates (age, gender, discipline, and prior experience in educational technology use) (see Figure 1). It is assumed that optimal support on the part of the university and a high level of conviction in the lecturers' own abilities had a decisive influence on the integration of digital technologies. Conversely, it is also assumed that the integration of digital technologies has a positive impact on skills in using them and, in the longer term, on the digital maturity of universities, which displays through the technical and pedagogical support offered, professional development, and technology infrastructure for teaching at universities [29].

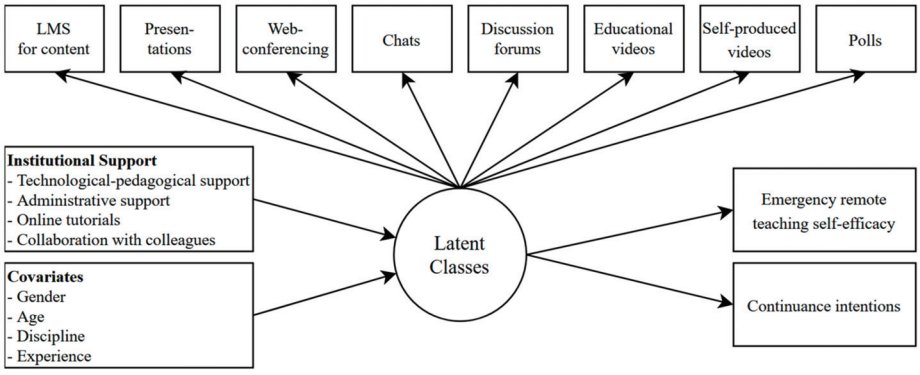

Figure 1. Latent class model.

As noted earlier, the sudden switch to ERT demanded a lot from lecturers: quickly shifting to online teaching and learning environments, adopting new digital technologies, shifting working environments, collaboration, and communication [34]. However, not all experienced this pressure and handled the teaching situation in the same way [61]. Based on the theoretical and empirical implications presented above, the following questions arise:

RQ1. Which latent classes can be identified based on lecturers' educational technology use during ERT (behavior)?
RQ2. In how far do lecturers' demographic and professional variables explain latent class membership (personal factors)?
RQ3. In how far are lecturers' ERT self-efficacy and continuance intentions related to latent class membership (personal factors)?
RQ4. In how far does institutional support for ERT explain latent class membership (environment)?

2. Materials and Methods

2.1. Participants

Participants were n = 796 lecturers who actively taught during the first COVID-19 lockdown in 2020. In total, five conventional face-to-face universities participated and invited all their lecturers to partake in the survey. The universities were in the UK, France, Germany, and Switzerland.

The French sample consisted of 398 lecturers, which accounted for exactly 50% of the analyzed sample. Followed by the Swiss (n = 157, 19.7%), the German (n = 154, 19.3%), and lastly the UK (n = 87, 10.9%). 381 (47.9%) lecturers described themselves as female, and 388 (48.7%) as male. 27 (3.4%) lecturers chose not to self-describe. For further analysis, two age groups were formed, which were of comparable size: 360 (45.2%) lecturers were 45 years old or younger, whereas 432 (53.3%) were older than that. More lecturers from Non-STEM (n = 488, 61.3%) participated than from STEM (n = 308, 38.7%) disciplines. Regarding prior experience, about half of the lecturers reported having used educational technology only to a small extent or not at all (n = 407, 51.1%). The other half had used educational technology to a moderate or large extent (n = 385, 48.4%).

After approval by appropriate ethic committees and rectorates, a link to the questionnaire was distributed to all lecturers at the participating universities, regardless of their academic position. Participants received information about the data processing of the study, which they confirmed with written consent. In addition, participants could end the survey or skip questions at any time. The survey was open from mid-May to mid-June. In addition, a reminder for participation was sent out after two weeks.

2.2. Instruments

The questionnaire consisted of three parts: Use of educational technology and experiences before and during the pandemic and a post-pandemic outlook. Because lecturers at the universities spoke different languages, the questionnaire was translated and back-translated from English into French and German. Then, the questionnaire was piloted on a sub-sample at each university. The collected feedback was then incorporated into the next version of the questionnaire before it was tested by university experts for content and face validity [16].

2.2.1. Covariates

Gender, age, discipline, and prior experience in using educational technology in teaching were included as covariates in the statistical analysis. Within the theoretical framework, however, they fall under the category of personal factors and are therefore of theoretical relevance, which is addressed by Research Question 2.

2.2.2. Educational Technology Use

As depicted in Table 1, the eight items that assessed lecturers' educational technology use during ERT functioned as indicators for LCA. Lecturers were asked to report their educational technology use on eight different types of technology. The 4-point Likert scale was dichotomized for LCA. Values 1 and 2 represent no or little use, whereas values 3 and 4 represent moderate or extensive use. The frequencies of use are shown in Table 1, along with a classification of educational technology according to the four dimensions of the SAMR model [30,31].

Table 1. Frequencies of self-reported educational technology use during lockdown.

Educational Technology	Not At All/ to a Small Extent	To a Moderate/ Large Extent	SAMR Classification
LMS for content	14.3%	85.7%	Substitution
Presentations	22.1%	77.9%	Substitution
Web-conferencing	36.8%	63.2%	Substitution/ augmentation
Chats	63.9%	36.1%	Substitution/ augmentation
Discussion forums	59.0%	41.0%	Augmentation/ modification
Educational videos	63.0%	37.0%	Augmentation/ modification
Self-produced videos	75.0%	25.9%	Augmentation/ modification
Polls	57.5%	42.5%	Augmentation/ modification

Note. SAMR = Substitution, Augmentation, Modification, Redefinition.

2.2.3. Emergency Remote Teaching Self-Efficacy

Lecturers' self-efficacy was assessed using a unidimensional 4-point Likert scale (1 = not at all, 4 = completely agree) consisting of 8 items (e.g., "I feel confident I am able to use digital tools as a means to maintain the same quality of teaching."). It was adapted and modified by the research team to capture lecturers' experiences more reliably during ERT. The original scale was derived from the *Online Teaching Self-Efficacy Inventory* [62] and the *College Teaching Self-Efficacy Scale* [63]. In this study, however, it is labeled as the *Emergency Remote Teaching Self-Efficacy* scale (ERT-SE). Internal consistency proved to be at a good level with Cronbach's $\alpha = 0.87$.

2.2.4. Continuance Intention

The continuance intention scale assesses whether lecturers plan to continue using educational technology for teaching after the pandemic. The research team developed it solely for the purpose of this study. The scale consists of four items rated on a 4-point Likert scale from "not at all" to "to a large extent" (e.g., "To what extent will your new experience in using digital tools affect your pedagogical practice?"). Factorial analyses demonstrated unidimensionality. The reliability was assessed using Cronbach's alpha. The score was acceptable, $\alpha = 0.73$.

2.2.5. Institutional Support

Four questions were developed to measure lecturers' perception of various aspects of their respective institutional support, which functioned as single items. The items were rated on a 4-point Likert scale (1 = "not at all", 4 = "to a large extent"). For further analysis, the items were dichotomized from 4 to 2 values (see Table 2).

Table 2. Dichotomized institutional support variables.

Usefulness of Institutional Support	Scale	*n* (%)
Technological-pedagogical support	Not at all/to a small extent	421 (52.9)
	To a moderate/large extent	330 (41.5)
Administrative support	Not at all/to a small extent	529 (66.5)
	To a moderate/large extent	214 (26.9)
Tutorials	Not at all/to a small extent	452 (56.8)
	To a moderate/large extent	280 (35.2)
Collaboration with colleagues	Not at all/to a small extent	354 (44.5)
	To a moderate/large extent	394 (49.5)

2.3. Statistical Analysis

Once collected, the data were imported into SPSS 27 for cleansing and initial descriptive analysis. In the first step of statistical analysis, a latent class analysis (LCA) was conducted using Mplus 8.8 LCA is a statistical method for empirically identifying an appropriate number of latent subgroups in a sample. As a person-centered mixture modeling approach, it aims to classify individuals based on their responses to a set of indicators [64]. The latent class indicators were the self-reported educational technology use presented in Section 2.2.2. above. The procedure for selecting a class solution was to run a series of models, starting with one class. Then, in an iterative process, models with one more class were each compared to the previous model. This procedure was repeated until a statistically sound solution was found that was also acceptable in terms of theoretical interpretability [65]. Statistical conformity was determined using the recommended information criteria [64], namely Aikake Information Criterion (AIC), Bayesian Information Criterion (BIC), and sample size adjusted Bayesian Information Criterion (aBIC). In addition, likelihood-based tests such as Lo-Mendell-Rubin (LMRT) and bootstrap likelihood ratio test (BLRT) were used as a source of information for model comparison [64]. After identifying the optimal class solution, each lecturer was assigned to a class based on their posterior class membership probabilities. For the next analytical steps, the parameters of the model were fixed, so that class assignments could not be changed anymore [66].

The second step of the analysis was to examine associations between latent classes, personal factors, and the environment. Multinomial logistic regression was performed to examine how covariates and environmental factors predicted class membership using a three-step approach proposed by Vermunt [67]. For the continuous personal factor variables, ERT self-efficacy, and continuance intentions, the automated Bolck-Croon-Hagenaars method (BCH) was applied [68–70]. The automatic BCH approach independently estimates the mean of the distal outcome variables per class and evaluates mean differences with the Wald chi-square test [68].

With 0.5 to 8.0% missing values at the item level, the impact of the missing values on the statistical results was marginal. However, due to the multiple steps of the multinomial logistic regression [66] and the BCH approach [67,69,70] methods, missing values were imputed at the item level. Missing data of distal outcome variables, as well as the environment variables, were handled beforehand using the *Fully Conditional Specification Method* (FCSM) in SPSS. Twenty imputed data sets were generated. Further analyses were then conducted based on the aggregated data from the twenty imputed data sets. To account for missing values of the eight indicator variables, models were estimated using *Full Information Maximum Likelihood* (FIML), which is standard in Mplus 8.8 [71].

3. Results

3.1. Research Question 1: How Many Latent Classes Can Be Identified for Educational Technology Use?

Based on multiple fit indices combined with theoretical interpretability, a 4-class solution was found that best explained differences between lecturers. Table 3 allows for reconstructing the iterative procedure of comparing the class solutions with six latent class models. As for the information criterion AIC, BIC, and aBIC, a smaller value corresponds to a better statistical fit of the latent class model [64,72]. The likelihood-based tests indicate with a *p*-value whether the class solution with one more latent class has a better statistical fit than the previous solution. Entropy is an omnibus index that indicates the accuracy of the individuals' classification into classes, where values > 0.60 are acceptable and >0.80 good [65]. Finally, individuals' average posterior probabilities, and therefore their most likely class membership, indicate how well the model classifies individuals into their class, with values > 0.70 indicating good differentiation between classes, as shown in Table 4 [72].

Table 3. Model fit indices to evaluate the class solution.

Model (*K*-Class)	AIC	BIC	aBIC	LMRT *p*-Value	BLRT *p*-Value	Entropy
1-class	7388.470	7425.907	7400.502	-	-	-
2-class	6965.198	7044.751	6990.766	<0.000	<0.000	**0.687**
3-class	6910.981	**7032.651**	6950.087	0.104	<0.000	0.678
4-class	6876.799	7040.585	**6929.441**	**0.004**	**<0.000**	0.630
5-class	**6876.402**	7082.305	6942.581	0.428	0.286	0.608
6-class	6876.611	7124.629	6956.325	0.345	0.098	0.595

Note. Bold values indicate the model fit criteria endorse. *K* = number of classes; AIC = Aikake Information Criterion; BIC = Bayesian Information Criterion; aBIC = adjusted BIC; LMRT = Lo-Mendell-Rubin test; BLRT = bootstrapped likelihood ratio test.

Table 4. Classification probabilities for the most likely class membership and class counts.

K-Class	Class-1 *Presenters* *n* = 363 (45.6%)	Class-2 *Strivers* *n* = 176 (22.1%)	Class-3 *Routineers* *n* = 156 (19.6%)	Class-4 *Evaders* *n* = 101 (12.7%)
Class-1	0.824	0.064	0.043	0.069
Class-2	0.203	0.721	0.130	0.023
Class-3	0.126	0.109	0.826	0.000
Class-4	0.064	0.025	0.000	0.772

Table 3 shows that the fit indices provide incongruent information, which is generally not uncommon for LCA [72]. The AIC value was lowest for the 5-class solution, BIC for the 3-class solution, and aBIC for the 4-class solution. However, both LMRT ($p = 0.004$) and BLRT ($p < 0.000$) *p*-values were significant for the 4-class solution. Accordingly, based on the aBIC and the likelihood-based tests, the 4-class solution showed a better statistical fit compared to the other models. Furthermore, too much interpretable information would have been lost with a 3-class solution. In a simulation study, researchers have shown that the BLRT is the most accurate indicator for statistical fit for latent class

models [64]. Finally, the 4-class model was chosen based on the above considerations and theoretical interpretability.

The results of the 4-class model are looked at in more detail here, from the largest to the smallest class count to answer the first research question (see Table 3).

The four latent classes differed in terms of class count. Class-1 was the largest group with n = 363 lecturers. They were likely to use LMS for content delivery, presentations, and web conferencing for ERT. Although on a low level, lecturers were more likely than two other classes to use educational videos and self-produced videos. Class-2 consisted of n = 176 lecturers. They were likely to use chats and forums moderately or extensively in their teaching, besides utilizing LMS, presentations, and web conferencing. However, compared to Class-1 lecturers, they were less likely to use videos. n = 156 lecturers belonged to class-3. They used all educational technology likely to a moderate or large extent for ERT and did so more frequently than lecturers from other classes. Lastly, class-4 lecturers, the smallest group with n = 101, very rarely used other educational technology besides LMS, presentations, and web-conferencing.

In this step, labels and short descriptions were given to the lecturers of the respective classes, which derived from an earlier person-centered study [22] and our own interpretations (see Figure 2).

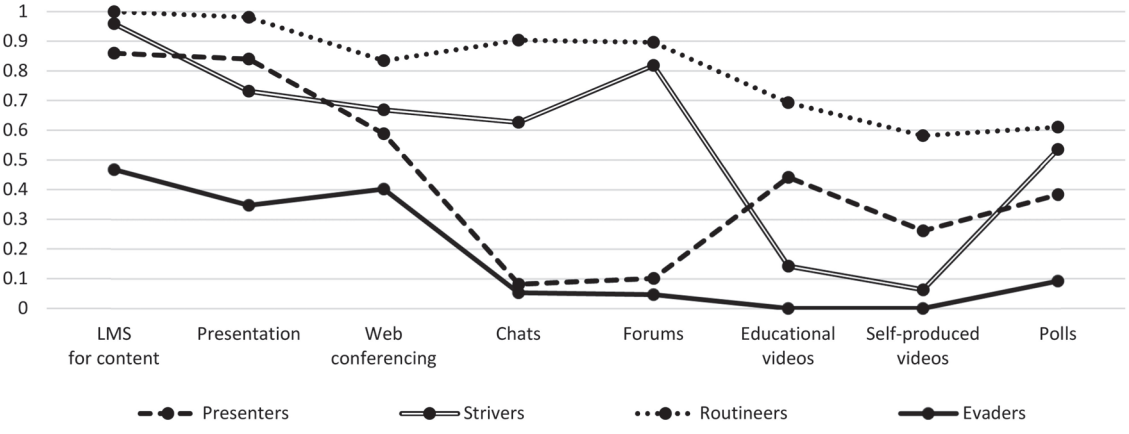

Figure 2. Latent classes of lecturers regarding educational technology use during ERT. Note. The figure shows the characteristics of the four classes based on responses to the eight indicators. The Y-axis represents the probability that lecturers responded that they used educational technology to a moderate or large extent.

Class-1: Presenters: Lecturers in this class were highly likely to use LMS and presentations to convey teaching materials. Also, they were more likely than two other classes to integrate educational videos and self-produced videos into their teaching. Chats and forums were rarely used whatsoever.

Class-2 Strivers: Although they were likely to integrate LMS and presentations during the lockdown, educational videos and self-produced videos were not. However, they integrated chats and forums for social interaction in their teaching.

Class-3 Routineers: Routineers were more likely to integrate all the assessed digital technologies in their teaching during lockdown than lecturers from the other classes.

Class-4 Evaders: Evaders were unlikely to integrate digital technologies in their teaching in a moderate or extensive way. Also, they did not adopt educational videos and self-produced videos at all.

3.2. Research Question 2: In How Far Do Lecturers' Demographic and Professional Covariates Explain Latent Class Membership?

A three-step approach [66] to conduct a multinomial logistic regression was employed to answer research Question 2, using *Presenters* as a reference to explain latent class membership.

Table 5 shows the results of the multinomial logistic regression of the demographic covariates (gender, age, discipline) and the prior experience with educational technology use (Educational technology use). When comparing *Presenters* and *Strivers*, none of the observed covariates explained significant differences. Lecturers from Non-STEM disciplines (humanities and art, social sciences, law, business and economics, theology, psychology, education, languages) were more likely to be members of *Routineers* ($OR = 2.468$, $p = 0.006$). Accordingly, the odds ratio of these lecturers belonging to *Routineers* was 2.468 higher compared to *Presenters*. The same goes for lecturers who integrated educational technology to a moderate or large extent before the pandemic. They were likely to be *Routineers* ($OR = 4.790$, $p < 0.000$). As for the *Evaders*, age ($OR = 2.612$, $p = 0.300$) as well as previous experience with educational technology use ($OR = 0.183$, $p = 0.006$) were class membership predictors. According to these findings, on the one hand, older lecturers were more likely to be assigned to this class. On the other hand, lecturers with experience in educational technology use were unlikely to be assigned to this class. Lastly, gender did not explain any class membership ($p > 0.050$).

Table 5. Multinomial logistic regression of lecturer background and institutional support for ERT.

	Strivers	**Routineers**	**Evaders**
Covariates	***OR* [95% *CI*], *p*-Value**	***OR* [95% *CI*], *p*-Value**	***OR* [95% *CI*], *p*-Value**
Gender, male	0.844 [0.491, 1.590], 0.680	0.811 [0.461, 1.430], 0.470	1.787 [0.762, 4.188], 0.182
Age $\geq$ 46	0.836 [0.468, 1.493], 0.544	0.710 [0.394, 1.277], 0.253	2.612 [1.099, 6.208], 0.030
Discipline, Non-STEM	0.921 [0.503, 1.686], 0.790	2.468 [1.303, 4.675], 0.006	1.300 [0.608, 2.780], 0.499
Experience	1.025 [0.570, 1.845], 0.933	4.790 [2.570, 8.929], < 0.000	0.183 [0.054, 0.620], 0.006
Institutional support			
Usefulness: Tech.-ped. supp.	0.850 [0.424, 1.706], 0.648	2.564 [1.317, 4.991], 0.006	0.995 [0.439, 2.258], 0.991
Usefulness: Admin. supp.	0.555 [0.269, 1.143], 0.110	0.982 [0.519, 1.856], 0.995	0.346 [0.126, 0.944], 0.038
Usefulness: Tutorials	0.868 [0.472, 1.597], 0.648	1.104 [0.610, 1.997], 0.744	0.308 [0.107, 0.881], 0.028
Collab. with colleagues	1.868 [0.628, 0.967], 0.063	1.528 [0.824, 2.833], 0.178	1.035 [0.475, 2.256], 0.931

Note. $n = 767$; *OR* = odds ratio; *CI* = confidence interval; Tech.-ped. supp. = Technological-pedagogical support; Admin. supp. = Administrative support; Collab. with colleagues = Collaboration with colleagues.

3.3. Research Question 3: In How Far Does Institutional Support for ERT Explain Latent Class Membership?

To answer the research Question 3, again, a three-step approach [66] to conduct a multinomial logistic regression was employed. *Presenters* functioned as a reference to explain latent class membership. Covariates and institutional support variables were computed in a single equation.

In the lower section "Institutional support" of Table 5, the results of four sources of institutional support are listed. These covariates contextualize lecturers' educational technology use during the COVID-19 lockdown. None of the analyzed institutional support sources were significant in explaining *Strivers* class membership. There is a slight tendency for an intensive collaboration with colleagues to possibly have an influence, although not significant ($OR = 1.868$, $p = 0.063$). Lecturers who found the technological-pedagogical support useful during lockdown were more likely to be assigned to *Routineers* ($OR = 2.564$, $p = 0.006$). A high perceived usefulness of administrative support ($OR = 0.364$, $p = 0.038$) and tutorials for educational technology use ($OR = 0.308$, $p = 0.028$) corresponded with unlikely class-4 *Evaders* membership compared to *Presenters*.

3.4. Research Question 4: In How Far Are "Intention to Adapt Teaching in the Future" and "Emergency Remote Teaching Self-Efficacy" (Distal Outcomes) Related to Latent Class Membership?

The means of lecturers' emergency remote teaching self-efficacy (ERT-SE) and continuance intentions for educational technology use (intention) are presented in Table 6. Overall, the Wald chi-square test was significant for both ERT-SE (Wald $\chi 2 = 49.219$, $p < 0.000$) and lecturers' intention (Wald $\chi 2 = 47.857$, $p < 0.000$) between classes. *Routineers* scored the highest means in both distal outcome variables (ERT-SE: $M = 2.91$, $SE = 0.036$; intention: $M = 2.58$, $SE = 0.045$). On the other end, the *Evaders* scored the lowest (ERT-SE: $M = 2.65$, $SE = 0.082$; intention: $M = 2.13$, $SE = 0.091$). In between were the *Presenters* and *Strivers*, whose means did not differ significantly. However, both classes had significantly higher scores on both distal outcome variables than the *Evaders* and significantly lower scores than the *Routineers*. Consequently, the Wald chi-square test was highly significant for *Routineers'* and *Evaders'* ERT-SE (Wald $\chi 2 = 36.091$, $p < 0.000$) as well as continuance intentions (Wald $\chi 2 = 45.148$, $p < 0.000$).

Table 6. Distal outcome analysis using the BCH method.

			Strivers		**Routineers**		**Evaders**	
	ERT-SE	**Intention**	**ERT-SE**	**Intention**	**ERT-SE**	**Intention**	**ERT-SE**	**Intention**
	M(SE)		***Wald* $\chi 2$, *p*-Value**					
Presenters	2.91 (0.036)	2.58 (0.045)	1.221 0.269	0.013 0.909	22.824 <0.000	12.732 <0.000	7.318 0.007	16.184 <0.000
Strivers	2.99 (0.054)	2.57 (0.068)	-	-	7.253 0.007	7.996 0.005	12.018 0.001	14.655 <0.000
Routineers	3.21 (0.048)	2.87 (0.062)	-	-	-	-	36.091 <0.000	45.148 <0.000
Evaders	2.65 (0.082)	2.13 (0.091)	-	-	-	-	-	-

Note. M = mean value; SE = standard error; ERT-SE = emergency remote teaching self-efficacy; Intention = continuance intention for educational technology use.

4. Discussion

The purpose of this study was to examine whether there are distinct types of lecturers regarding educational technology use during COVID-19 lockdown measures and, thus, the spatial distancing of lecturers, learners, and the classroom (Research Question 1). In addition, and in accordance with the theoretical framework, relationships between class membership and personal factors (Research Questions 2 and 4) and institutional support (Research Question 3) were further examined. To answer the research questions, lecturers who were actively teaching during the first COVID-19 lockdown measures in 2020 were questioned. Data were analyzed using a person-centric approach to derive latent classes of lecturers. The results of the iterative LCA procedure pointed to a four-class solution: *Presenters*, *Strivers*, *Routineers*, and *Evaders*. Three key findings emerge when looking at the four classes.

Besides the *Evaders*, the other lecturers reported moderate and extensive use of educational technology during ERT. In order to achieve this, two premises needed to be met by their technological environment and personal factors. Drawing on the *Social Cognitive Theory* [24], using educational technology goes hand in hand with institutional support (educational technology environment) and personal factors (prior experiences, self-efficacy, continuance intentions).

First, it may be rated as a success that most of the lecturers were able to continue delivering education to students, despite having to switch to ERT within a short period of time [73] and being exposed to new sources of physiological and psychological strain because of the lockdown [74]. *Presenters* account for the largest part of the sample. Moreover, they are a good example of how lecturers tried to replicate their conventional teaching in the online space by delivering content in LMS, presentations, and web conferencing. Digital technologies were the means to substitute [31] what was before. The focus hereby

laid on the lecturer, disregarding the students' needs for autonomy, competence, and relatedness [75]. The second largest group, the *Strivers*, however, integrated technologies such as chats and discussion forums, accounting for students' need for relatedness to peers and lecturers. A recent study revealed that students felt the social aspect of studying dramatically suffered during the COVID-19 measures [37,75,76], which had an immediate effect on motivation [77]. *Routineers* could also be labeled as tech-savvy since they integrated educational technology more than the other classes and were highly likely to do so for any type of assessed technology. In this case, it would have been interesting to see if they had also integrated more advanced technologies such as educational games or virtual reality. The sentiment of the *Evaders* is best illuminated by a comment in an open-ended survey question: "A frustrating experience; to teach you have to perceive the reactions of the audience, even in large lecture halls. Online teaching is dehumanizing." The loss of social interaction, in combination with lack of ICT-competences and prior experience, made the switch to ERT a frustrating experience for them [15].

Putting these findings into the research context of educational technology use with person-centric approaches, the identified classes accord somewhat: *Experienced*, *Enthusiastic*, and *Cautious* [17] or *Highly supportive*, *Instructor centered*, and *More detached* [18] during the pandemic. In addition, person-centric research before the pandemic found *Technology enthusiasts*, *Knowledgeable adopters*, *Knowledgeable skeptics*, *Prospective adopters*, and *Non-adopters* [20]. The most convergence of results was found compared to the study of Graves and Bowers [22], who found similar classes based on educational technology use as indicators: *Dexterous*, *Presenters*, *Assessors*, and *Evaders*. Consequently, it becomes apparent that there is repetition in the way researchers label classes and profiles, which may indicate a certain empirical consensus and validity of the present study.

Second, class membership was determined by three demographic and socio-professional variables, namely age, discipline, and prior experience in educational technology use. These findings are in line with empirical studies, stating that older lecturers, on the one hand, have lower self-efficacy beliefs, a lack of ICT competencies, and less experience in educational technology use [16,78,79]. Regarding prior experience, this finding broadly supports the work of other studies in this area. Accordingly, prior experience is a crucial factor for further educational technology use. From this standpoint, it is arguable that lecturers will continue using certain technologies and methods, especially if perceived as successful for teaching and learning [80]. However, experience and "better" online teaching must not per se correlate linearly. Scherer et al. [81] show a curvilinear correlation, meaning that experience and readiness, perceived institutional support, and self-efficacy increase until a peak and then decreases over time. During COVID-19, however, the situation was different, and lecturers who had, for example, experience in web-conferencing were certainly at an advantage [73]. Age and prior experience in educational technology use are interwoven with the perceived usefulness of the online teaching support the universities offered [19,82,83]. Another important finding revealed that lecturers who perceived the technological-pedagogical support as useful were more likely to be classified as *Strivers*, whereas *Evaders* rarely perceived administrative support and tutorials as useful. At first glance, this result could appear surprising, expecting that lecturers struggling with ERT would seek help. Nevertheless, these results are indeed in line with those of previous studies establishing that lecturers were already under immense time pressure in order to additionally seek support and may have been aware of what their institution had to offer [19]. However, the empirical ground regarding the role of support remains inconsistent, as some stress the necessity for individualized teaching support [84], and others find no evidence that the supports reached the right audience [60] and thus was perceived as not useful for ERT.

Third, how lecturers integrated educational technology was related to self-efficacy beliefs and continuance intentions. *Routineers* had not only the highest self-efficacy beliefs but also the strongest intentions to continue integrating educational technology in their future teaching. As the name suggests and results underline, *Routineers* had a certain

routine of educational technology use before the pandemic, which helped them navigate through ERT and will most likely do so for post-pandemic teaching. In contrast, the *Evaders* are cause for concern since personal, environmental, and behavioral factors reciprocally influence each other, as proposed in the theoretical framework in Section 1.4. Accordingly, these lecturers did likely have no prior experience in educational technology use, perceived no usefulness or did not know about the capacities of the institutional support, and did consequently evade the usage of educational technology to create an online learning environment for students. This is tantamount to giving up on the students' needs and right to education. Looking at this case with a magnifying glass, it becomes apparent that these lecturers had most likely no accessible sources for positive self-efficacy beliefs [38] and therefore lacked the capacity to endure especially stressful times, being in spite flexible and able to alter plans [43]. This would include, for example, seeking technological and pedagogical support from the institution or collaborating with experienced colleagues. Taking *Presenters*, *Strivers*, and *Routineers* together, however, a positive trend regarding continuance intentions is recognizable, which accords with other studies [20,33].

5. Conclusions, Limitations, and Future Research

Two years after the first COVID-19 lockdown and ERT at universities, lecturers' capabilities and their technological environment have changed. Now, in this post-pandemic phase of digital transformation at universities, the question is how sustainable the enforced digitalization boost was for technology-enhanced learning. The person-centric approach of the present study revealed that lecturers started their journey into online teaching from different starting points. Personal factors, educational technology, and institutional support diverged among them, as reflected in the classification of lecturers into the four classes found in this study. Based on lecturers' experiences and study findings, it is likely that professional development happened due to this emergency. At least the ice has been broken in regard to educational technology use. In other words, lecturers had the chance to gather experiences, which is a great advantage for moving forward in the digital transformation of university teaching [16,45].

As the *Social Cognitive Theory* [24] suggests, it is crucial that all of the factors listed therein be considered in the development of post-pandemic university teaching. On the one hand, lecturers must be prepared on an individual level, as they have different prerequisites like experience, self-efficacy, competencies, and beliefs [12,34,42,48,85]. Professional development with the scope of the TPACK framework [48] would ensure that the interweaving of pedagogical, technical, and professional knowledge serves the quality of teaching and learning [29]. On the other hand, universities must deliver a solid technological environment for lecturers, including a variety of digital technologies, but also technological and pedagogical support regarding educational technology use [23,56]. It is gratifying that most of the lecturers studied were able to pass on their teaching content to the students during ERT. However, there remains the group of *Evaders* who need special attention in the development of post-pandemic university teaching. These hold a particularly evading and resisting stance when it comes to educational technology use. These facts once more stress the importance of lecturer professional development that is enabled through a solid technological foundation that goes hand in hand with a shared vision for educational technology use, networks and communities, and design-based research [86].

This study has limitations in the following aspects. Lecturers could partake voluntarily in this study. Considering the stressful time of the first COVID-19 lockdown, it is probable that lecturers who had spare resources filled out the survey, which manifested in the low response rate of below 20% per each university. This could have resulted in a positive bias towards educational technology use and the related constructs. In addition, person-centric approaches are prone to sample-specific results, damping generalizability. However, the latent class analysis conducted is a model-based method controlled by fit indices, which is a strength of the study. Furthermore, despite low response rates, the lecturers who participated in this study varied in their backgrounds, experiences, and disciplines, which

allowed for a holistic display of latent classes. Another strength is the sound theoretical foundation of this study. The *Social Cognitive Theory* makes it possible to place relevant factors and outcomes in a strong theoretical framework that enables interpretation. The results are consistent with other studies and thus confirm the theoretical approach, which underlines the importance and validity of the results of this study, not to mention the replicability of the approach.

Second, the cross-sectional study design only allows for exploratory analysis of the data to answer the research question, and no causal conclusions can be drawn. Third, the indicators of the latent class analysis are based only on self-reported integration of digital technologies. Future studies could assess how lecturers create technology-enhanced learning environments more objectively and fine-grained, e.g., through observational and video studies.

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Article

Experienced, Enthusiastic and Cautious: Pedagogy Profiles in Emergency and Post-Emergency

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Abstract: Background: The COVID-19 pandemic has generated one of the most significant global disruptions to education systems in generations. **Purpose**: This study aims to examine the link between the profiles of teachers identified over the course of the period of Emergency Remote Teaching (ERT) as "experienced", "enthusiastic", or "cautious", and their willingness to incorporate new pedagogical practices that adapt to the new virtual teaching environments. **Methodology**: This is a qualitative study in which a thematic–discursive analysis of in-depth interviews with university teachers is conducted in real time. **Conclusions**: The study found significant differences between the teachers as categorized in terms of responses and practices. These differences are expressed in three main spheres: the capacity of perception (insight), the available repertoire of practices, and the teaching gaze. The Teacher Profiles model in ERT has been updated accordingly. **Implications**: The adjusted Technology Acceptance model along with the recommendations derived from this study may contribute to the training and professional development of university teachers in the field of digital literacy.

Keywords: digital literacy; Emergency Remote Teaching; COVID-19; pedagogical conceptions

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1. Introduction

The present study is a continuation of previous research conducted at the beginning of the COVID-19 crisis in March of 2020. At that time, an interdisciplinary research team comprising researchers from five universities in Latin America, the US, Europe, and Israel developed qualitative and quantitative instruments aimed at investigating the impact of the situation of Emergency Remote Teaching (ERT) on the pedagogical practices of university teachers.

To date, two articles on the subject have been published. In the first, three teaching profiles were identified, essentially derived from pedagogical conceptions and modes of coping with crisis situations, and relating to the levels of digital literacy acquired by these teachers [1] In the second, [2] the authors analyzed the teacher profiles identified in the ERT situation in light of the Unified Theory of Acceptance and Use of Technology and proposed a new model for acceptance and use of technologies in teaching, which they called the Updated Technology Acceptance Model [3,4].

The existing literature responds to the professional modalities of university teachers during the ERT period, when the common view suggested that within a short period of time it would be possible to return to a normal situation. However, two years into this crisis we might propose that we are witnessing three stages in its development: 1. The emergency stage itself (ERT)—essentially, distance learning; 2. The programmed emergency stage, which combines distance and face-to-face teaching periods as necessary and with a certain degree of uncertainty, although less than in the first stage; and 3. The post-emergency stage (the current situation), in which societies reorganize themselves to live with the virus.

In the present study, the authors analyzed the strategies reported by teachers at different universities during the emergency and programmed emergency stages, then analyzed the relationship between the different university teacher profiles in the light of those strategies, the technological practices that they adopted during those periods which proved effective, and their willingness to incorporate these practices in the post-emergency period.

The objectives of this research were:

- To understand the impact of ERT on the specific practices of teachers in the classroom;
- To understand the link between the teacher profiles identified during the ERT period and the level of willingness of each group to incorporate new pedagogical practices adapted to the new virtual teaching environments; and
- To understand the relationship between the teachers' degree of digital literacy and their pedagogical practices during ERT.
- The central research question in the current work is:

    a. Is it possible to identify a relationship between the various teacher profiles identified in the emergency situation ("experienced", "enthusiastic", and "cautious") and the willingness of each group to incorporate new pedagogical practices adapted to the new virtual teaching environments?

    The following sub-questions are derived from the above:
    a.1: What are the teaching strategies employed by teachers in the ERT situation?
    a.2: Where was the teacher's gaze focused? Is there any relationship between this orientation and their strategies and willingness to incorporate technology in teaching?

The assumption underlying the study is that a deeper understanding of the processes that are triggered in educational emergency situations that is mainly focused on the practices actually developed by teachers in the relevant situations will contribute to the training of teachers to introduce similar processes in other educational institutions.

2. Theoretical Framework

As a consequence of the COVID-19 pandemic, teaching institutions at all levels shifted to digital teaching environments in an emergency mode called ERT (Emergency Remote Teaching). Although this modality is not new [5], its appearance during the pandemic was unprecedented in its extent and duration [6–9].

In the first stage of the research, we identified three teacher profiles, namely, experienced, enthusiastic, and cautious, defined in relation to three relevant components: level of digital literacy [3,10,11]; teaching approach [11–13]; and willingness to undergo pedagogical change [1,2,14,15].

In defining digital literacy, we adopt the conceptual framework proposed by Eshet and Alkalai (2004), which includes the acquisition of five skills: photovisual literacy, reproductive literacy, information literacy, branching literacy, and socio-emotional literacy [5].

In the second stage, the disposition of people in general and teachers in particular to use technologies in their practices was examined in depth, with the development of different models aimed at explaining the processes of acceptance of the technologies. Davis (1989), in his Technology Acceptance Model (TAM), suggests two determining factors: perception of usefulness, and perception of ease of use [16]. This model was subsequently expanded to the TAM2 and TAM3 models [17].

Finally, Admiraal et al. adopted Venkatesh's Unified Theory of Acceptance and Use of Technology (UTAUT) [3,18,19]. This model attempts to unify the different existing models, and is based on four constructs that Venkatesh and his colleagues consider as determinants for the use of technologies [19]:

The first is performance expectancy, which is defined as "the degree to which individuals believe that using the system will help them obtain advantages in their work performance" [19] (p. 447). In the various models analyzed, this seems to be the most significant predictor of the use of technologies in terms of motivation, perception of success, and social context.

The second is effort expectancy, defined as "the degree of ease associated with using the system" [19] (p. 450). This category is especially relevant for the initial period of technology use, and refers to the perception of the complexity of the task to be tackled and the effort required to carry it out. The expectation of ease of use is possibly a central component in the willingness to incorporate technologies, and research shows that it is frequently mentioned in the field of teaching.

The third construct is social influence, defined as "the degree to which individuals perceive that significant others believe they should use the new system" [19] (p. 451). This category refers to the perception of the acceptance of technologies as a resource relevant to the subject's social and labor context and of self-image. Unlike the first two constructs, which relate to the psychological-individual sphere, the third construct relates to the socio-communal sphere [19] (p. 451).

The fourth and final construct is "enabling conditions", defined as "the degree to which individuals believe that there is an organizational and technical infrastructure to support the use of the system" [19] (p. 453). This refers to the extent to which individuals perceive that they will be able to control the systems with techno-pedagogical assistance (human and material resources) and with the technical and administrative support of the institution. This fourth construct belongs to the political–institutional sphere, thus completing a broad spectrum that opens up from the particular to the general.

The third stage of the research takes particular note of teaching models and approaches. Of special relevance from this perspective is the need to "normalize a post-pandemic pedagogy, in which online teaching is part of a new normalization of emergency e-Learning, which refers to strategies that frame the widespread adoption of online learning under COVID-19 as a path to a new normal response rather than an emergency response" [20] (p. 10). Murphy refers to the need for a pedagogical rethinking in view of the establishment of a new routine of "living alongside the pandemic".

Different authors have taken up this challenge, proposing strategies to start building a post-pandemic pedagogy. Among them, [21] proposes the following: first, create an alternative teaching plan; second, pay attention to our own voice; third, relate to the small class as an attractive framework; fourth, enhance students' competence through study activity outside of the classroom; fifth, introduce a pedagogical teacher's assistant; and sixth, combine the virtual classroom with the traditional face-to-face classroom. [6] proposes a similar model: first, make emergency preparedness plans for unexpected problems; second, separate the teaching content into smaller units to help students focus; third, emphasize the use of voice in teaching; fourth, work with teaching assistants and gain online support from them; fifth, strengthen students' active learning ability outside of class, and sixth, combine online learning and offline self-learning effectively.

Some authors have coined a new term—ERL, Emergency Remote Learning—to express the emergency situation as experienced not only by teachers but also by students and their families [22,23] reports two predominant components in the experience of university students: the experience of blended learning,, and that of "paradoxical learning" that assumes the coexistence of positive and negative factors in the learning experience in the emergency situation.

At the time of writing this study, we find ourselves in what we might call the post-emergency stage; although the pandemic is active, universities have mostly returned to face-to-face classes thanks to the existence of vaccines, rapid tests, effective treatments, etc. The relevant question is what we have learned over the past two years, and how we should go about building a new pedagogy that includes new tools and concepts that can help us navigate future emergencies. To this end, the analysis of the practices of teachers in the first stage of the emergency, especially those most successful in terms of acceptance and willingness to embrace pedagogical change, will allow us to rethink training and professional development processes.

3. Materials and Methods

At the beginning of this chapter, it should be noted that both the design and the instruments of this research were developed together with an international team of researchers who worked in parallel at their respective universities (Prof. G. Horenczyk and Dr. M. Dorfsman, Hebrew University, Israel; Dr. C. Lion, Universidad de Buenos Aires, Argentina; Prof. K. Göbel, Universität Duisburg-Essen, Germany; Prof. E. Makarova, Universität Basel, Switzerland; Dr. D. Birman, Miami University, USA). Furthermore, the in-depth interviews upon which this work is based were carried out during the first stage of this investigation.

A quantitative questionnaire was first administered to the teaching staff of the Hebrew University, yielding a total of 241 participants. In the questionnaire, respondents were asked to indicate whether they would be willing to participate in the qualitative research stage, consisting of an in-depth interview, in order to broaden and deepen the data requested in the questionnaire. We received 110 positive responses; to define the sample, we used the judging sampling technique. In this type of sampling, following the principles of structural representativeness, the variables that delimit the composition of the sample are chosen under previously agreed-upon theoretical criteria. The number of units required was established according to the saturation point principle [24,25].

The researchers chose two variables to construct the sample, namely, years of experience and disciplinary field of teaching. The sample arrived at included ten female teachers and five male teachers; ten of them taught in the humanities and five in the natural sciences. Six teachers reported between 1 and 5 years of experience, three between 6 and 11 years, two between 12 and 17 years, and four reported 18 years or more of teaching experience.

The fifteen selected teachers each participated in a semi-structured interview lasting approximately one hour.

The interview script considered the three stages that made up the questionnaire: teaching practices prior to CRTS (Corona Related Teaching Situation), the confrontation with the emergency situation, and the "day after". It was elaborated and validated in cooperation with the international research team whose members helped design the model and its instruments.

The interview addressed five topics:

a. Teaching background—for example: In what areas do you work? How long have you been at your university? For how many years have you been teaching?

b. Teaching conceptions—for example: How do you usually prepare your classes? What kind of resources do you use? Before the crisis, did you use technological tools? How? Which?

c. The impact of online teaching on practices—for example: How did you approach the CRTS? Did you have time to prepare for it? In addition to the zoom platform, did you use other tools? Have you noticed any differences between the first and last class you taught? What kind of differences?

d. The institutional perspective—for example: what could have been better in institutional performance? Did you feel that you could conduct yourself freely in your teaching?. The day after: How do you foresee the return to conventional classes? How do you conceive the new situation? Would you like to return to the type of practice that you developed before the crisis? Do you think this is likely to change? (See interview protocol in Appendix A).

The interviews were recorded and later transcribed for analysis using the thematic analysis method [26]. This methodology makes it possible to systematically identify, organize, and present reliable information on patterns of meaning in a data set. Its main advantage is its flexibility in accessing the data and undertaking its analysis. Within the framework of this methodology, a deductive approach was implemented "in which the researcher contributes to the data a series of concepts, ideas or themes that he uses to codify and interpret the data" [27] (p. 3). In the use of this approach, the semantic interpretation prevails; the orientation is critical, and favors triangulation.

In qualitative research, the researchers focus on carrying out the interviews without preconceptions regarding the answers to be obtained by the interviewees, the scope of their experience, their tenure, or the size of their classes. Although there were different types of answers according to the situation of each interviewee, they were processed according to strict methodological criteria.

The analysis took place in three stages:

- Stage 1. Thematic–deductive analysis based on the scientific literature
- Stage 2. Analysis according to the typology of Acceptance of Pedagogical Change [11]
- Stage 3. Analysis and recategorization through five thematic axes formulated as a reduction and reconceptualization of those set forth in stage 1, supported by the scientific literature.

In the first stage, the interviews were coded according to six axes that were selected based on the analyzed scientific literature: 1. Emergency preparations; 2. Dividing up teaching content; 3. Use of voice in teaching; 4. Teaching assistants; 5. Strengthening students' self-study; 6. Combining online and offline learning. Especially interesting was the third category, "use of the voice in teaching", referring to the teacher's need to reach the students. In the absence of the immediate direct contact of the regular classroom, the "voice" is an element that can contribute to and enhance contact.

In the second stage, the interviews were further analyzed according to the Typology of Acceptance of Pedagogical Change [1]; see Table 1. This table shows the analysis based on the sample taken in terms of the three main categories analyzed in this research: pedagogical conception, digital literacy, and pedagogical change, as discussed in our first article on this topic [1]. The teachers were assigned to the respective profiles according to the score received (see reference at the bottom of the table), and this generated the three profiles: experienced, enthusiastic, and cautious. In the table, a specific score has been established for each of the three categories, according to the references at the bottom.

Table 1. Typology of Acceptance of Pedagogical Change (TAPC).

Profiles		Pedagogical Conception	Digital Literacy	Pedagogical Change
Experienced	Michal (All the names are fictitious)	3	3	3
	Rachel	3	3	3
	Elisheva	3	3	3
	Shlomo	3	2	3
	Esther	2	3	3
Enthusiastic	Revital	3	3	2
	Noa	1	3	2
	Michael	2	2	2
	Meital	2	2	2
	Moshe	2	2	2
	Shulamit	1	2	2
	Avigdor	1	2	2
Cautious	Yael	2	1	1
	Marc	1	2	1
	Lior	1	1	1
References		1. Teaching based	1. Uses digital tools, is not enthusiastic about continuing to use.	1. Resist change; tactical change.
		2. Teacher based → Student based	2. Discovered the tools and is interested in continuing to use them.	2. Accept change; formal change.
		3. Student based	3. Already used digital tools, and continues.	3. Genuine change.

Source: [1].

The experienced teachers received between 8 and 9 points, the enthusiastic between 7 and 5, and the cautious 4 or less. In the case of identical scores, as in the case of Esther and Revital (both 8 points), we decided to prioritize the third column (pedagogical change) and categorize it accordingly.

In the third stage, and thanks to data decoding and reduction work [28], the information was analyzed, recategorized, and reconceptualized through the following thematic axes: 1. Emergency planning (A re-reading of the interviews leads us to propose that the teachers were actually thinking in terms of "pedagogical planning" or "planning" rather than "preparation"); 2. Methodological considerations (Inclusion of the previous considerations—"Divide didactic content" and "Combine online and offline learning"—within this category seems more precise and explanatory for the purposes of our analysis); 3. Seeking direct connection with the student (The category "Seeking direct connection with the student" allows us to express more clearly the type of link the teacher is looking for with the student); 4. Teamwork; and 5. Consideration of student needs (In our view, the category "Consideration of student needs" allows us to express more clearly the teacher's concern for the students). These categories are the product of the reduction and reconceptualization of those set forth in stage 1, supported by the scientific literature.

Each of these categories was in turn divided into subcategories that allowed a deeper understanding of the pedagogical phenomenon manifested in each of the teacher profiles [12].

The entire coding process was carried out by each of the researchers separately, with the results obtained and then compared to guarantee the validity of the process and avoid subjectivity as much as possible.

In this thematic–discursive analysis, our focus was placed on the holistic analysis of the particular experiences of the interviewees during the educational emergency and in its context [29].

At the end of each stage, the researchers validated the coding process, obtaining a high percentage of concordance between both cases. It was not considered necessary to rely on statistical coefficients such as Cohen's Kappa or Kendall's T coefficient, as in this discursive type of analysis the congruence of the results is guaranteed by the concordance between the problem analyzed, the research question, the methodology chosen, and the type of information obtained [27].

As seen in the research results, each category refers to how each identified profile reacted in the emergency situation and acted accordingly. The coincidence between what the scientific literature indicates as best practices and those effectively demonstrated by the profiles most prone to genuine change indicated to us that this categorization was on the right track.

In the next chapter, we analyze in depth the categories mentioned in terms of the particular characteristics of the profiles in question.

4. Results

Our analysis of the interviews, as explained in the previous section, allowed us to describe how the three categories of Acceptance of Pedagogical Change emerged in each of the five thematic axes: a. Emergency planning; b. Methodological considerations; c. Seeking direct contact with the student; d. Teamwork; and e. Consideration for the needs of the student.

We now present each category as it emerges from the analysis. Finally, we corroborate how it is expressed in each teacher profile identified during the ERT.

4.1. Emergency Planning

In this first thematic axis, we find different answers regarding the nature and modality of the so-called "emergency". The current concept of emergency teaching originated in 2003 with the advent of SARS in the Far East [30].

We ask ourselves, how do university teachers react to an emergency, and how are they prepared to address it?

In our analysis of the interviews conducted between April and June 2020 we found that teachers in the **experienced** group quickly became aware of the dimension of change and of the need to make significant changes in their pedagogical practices: "I made a strategic decision: first record the classes and then do an online class discussion . . . " (Michal). Also, this understanding made them aware of the need to become "students" themselves, given that they would have to learn new tools in the new situation: " . . . From the beginning, I knew that I was going to have to make changes. I did not know what to expect, but I understood that there was going to be a learning stage (for me) . . . " (Rachel). Finally, consideration for the students was already present at that time: "One of the reasons why the teaching method I chose was to pre-record the lectures and do a 'flipped' course was because . . . it was also technical, making shorter videos . . . and for many students, that is better . . . " (Shlomo).

Teachers in the **enthusiastic** group were initially interested in the digital resources they were going to need and tried to organize their classes in view of the characteristics, and eventually the advantages, of these tools: "One of the things we thought about then was to prepare a lot of presentations for digital work, for working with digital tools, and now it saved us" (Noa,). Furthermore, they sought more "sophisticated" resources: " . . . I had to do an auditory PowerPoint, which they would listen to beforehand, and then the class—let's say a one-hour PowerPoint, and half-an-hour class. However, the PowerPoint took me so long, and it was so 'cost-ineffective', that I gave it up . . . " (Michael,).

The teachers in the **cautious** group organized their practices in a similar way as before, with minor changes: " . . . I didn't change much, if I changed in any sense I made some additional PPTs, a little more, I gave them the bibliography—instead of orally, in organized lists in Moodle . . . " (Yael).

Within the framework of these preparations, the search for "partners" for teaching stands out as a distinguishing feature. While the experienced and enthusiastic teachers relied on working with teams or colleagues: " . . . in general, I wouldn't have taken this course if I hadn't had a team that supported me in the first place" (Rachel), the cautious teachers did not mention this option.

4.2. Methodological Considerations

Faced with imminent change in the teaching modality, university teachers quickly began to assess the need to introduce changes in their practices. In the interviews, these changes were already taking place or being considered.

A general review of the data shows that the teachers considered specific modifications to their presentations ("more detailed PowerPoint"), combining online with offline, modifying the syllabus and the content of the classes. and reinforcing follow-up of their students in various ways.

In this context, it was the **experienced** teachers who made the most significant changes in their methodologies, especially highlighting their concern for their students: " . . . We decided to record the lessons. It's a bit challenging because we can't let them do 5 h of Zoom, or individual work with all the students; it's something that we can't do anymore, so we decided to record the lessons and then I would upload the recorded lesson, give them two weeks to work on an exercise, we did a focused lesson where we answered questions a week later . . . and in the process we organized a kind of forum which was really cool . . . " (Elisheva); "We realized that it was not working and so we started working a lot in groups, (. . .) each class had at least one session in pairs or trios . . . " (Rachel); " . . . for many students, it is better: how do I put together a class where they are active? How do I get them to engage?" (Michal).

The **enthusiastic** group mainly dedicated themselves to reviewing the resources and learning the new scenarios: "I tried to make the PowerPoint presentations more detailed to help them. In online teaching, that much more is required . . . (for) getting students to engage, that is, find ways to turn them from passive into active . . . "; " . . . So, first of all, PowerPoint preparation. Second, I don't know exactly how to explain this. It must be exact.

Something in the flow . . . I don't even know why . . . You must be sure that everything you say connects very well . . . " (Meital).

The **cautious** group was hesitant about adapting to the new conditions, changing their previous practices as little as possible: "Simply more orderly. Beyond that, no . . . Right, I worked more on the presentations, which means I was more concerned with them being a little more detailed or a little more visual, but of course in terms of the course content I didn't change . . . " (Yael).

" . . . So it took me a while to adapt, let's say share, let's say Power Point. I'll give you an example. I wanted to show them some clips, at first there was a problem because I didn't know how to make the sound so they could hear it. So I tried to show them a video, but they couldn't hear . . . ." (Lior).

4.3. Seeking Direct Connection with the Student

In this category, we analyzed an issue that teachers expressed with regard to their students at the beginning of the crisis: for all of them, the online Zoon teaching situation introduced a physical and psychological barrier that prevented direct contact. For many, this was an insurmountable barrier; for others, it was an opportunity to find new approach strategies.

In the case of the **experienced** group, what came through very clearly was their search for contact with their students, either visually via Zoom or using different strategies that highlighted the direct relationship with them: "In fact, I detailed each week what my expectations of them were, to help them to organize themselves, because I know that [students] jump [on Zoom] from one course to another (Michal)"—" . . . to see them, to look into their eyes . . . ." (Michal); "And also for me I think that in Zoom there was something very strong because the class presence is strong: at least you see the faces, you can understand if someone, by his look, is with us" (Esther).

The **enthusiastic** group showed a similar pattern. In general, while they sought contact with the students, in the ERT situation it was difficult for them to establish contact, and they felt the absence: "I told them, 'I want to listen'—I feel alone not listening to them, I didn't come here to talk to myself all the time. At some point it helped me, but I really complained to them, . . . I don't find this pleasant; I want to hear their voices, and at some point it settled down, but at first . . . I don't know, it was like a refrigerator" (Shulamit); " . . . because there is no class and you don't see all kinds of signs that maybe in class you can see" (Shlomi).

The **cautious** group did not make special mention of this category; however, when they did, it was in a tone of disappointment and even anger: "On the other hand, even now I feel that I don't have . . . I really don't know what students are, I don't know students, really. No . . . it's not the atmosphere of a course" (Marc).

In short, in this category, we can synthesize the three modalities that appear spontaneously in the teachers' search for contact with students: the **experienced** group actively seeks contact through different strategies; teachers in the **enthusiastic** group wish to do this and become frustrated when they cannot; and the **cautious** group do not seek contact, or else they do and are frustrated by the non-contact situation.

4.4. Teamwork

This category refers to the willingness and need felt by teachers to work in teams or with colleagues.

The teachers in the **experienced** group turned to colleagues to plan or 'rehearse' the implementation of the teaching system: "I worked together, I didn't work alone. The teachers [who were] alone were in a different situation" (Rachel); "The first time we rehearsed the class with my colleague, to see if everything worked well and we had no technical difficulties . . . " (Michal).

Among the **enthusiastic** group, while in many cases teachers were aware of the need for help and its importance, they expressed frustration at the inadequacy of what was

available: "But we don't have teaching assistants. So it is challenging (. . .), and there was no [direct] response either; there was an online response, there were online courses, but if I say I wanted someone [technical support] to come and help me . . . it was not like that . . . " (Revital).

Among the **cautious** group, the topic generally did not come up.

4.5. Consideration of Student Needs

This last category considers the actions carried out or described by the teacher in relation to meeting the needs of their students during ERT, encouraging them, and making sure that they maintained their learning routine and understood the content that was being taught.

Teachers in the **experienced** group invested great efforts in helping their students, provided them with additional exercises, and generated didactic reinforcement schemes and ad hoc forums for specific exercises and problems. They tried by all means to be "present": "It was important to me that if a student wanted to carry out his semester as a regular semester, then that's what we would do . . . We comment on the exercises; we do more things that are a little more as they were previously" (Shlomo).

"We were answering their questions and not letting them take care of themselves, which is something that we thought this year we would try to change, yes, we would make them take care of their problems and not just raise your hand and run to them, try to let the students cope by themselves more . . . " (Elisheva); "Let them see that I am a person behind the computer, and I will see that they are people . . . " (Michal).

While the teachers in the **enthusiastic** group invested efforts to help their students, they found themselves paralyzed by the situation of forced isolation. In many cases, "losing" students generated annoyance and frustration that led to a feeling of impotence: " . . . .In class I also lose some of the students, with all that I move around a lot, I lose some of the students, so I cannot imagine what happens in the Zoom. It bothers me a lot (. . .) and the students were stressed about it,—I mean because beyond that, also we . . . you know, we come to help the students, there are MA or PhD students who were experiencing difficulties and had no available help . . . " (Revital). "I have a lot of patience for my students (. . .), there is no question that is not a legitimate question, and I will explain to the students until they understand and I show a lot of patience (. . .) and also I set schedules for them, I scheduled them three times in the semester for personal meetings to find out how they are feeling and what is happening to them and all kinds of things not necessarily related to studies but more personal . . . " (Noa); "But I also felt that over time I was losing others—and when I didn't see someone in the class then I had no idea, so if I see a black screen I say, Well, he's not with me—I found myself adding three or four slides to each lesson to help them" (Moshe).

An interesting example is that of Shulamit, who expressed her teacher-based perspective: "But I did not use presentations at all, because of a thought that I want them to look at me and not start copying the presentation from the board . . . (Shulamit).

The contents of this category received almost no mention in the interviews of teachers from the **cautious** group.

In the discussion section, we analyze to what extent the practices reported by the teachers interviewed during the ERT period are consistent with the pedagogical conceptions and levels of digital literacy according to the profiles identified in our research. We try to answer the research questions, and take initial steps towards developing a Typology of Pedagogical Practices for the post-emergency situation.

5. Discussion

In this study, we examined the relationship between the teacher profiles identified in the emergency situation (experienced, enthusiastic, and cautious) and the willingness of teachers in these respective groups to incorporate new pedagogical practices adapted to the new virtual teaching environments.

The following sub-questions were derived from the above question:

- What are the teaching strategies employed by teachers in the ERT situation?
- Where was the teacher's gaze focused? Is there any relationship between this orientation and his/her strategies and willingness to incorporate technology in teaching?

Following analysis of the answers provided by the teachers in a situation of complete ERT, the following interesting issues deserve consideration.

5.1. Insight

All the teachers interviewed, without exception, spontaneously expressed the view that reality has changed and that decisions need to be made concerning the modalities for teaching practice going forward. This idea, which at first glance seems self-evident, has not come to the fore in this way in most professional practices. Unlike other professions (health, law, economics, etc.), in the case of teachers the change went far beyond mere presence in class. However, this understanding or insight regarding the new situation did not occur in the same way among the teachers belonging to the three profiles examined.

The **experienced** group quickly became aware of the seriousness of the event and the need to make significant changes in their practices. This initial perception was accompanied by an almost immediate call to action, expressed in strategic decisions and innovative practices. The pedagogic perception, in this case, may be defined as "strategic perception" based on a clear vision of the situation and an ability to think of medium- and long-term practices to address it.

Teachers in the **enthusiastic** group likewise understood the magnitude of the challenge and the need to implement changes in their practices. However, due to constraints arising from their limited experience in digital environments, they were not able to translate this into the possibility of introducing genuine pedagogical changes in their practices. We might refer to this as a "voluntarist perception"; on one hand, it is less strategic than tactical, while on the other it cannot be considered solely tactical, as it is accompanied by the intention of being able to offer students learning possibilities even in the new environments.

The perception of teachers in the **cautious** group is more complex; while they are aware of the new situation, they do not seem aware of its magnitude. In this sense, we might say that the perception is, at best, a tactical perception which they rely on to help them overcome the challenge.

5.2. Repertoire of Practices

The spontaneous reactions of the teachers interviewed gave rise to an exciting and varied repertoire of strategies and practices that they implemented in the first months of the ERT situation.

The teachers in the **experienced** group were characterized by substantial modification of their methodology, in most cases moving deliberately to a "flipped classroom" thanks to the training offered by the university. This modality involved the production of short videos, the combination of synchronous and asynchronous teaching, the intensification of work on the platform (Moodle) through forums and self-learning exercises, an increase in availability hours and individual meetings, changes in the evaluation modality and the syllabus in general, an increase in online work and asynchronous teams, etc.

These strategies were viewed as the product of two factors: on one hand, an intensive investment of time and effort; on the other, a focus on the needs and possibilities of the students, who were in an emergency situation as well [23]. Alongside this rich and varied repertoire of resources, teachers in the **experienced** group worked extensively

with colleagues and, where available, teaching assistants. Work with colleagues may be considered as yet another resource used mainly by this group.

Teachers in the **enthusiastic** group limited themselves to the resources they knew best and used most extensively, such as Powerpoint and Moodle. The first was the most frequently mentioned, including consideration of the possibility of adding audio and turning it into an audio class. However, this possibility simultaneously evoked the desire to make changes and the incapability of doing so in a significant way.

The **cautious** group mentioned the use of PowerPoint as the predominant resource of their new practices; however, in contrast to teachers in the enthusiastic group, the changes in PowerPoint here were at best cosmetic.

5.3. The Teaching Gaze

One of the questions we asked ourselves during the emergency situation was where the teacher's gaze was focused, and whether there was any relationship between this and their willingness to incorporate technology in their teaching.

One of the central concerns voiced by the teachers was the encounter with so-called "black squares," a reality in which they were forced to teach students who chose not to open their cameras on Zoom, thereby ruling out any possibility of eye contact with the rest of the group and with the teacher.

Whether intentionally or not, the absence of the student's gaze affects the teacher's gaze. In certain cases, the teacher's frustration led to a feeling of anger and personal offense; in others, it generated deep concern and redoubled efforts to "recover the lost gaze".

The teachers in the **experienced** group, whose pedagogical conception is based on meeting the students' needs [19], belong to the latter category. Far from being "offended" by the situation, they sought ways and strategies to reach their students. The teachers in the **cautious** group, whose perception is mostly "teacher-based" [12] belonged to the former category. They tended to view the students' decision not to open their cameras as a personal affront, and this situation paralyzed them.

The teaching gaze thus became a factor with a mobilizing, immobilizing, or variable effect; in the case of the experienced group, it mobilizes, among the cautious group, it immobilizes, and among the enthusiastic group the reactions are varied. Those whose teaching gaze is paralyzed remain immersed in the ERT, while those whose glance mobilizes are simultaneously part of ERL.

In sum, we can say that the teachers in the experienced group, whose level of digital literacy is high and whose level of resistance to integration of technology is relatively low, have achieved a strategic perception that allows them to plan and act, and they have a vast repertoire of resources which allows them to shift from ERT to ERL.

Teachers in the **cautious** group, whose level of digital literacy is low and whose level of technology resistance is relatively high, have retained a tactical perception that does not allow them to look at the long term and act accordingly. They have a very limited repertoire of resources, which prevents them from getting involved in their students' problems [31,32].

Teachers in the **enthusiastic** group, whose level of literacy is low and whose level of resistance to integrating technology begins to recede, especially in its psychological components, are characterized by a tactical–voluntarist perception and a limited repertoire of resources, which they try to expand in the short and medium-term.

In Figure 1, we summarize a re-characterization of the three profiles based on the results of this analysis.

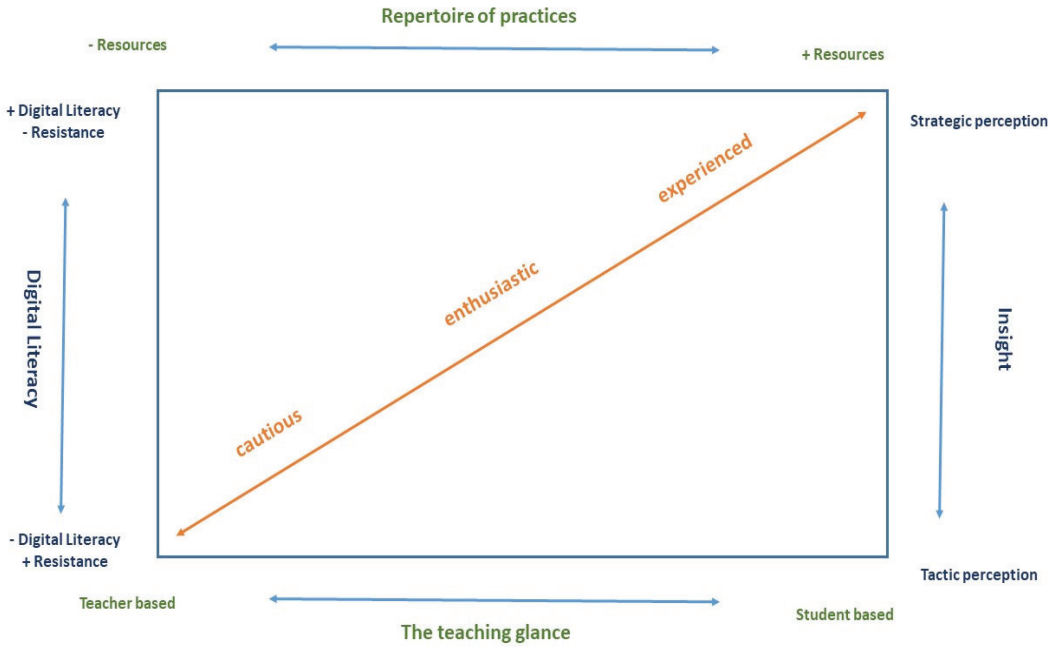

Figure 1. Redefinition of teaching profiles in ERT.

6. Conclusions

This study exposed us to a number of interesting elements of analysis that allow us to understand in greater depth the emergency situation experienced in university education since March 2020.

One key concept that allows us a comprehensive view is the concept of ERL, which invites us to shift the perspective from the teacher (ERT) to the student (ERL).

Regarding the question of how the emergency situation impacted teachers' pedagogical practice, the sub-question must be added of how this practice, in an emergency situation, generated conditions that enable autonomous or directed student learning.

As we learn from [23], when analyzing the emergency situation from a student's perspective (ERL), we find ourselves in a paradoxical situation which simultaneously includes both positive and negative experiences. The experience was a positive one as far as students were able to continue studying even in the challenging emergency situation; the negative aspect related to the lack of adequate preparation to do so, and frustration due to the lack of direct contact with the teacher and with fellow students.

If we take ERL as our key concept, we can say that the three new proposed categorizations, namely, insight, repertoire of practices, and the teaching gaze, oscillate like a pendulum between a situation of ERT and one of ERL.

The insight capacity oscillates between tactical perception, reflecting the traditional teacher-based approach. and the strategic perception, reflecting a more student-based approach.

The repertoire of practices oscillates between the traditional and directed class based on the teacher and the flipped classroom, which is more heavily reliant on the student.

Lastly, the teaching gaze and the case of the "black squares" show this oscillation very clearly, as explained in the previous chapter.

In conclusion, we can say that our three profiles are the most complete expression of this pendulum, from the cautious group immersed in the world of ERT, to the experienced group which shifted to ERL, passing through the enthusiastic group, which oscillates between ERL and ERT (see Figure 2).

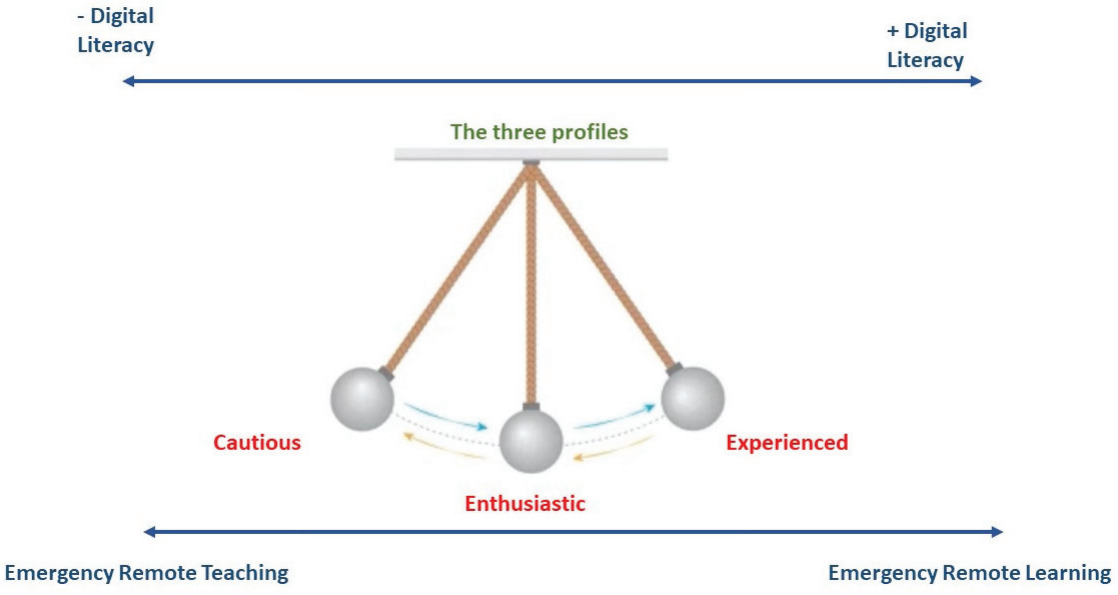

Figure 2. The pendulum of pedagogical practices in emergency situations.

Preparing teachers for the next emergency, with an emphasis on the enthusiastic group, is the major challenge in the development of pedagogies for emergency and post-emergency situations.

7. Future Directions of Research and Limitations

In this study, we analyzed pedagogical practices during the educational emergency imposed by the pandemic.

In a future study, we will propose a survey of university teachers investigating the learning obtained during this stage and its implementation (or not) in the post-pandemic era.

We are interested in knowing what we have learned and how prepared we are for the next emergency.

This research involves the same limitations mentioned our previous studies, some of which are related to methodology and others to conceptualization. From the methodological point of view, we would like to stress once again the use of mixed methods with a qualitative emphasis. This involves the arduous task of combining the two methods and the integration of the findings obtained from both.

Additionally, this qualitative thematic–interpretive research was based on data collected two years ago at the Hebrew University [11]. As with all qualitative research, the results and categories obtained must be corroborated in other comparable contexts.

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Appendix A. Protocol for the Qualitative Stage

Thank you very much for agreeing to participate in this phase of the investigation.

This in-depth interview aims to examine some of the topics already addressed in the questionnaire that you answered, to understand more deeply your conception of teaching in general, and of in-depth online teaching; to analyze the impact that the situation generated by the COVID crisis had on teaching practices; to understand how the institutional context has impacted your performance and how you believe it will do so in the future; and also to understand whether you believe that this forced step of moving into online teaching will have an impact on your future practice.

The duration of this interview is approximately one hour. If you are agreeable, it will be recorded for better use.

All data collected in this interview, as well as from the questionnaire, is confidential and will be used exclusively for this study.

During the interview, we will elaborate on the questions presented to you in the questionnaire, in order to expand and deepen the information.

Thank you for your consent to participate.

a. Background

Examples of questions:

What area(s) do you work in? How many years have you been at the (your) University? How many in teaching?

b. Conceptions of Teaching

Examples of questions:

In the questionnaire, you answered that you considered yourself a ____ teacher. Can you elaborate? How do you usually prepare your classes? What kind of resources do you use? Before the crisis, did you use technological tools? How? Which ones?

c. The impact of online teaching on your practices

Examples of questions:

In the questionnaire, you told us about your feelings in the face of the crisis; can you expand on them? How were you able to cope with it? Did you have the possibility of preparing yourself? In addition to video conferencing, did you use other tools? Did you notice differences between the first class and the last class you taught? What kind of differences?

Were you able to take advantage of the tools offered by the different environments? Did you continue teaching as before? Did you notice changes?

Can you share an example of "good practice" during this period? Can you tell us about a frustrating incident/experience?

How do you think this experience affects your teaching? How does it affect your students? How do you evaluate or plan to evaluate the students' achievements?

How do you approach the subject of evaluation now?

d. The institutional perspective

Examples of questions:

In the questionnaire you told us that the institution you work at . . . Could you expand: What do you emphasize, and what could have been better? Did you feel like you could conduct yourself freely in your teaching?

e. The return to the next semester: conventional teaching or "zoom teaching"

Examples of questions:

In the questionnaire you offered your perceptions regarding the end of the crisis. Can you elaborate? How do you foresee the return to the conventional teaching/frontal classes? How do you conceive the new situation? told about your views.

How do you define "normality"? Would you like to return to the kind of teaching practice that you used before the crisis? Do you think that it is likely to change? How? Why? Will the change be due to your own initiative or will it be imposed by your institution?

What are your expectations concerning your institution following the return to "normality"?

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Article

Self-Efficacy in Online Teaching during the Immediate Transition from Conventional to Online Teaching in German and Argentinian Universities—The Relevance of Institutional Support and Individual Characteristics

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Abstract: Triggered by the spread of the Coronavirus and the lockdown of universities in spring 2020, universities were required to provide infrastructure for digital teaching within a very short time. Further, all university members needed to develop knowledge and skills for teaching online. This paper presents data from the cross-cultural CRTS-Study (Coronavirus-Related Teaching Situation Study), which compares the experiences, attitudes and needs of university teachers in Germany and Argentina during the first lockdown in the context of the Coronavirus pandemic. The study has been carried out in spring 2020 as a cross-sectional online survey study with university teachers in Germany and Argentina ($N = 728$). The overall picture reveals a mostly successful implementation of online teaching for university teachers in both countries, with Argentinian university teachers reporting a slightly more positive perspective and slightly higher self-efficacy beliefs in online teaching when compared with the German colleagues. The results of regression analysis hint at the relevance of prior personal experience and institutional support for self-efficacy beliefs in online teaching for both samples. In conclusion, individual experience and training as well as supportive institutional conditions seem to be relevant for the development of digital teaching at universities in both countries.

Keywords: ERT; self-efficacy in online teaching; cross-country comparison; university teachers

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1. Introduction

1.1. Online Teaching during the Beginning of the Coronavirus Pandemic

In December 2019, the SARS-CoV-2 virus was first discovered in Wuhan, the capital of Hubei Province, and has since then spread across national borders and continents. To limit the spread of the coronavirus, a lockdown of social life including universities and schools had been successively realized almost worldwide. In response to the first closure of the universities in spring 2020, university teachers ventured into often uncharted, unfamiliar terrain and designed an online teaching format for their courses overnight [1,2]. This crisis-induced transfer from face-to-face teaching to online-supported formats, named as "Emergency Remote Teaching (ERT)" [3], must be clearly distinguished from carefully planned digital teaching formats, as their primary aim was to counteract the inhibitory effects of the pandemic-related lockdown on the quality of higher education processes as quickly as possible and to enable alternative access to teaching and learning content and mentoring [4]. In the context of university lockdowns, the implementation of educational technology had been intensified to create a synchronous or asynchronous teaching offerings [5–8]. The switch to Emergency Remote Teaching (ERT) was commonly supported by

developing guidelines on the design of digital teaching and on the use of different digital tools, e.g., learning management platforms, videos, videoconference tools and others [9–15]. Still, neither the infrastructure of universities nor the competencies of university teachers were adequately prepared for this challenging transition from face-to-face to digital teaching and learning formats [16]. Nevertheless, the necessity to re-think and re-design higher education learning offered in the context of ERT was seen as an opportunity for stakeholders in higher education to reconsider the role of information and communication technologies (ICT), review its effectiveness, and hence increase resilience and sustainability of online learning in higher education for the future [17].

The ERT situation and the lockdowns due to the pandemic have been a challenge for university teachers and students [18]. During the first lockdown in spring 2020, students and university teachers used more educational technology tools than they were usually using before [19]. Most studies in the context of the switch to online teaching in higher education have been realized on student samples [20]. Students reported advantages with online learning, as they could listen to lectures from any places, which made online learning flexible, but due to few activating interactions and network instability, concentration in the learning process was partly reduced [21]. Further, students were concerned that during the pandemic their mental and physical health had deteriorated [22]; female students assessed a greater negative impacts of the pandemic, like social isolation, stress and mental health problems, compared with their male counterparts [23]. Nevertheless, female students reported being more active in learning and their satisfaction with processes of online learning and the university was higher than that of male students [24].

Compared with the various experiences of students, the experience of university teachers during the pandemic has only been addressed in a few studies [5,25–32]. Results indicate that university teachers experienced the new teaching and learning situation as largely successful, rating it more positively may have been expected [5,25–28]. Several potentials for the switch to online teaching have been perceived by university teachers, e.g., more flexibility and autonomy in learning as well as digital competence development [5,29–32]. Nevertheless, individual characteristics of university teachers with regards to digital technology, such as former experience, a positive attitude and self-efficacy beliefs seem to play a relevant role for successfully managing the rapid shift to online teaching [6,33,34].

1.2. The Relevance of Self-Efficacy Beliefs for Online Teaching

Aspects of self-efficacy beliefs might be important for the realization of online teaching [35], and self-efficacy beliefs may even function independently of underlying skills [36]. Self-efficacy beliefs can be conceptualized in a quite general manner, but also in a more specific manner depending on the context, the environment, and the specific task [37]. From a general learning perspective, self-efficacy beliefs are nurtured from different sources, but experiences of mastery seem to be most important [38]. Concerning expertise in face-to-face teaching, there is significant evidence for the correlation between teachers' self-efficacy beliefs, their teaching performance and students' learning success in schools [39,40]. However, as online teaching is different from face-to-face teaching, a specific examination of self-efficacy in online teaching seems necessary. From research in the context of the technology acceptance model, we know that self-efficacy beliefs are related to perceived usefulness and ease of use of digital tools [41]. More specifically, technology enhanced self-efficacy beliefs of students are shown to be associated with a higher perception of ease of use; hence result in a higher willingness to use technology [42–44]. Another recent study on self-efficacy beliefs in online learning indicates a negative correlation between self-efficacy beliefs and difficulties in online learning for students [45]. Concerning the use of digital technology, motivational aspects seem to be especially relevant for female students [44].

Consequently, teachers' self-efficacy beliefs regarding digital teaching and digital teaching tools should also be influential for the implementation of online teaching formats [46]. When trying to explain perceived effectiveness and skills in dealing with technologies in higher education, empirical findings show that the actual use of digital tools [46,47], and

the perceived usefulness of these technologies [48] play a relevant role. However, when looking at the literature concerning online teaching, there are still only a few studies address self-efficacy beliefs and teaching quality in online teaching contexts from the perspective of university teachers [49].

In comparison, a large body of studies describe conditions and challenges in online teaching, aiming at differentiating different competencies and levels of university teachers' expertise in online teaching [50–53].

In the context of a study with Chinese university teachers, most respondents lacked experience in online teaching at the beginning of the first lockdown, but technology application increased during online teaching, and although general self-efficacy beliefs in online teaching had not been perceived to have increased, self-efficacy in online applications still increased among Chinese university teachers during the lockdown [54]. From the perspective of university teachers, the increase in online teaching goes along with increased flexibility and more independent student learning, which is evaluated positively. However, university teachers point at the problem of maintaining the relationship with students; the lack of contact is a relevant problem which should somehow be addressed in adequate online formats [54,55]. A survey study in the United States realized during ERT reveals a relevant shift in online teaching strategies towards a more instructor-centered mode in online teaching, which was more detached from students when compared with face-to-face teaching [56]. Scherer and Colleagues assume that university teachers' mastery of online teaching might be dependent on individual and contextual variables, arguing that individual variables like gender and online teaching experience as well as contextual variables of the institution might play a role for the success of online teaching in the context of the pandemic related ERT [57].

Results from an international study on university teachers suggest that although the quality of teaching was impeded, university teachers tried to maintain teaching quality despite the difficult situation, but the actual success in maintaining teaching quality seems to be highly determined by prior personal experience [58]. Dorfsman and Horenczyk also point to the relevance of digital literacy before the pandemic related ERT as predictor for mastery in online teaching [50]. Besides individual experience in online teaching, individual characteristics might also be relevant for dealing with online teaching formats. Following the idea of a global digital gender divide in the use of digital technology [59,60], gender-specific attitudes and experiences might have an influence on individual openness to digital teaching and learning formats, but the results concerning university teachers seem heterogeneous. In a study with Spanish university teachers investigating their attitudes towards ICT (information and communication technologies), the authors found that female university teachers tend to report lower general positive attitudes towards ICT than their male peers [60]. A similar picture shows up in an international teacher survey, where female teachers seem to be less engaged in digital teaching than their male peers [61]. In contrast, a study in the US revealed a higher self-efficacy level in online teaching instruction for female university teachers [62]; furthermore, the perception of student learning was highly associated with the self-efficacy beliefs of the university teachers in this survey.

While it can be stated that prior personal experience with digital technology and online teaching of university teachers is influential for self-efficacy beliefs in digital teaching, the context where digital teaching is implemented seems a further relevant framing condition of individual performance and the development of expertise. Several studies hint at the relevance of an enabling environment, which integrates and supports the use of digital technology on campus as being influential for the individual mastery of online teaching [57,63]. A common concept of the learning process seems helpful for the use of digital media in times of ERT at universities [63]. Further, a study on college teachers in Indonesia during ERT could confirm that perceived organizational support had a significant influence on university teachers' online teaching self-efficacy and on their readiness for change [64]. In contrast, a study on American university teachers from the nursing faculty revealed that

their online teaching self-efficacy could be predicted by prior online teaching; institutional support did not appear to be predictive for perceived online teaching self-efficacy [65].

Summing up, empirical studies relating to the mastery of online teaching during ERT hint at the relevance of individual characteristics, such as prior experience, on the one hand, and institutional support aspects on the other hand.

2. Comparative Perspectives on ERT

Although there is a wide range of research on the differences made by ERT, comparative approaches to understand possible differences between cultures and populations are still scarce [6]. Studies prior to ERT hint at the relevance of cultural influences on technology use and acceptance in educational settings, which has been discussed in the context of levels of technological development in the countries studied [66]. A comparison between German and US university teachers revealed differences in self-efficacy beliefs concerning online teaching, where US teachers reported higher levels of self-efficacy and relevance of the integration of educational technology in their teaching [51]. The differences might be interpreted as German university teachers having less experience in the use of educational technology or may also be attributed to different perceptions of the constructs in use [67]. In the context of ERT, studies show that measures have been taken to deal with this situation in different contexts, but the institutional preconditions concerning digital teaching still vary between countries, which might have led to different measures [4,8].

The CRTS-Study (Coronavirus-Related Teaching Situation Study) has been conceptualized at the beginning of ERT by researchers from Israel, Argentina, Switzerland, France, UK, and Germany, which allows for comparative perspectives on the implementation of online teaching in ERT [5,6]. In the context of a comparison between European countries (Germany, Switzerland, France, and UK), Germany and Switzerland have quite high self-efficacy perceptions concerning online teaching. All university teachers reported a higher use of educational technology, especially concerning synchronous web conferencing systems, during the first lockdown than before, which implies that they adapted their teaching to the ERT situation [6]. As the study of Kaqinari and colleagues focused on European university teachers, the present article expands the focus by comparing university teachers from Argentina with university teachers from Germany, looking at their perceptions of the transition process and analyzing the relevance of individual and institutional factors for their self-efficacy beliefs. The ERT situation in both countries is described briefly in the following section.

2.1. Online Teaching at German Universities

In spring 2020, the coronavirus spread rapidly and extensively in Germany and all over the world. While the number of laboratory-confirmed infections with the coronavirus had doubled in Germany, the federal states ordered closures of public educational institutions, such as universities, schools, and childcare centers. On 16 March, Germany implemented a widespread lockdown and enacted various arrangements to slow down the spread of the coronavirus. The lockdown included restrictions on public life (e.g., by closing restaurants, bars, stores, and entertainment and recreational facilities) and was meant to minimize social contact [68,69]. 'Social distancing' has since been considered as one of the most important guidelines in the fight against the coronavirus [70]. Facility closures and extended contact restrictions resulted in many businesses going to part-time work or employees working in home offices. The guidelines on restrictions on public life as well as social distancing could help to reduce the number of new daily coronavirus infections in Germany. A gradual lifting of restrictions was announced in Germany on 15 April [71]. Still subject to compliance with special hygiene guidelines (use of masks and contact tracing), starting in May, schools, and even libraries and stores were allowed to gradually reopen.

In compliance with the respectively valid legal situation, universities in Germany, Austria and Switzerland planned different online study formats to avoid a "lost semester" for students. All university teachers had to prepare to realize technology-mediated teaching

and learning formats almost immediately [72]. The digitization of teaching and learning at universities in Germany was already being demanded before the outbreak of the coronavirus pandemic [73] and had gained interest at the level of higher education management [74–76]. The use of digital media was estimated to have a potential to enrich existing learning opportunities and materials in addition to face-to-face teaching. Furthermore, by providing asynchronous formats, such as videos or recorded presentations, the diversity of students' needs might be better met, as they can be used independently of time and location [77]. Hence, the use of digital tools in higher education was seen to promote individualized and flexible learning experiences, and potentially enhance the didactic quality of teaching and the acquisition of competencies by students [74,78,79]. In the years before the coronavirus-related lockdown, Riedel carried out a study with university teachers in Germany concerning their digital teaching [80]. The majority could be characterized as 'material users', of whom about half of all respondents could be counted. This group only integrated individual digital learning materials, such as texts or videos, into their teaching. Approximately 30% of the respondents could be assigned to the group of 'multimedia users', using tools that enabled digital presentations and video conferencing with above-average frequency. Only about 18% of the respondents declared using digital tools intensively. Many university teachers reported that they did not have previous experience with digital teaching prior to the first coronavirus-related ERT (digital summer semester 2020) [81]. Birkenrahe, Hingst and Mey also address the issue of insufficient experience among university teachers, pointing to reasons such as a lack of media competence and having too little time to improve upon this [82].

A German survey of professors and students In 2020 showed that, overall, the German universities have coped well with the challenges due to the switch to online teaching caused by the coronavirus pandemic [83,84]. Teaching was largely maintained in the coronavirus-impacted teaching semesters and according to the interviewed professors, only a few lectures and seminars had to be cancelled without replacement, and it was still possible to take examinations [83]. A German online survey in 2020 with around 25,000 students [84] revealed that, regardless of whether the respondents were freshmen or not, digital teaching was viewed ambivalently; on the one hand, students appreciated the time flexibility that digital teaching formats allow; on the other hand, students missed the contact with fellow students and university teachers. Preparing for exams and taking them digitally is also viewed rather critically. Most students' computers allowed them to participate in digital teaching formats without any problems. However, the capacity of the internet connection at home was not always sufficient. The living situation was not perceived to be ideal for digital teaching and studying for all students, hence, many students feared that their study time will be extended due to the pandemic [84,85].

2.2. Online Teaching at Argentinian Universities

Once the pandemic was declared by the World Health Organization (WHO) in March 2020 [86], Argentina began preparing for the response through timely detection of sick people arriving in the country in order to contain the disease and mitigate its spread. Among these measures, the preventive and compulsory social isolation (ASPO, according to the Spanish acronym) stands out for those who do not work in essential sectors of the economy throughout the country, which came into force early on 20 March [87].

Due to ASPO, all schools and universities in Argentina closed their buildings and transformed their regular activities into a fully virtual mode in just a few weeks. The universities made efforts to continue teaching within the framework of educational policies. The students have been able to continue their educational activities beyond the emergency. The university system promoted conditions of equal opportunity of access to technological resources in the development of the virtual modality, by means of scholarships, connectivity agreements with service providers, making course regimes more flexible, implementing tutorial accompaniments, and materially assisting those in need. This virtual-learning modality arose as a precedent for the future, both in virtual work linked to various aspects

of institutional management and in access to higher education through virtual platforms, demonstrating the universities' capacity, commitment, and quality in guaranteeing the continuity of studies [88]. Several programs were developed by the Ministry of Education to support transition, initially to the virtual modality and later to the hybrid modality [89–91]. The general scenario was that the academic community was unprepared but still able to deliver. Nevertheless, inequalities became more visible and issues started to emerge in the debates in the government [92].

The context of COVID-19 has deeply penetrated various aspects of university life, such as academic and administrative management; teaching practices and learning have been challenged and, in some way, transformed. During the second half of the year 2020, the Secretary of University Policies conducted a series of surveys at different university levels: authorities, professors, students and non-teaching workers to generate systematic data on the effects of COVID-19 in the organization of academic, work and family life within the university community [89]. The results of this survey showed that almost all universities (99.5%) decided to transform their courses into a virtual modality and 87% of them were effectively developed according to the proposed objectives. The reasons for not being able to make this transformation varied, such as a lack of technological resources, difficulties teaching in a virtual mode, or not having enough time to reorganize the course. It is important to point out that more than 60% of the professors said that they did not have previous experience in distance education before the suspension of face-to-face lectures. The most widely used technological tools during this period were learning management systems, e-mail, and videoconferencing. Some professors said that they also used instant messaging tools. When asked about the percentage of the course content covered under the virtual mode, 61% answered that they were able to cover more than 80%, and only 24% developed between 60% and 80% of the content. Interestingly, almost all professors (96.4%) declared that they were able to evaluate students. There was no major agreement about the questions related with the training provided by the university regarding the technological and computer resources necessary for lecturing in the virtual mode. Finally, more than 80% of the professors said that they were satisfied in general with the development of their courses and 67% said that they were able to complete their courses.

Two of the biggest universities in Argentina conducted a survey among 400 university teachers asking about the changes brought about by the pandemic to higher education [27]. Results from the survey reveal that the use of technologies increased compared with the usage before the coronavirus pandemic. The authors conclude that the context forced the use of synchronous tools and virtual environments. Furthermore, it could be shown that the support of the university was important for the feasibility of good practices through teacher training. In those cases where faculties were able to access tools and training, teachers recognized that they were able to carry out their teaching in a better way. Moreover, the results show that there was a high degree of adaptability among university teachers despite not having chosen this modality. In addition, they found that many teachers consider that they have managed to improve their lessons with the inclusion of technologies and generated other bonds with their students. Finally, there is a recognition of diverse good practices according to each professional field. In the case of academic fields that require a high load of practical teaching, working online has been more complex.

2.3. The Present Study

The present article focuses on university teachers' perspectives on the implementation of online teaching and the associated challenges in times of the first coronavirus-related lockdown of the universities. As comparisons between different contexts concerning the perception of ERT and the concept of self-efficacy are still scarce, the present article focuses on the comparison of the perception of the transition to online teaching in the first lockdown and at the relevance of individual and institutional predictors for the perception of self-efficacy beliefs in online teaching, comparing the perspectives of university teachers from German and Argentinian universities.

The paper presents exploratory results regarding the following research questions:

(1) How did German and Argentinian university teachers experience the transition from face-to-face to online teaching?

(2) How do German and Argentinian university teachers assess the success of their first online teaching experience, and do they differ in their self-efficacy beliefs in online teaching?

(3) To what extent do personal characteristics, individual competency, and relevant institutional factors correlate with the perception of self-efficacy beliefs in online teaching in both countries?

3. Method

3.1. Study Design

The present data is derived from a larger study context, which is the CRTS study (Coronavirus-Related Teaching Situation Study). It aims to investigate how university teachers experienced the challenging situation of the immediate transition from face-to-face to online teaching in the initial coronavirus-related lockdown in Spring 2020. The online survey was based on a questionnaire approved by the Ethics Committee of the Faculty of Education at the Hebrew University. The questionnaire (see Appendix A) was developed jointly by the teams participating in the CRTS project (Initiators of this study are: Prof. G. Horenczyk and Dr. M. Dorfsman (Hebrew University, Israel); Dr. C. Lion (University of Buenos Aires, Argentina); Prof. K. Göbel (University of Duisburg-Essen, Germany); Prof. E. Makarova (University of Basel, Switzerland); Dr. D. Birman (Miami University, USA).) covering the following topics: pedagogical–didactic challenges and the ways in which university teachers deal with these challenges; needs and attitudes related to the transition of teaching; and the extent to which the university responds to the challenges and needs of academic staff according to the university teachers' assessment.

The present paper is based on an online survey with university teachers from German universities (headed by researchers from the University of Duisburg-Essen) and university teachers from Argentina (headed by researchers from the University of Buenos Aires and the National Technological University). The participants were surveyed with an online questionnaire focusing on attitudes towards the transition to online teaching, self-assessed competency for online teaching, use of digital tools before and during the lockdown, evaluation of the preparatory process and evaluation of online teaching units. Furthermore, age and gender of participants were assessed.

3.2. Participants

A total of $n = 292$ university teachers from German universities (176 of them female; 63.1%) and $n = 436$ university teachers from Argentina (209 of them female; 48.4%) took part in the online survey on the teaching situation in the time of the coronavirus pandemic. The German sample consists of university teachers from eleven different universities, with most participants belonging to the University of Duisburg-Essen ($n = 154$, 86.5%). The Argentinian sample equally includes participants from the University of Buenos Aires (UBA, $n = 219$) and from the National Technological University (UTN, $n = 217$), with most university teachers currently teaching in the University of Buenos Aires ($n = 102$, 23.4%), followed by regional faculty of General Pacheco of UTN ($n = 44$, 10.1%).

The difference in the gender distribution between both countries was found to be significant (chi-square (1, $n = 711$) = 14.760, $p < 0.001$). Regarding age and teaching experience in the tertiary sector, a heterogeneous composition of the overall sample emerges (see Table 1). An age range of 26 to 35 years is most frequently reported by respondents from the German universities (31.4%), while in the Argentinian sample most university teachers reported an age range of 46 to 55 years (35.8%). Overall, participants from German universities appear to be younger than university teachers from Argentina (see Table 1): 58.9% of respondents from Germany indicate an age below 45 years; this applies to only a third of the respondents from Argentina (27.3%). Concerning the teaching experience in

the higher education sector, a similarly different distribution of answers emerges among university teachers from both countries (see Table 1).

Table 1. Valid and cumulative percentages to describe the sample.

	German University Teachers			Argentinian University Teachers		
	N	**%**	**Cum. %**	**N**	**%**	**Cum. %**
Gender						
female	176	63.1	63.1	209	48.4	48.4
male	193	36.9	100	223	51.6	
Total	279	100		432	100	
Age in years						
25 and younger	1	0.3	0.3	1	0.2	0.2
26–35	90	31.4	31.7	49	11.2	11.5
36–45	78	27.2	58.9	69	15.8	27.3
46–55	61	21.3	80.1	156	35.8	63.1
56–65	50	17.4	97.6	138	31.7	94.7
older than 65	7	2.4	100	23	5.3	100
Total	287	100		436	100	
Teaching experience in the tertiary sector in years						
1–5	91	31.6	31.6	25	5.7	5.7
6–11	68	23.6	55.2	66	15.2	20.9
12–17	55	19.1	74.3	76	17.5	38.4
18 and more	74	25.7	100	268	61.6	100
Total	288	100		435	100	
Teaching hours per week						
1–2	66	23.0	23.0	12	2.8	2.8
3–6	93	32.4	55.4	95	21.8	24.5
7–11	83	28.9	84.3	173	39.7	64.2
12 and more	45	15.7	100	156	35.8	100
Total	287	100		436	100	

Regarding the average teaching time per week, there are differences between the study groups (see Table 1). While at the German universities more than half of the university teachers surveyed stated that they teach between one and six hours per week (55.4%), this only applies to 24.5% of the respondents at the Argentinian universities, where 35.8% of the respondents reported to teach more than 12 h per week; this is true for only 15.7% of German university teachers. Likewise, the samples significantly differ regarding the received support (e.g., student assistant) in the preparation and implementation of teaching activities (chi-square (2, n = 718) = 207.782, $p < 0.001$). While more than half of the respondents in Argentina (n = 235, 53.9%) state that they receive support in all courses, this is only true for 23 respondents from Germany (8.2%). The majority of German respondents state that they do not receive any support (n = 211, 74.8%).

3.3. Measure

This paper focuses on university teachers' assessments of the pedagogical–didactic challenges during the coronavirus-related teaching situation at their university and on the university teachers' self-efficacy beliefs concerning online teaching.

To better understand how university teachers perceive the pedagogical–didactic challenges during the coronavirus-related teaching situation at their university, the university teachers were asked to indicate the extent to which they had used or were using vari-

ous digital tools before and during the lockdown of the universities (1 = "not at al" to 4 = "to a large extent"). Retrospectively, the university teachers were asked to describe their experience with the transition from conventional to online teaching (ranging from "very positive and inspiring", via "mostly positive and reassuring" to "complex", "frustrating" or "nothing special") as well as the implementation of the first online-based teaching units (ranging from 1 = "unsuccessful" to 5 = ""very successful""). Furthermore, university teachers were asked to articulate support needs (To what extent would you expect support of your institution in time of a future crisis?). The assessment of support needs in future crisis situations (time for preparation, individual support, and monetary compensation) was based on a four-point scale from 1 = "not at all" to 4 = "to a large extent".

It was of special interest to understand how the university teachers assess their abilities to implement online teaching using digital tools. Self-assessed ability to implement online teaching was captured via a self-efficacy beliefs scale, which included questions about the extent to which university teachers are confident in their ability to successfully teach online during university closures. In total, eight items from two existing scales [93,94] were adopted and modified for the coronavirus-related teaching situation (for example: I feel confident that I am able to select the most efficient digital tools for teaching in this situation). All items were answered with a Likert scale from 1 = "not at all" to 4 = "completely agree". Analyses revealed satisfactory internal consistencies for both samples (Germany: Cronbach's $\alpha = 0.83$, Argentina: Cronbach's $\alpha = 0.79$).

Retrospectively, the participants were asked about the reasons for successful online teaching in the current context; we distinguish between internal, personal reasons, such as own technological skills or the competence of addressing issues faced by the students; and external, context-related conditions, such as institutional support or sense of emergency. The response options ranged from 1 = "not at all" to 4 = "to a large extent". Three items considered institutional support factors: technological pedagogical support of the academic institution; existing online tutorials; support and encouragement of administration/senior management of the institution; these three items were combined into one scale for further regression analysis (Germany: Cronbach's $\alpha = 0.67$, Argentina: Cronbach's $\alpha = 0.69$).

Finally, personal characteristics concerning gender, age and occupational experience in years were surveyed.

3.4. Analysis

The data collected on the experiences and assessments of the coronavirus-related teaching situation were analyzed descriptively at the level of the individual items. Non-parametric procedures (chi-square and Mann–Whitney U tests; fixed significance level of 5%) were calculated to determine if there were differences between university teachers from Germany and Argentina.

To examine the extent to which personal characteristics, own competencies and support needs influence the university teachers' self-efficacy beliefs in online teaching, the data collected were analyzed using multiple regression models. In an overall regression model, the country emerged as a relevant predictor of self-efficacy beliefs, so we decided to analyze the regression models for each country separately and compare the model results descriptively with each other. Stepwise regression equations were carried out to identify the respective explanatory power of the resulting models. The first model only includes personal characteristics (gender; age; occupational experience in years); in the second model, reasons for successful online teaching were integrated as dummy variables (Coding: 0 = not at all/small extent; 1 = moderate/large extent); three items considered institutional support factors were combined into the scale institutional support factors (see above). The final model also contains expected support needs in further crisis situations (Coding: 0 = not at all/small extent; 1 = moderate/large extent).

As former studies hint at the relevance of prior experience and competence concerning the use of digital tools for the mastery of online teaching [6,47,55], prior experience might also be a relevant predictor for the perception of self-efficacy. In our study, we measured

prior and actual online teaching experience with the scales "use of digital tools before lockdown" (Germany: $\alpha = 0.53$; Argentina: $\alpha = 0.64$) and "use of digital tools during lockdown" (Germany: $\alpha = 0.27$; Argentina: $\alpha = 0.47$). The scales were developed by averaging the respective items. We decided not to integrate the corresponding scale "use of digital tools before lockdown" into our regression models due to its insufficient internal consistency. However, exploratory correlation analyses were conducted to investigate the potential relationship between self-efficacy beliefs in online teaching and the use of digital tools.

4. Results

4.1. Experience with the Transition to Online Teaching

Results from the German and Argentinian survey concerning the use of digital tools reveal that university teachers from both universities used LMS platforms and presentations (e.g., PowerPoint) to a moderate or large extent in their own teaching, both before and during the closure of the universities (see Figure 1). The comparison of the countries reveals that respondents from Argentina used digital media more frequently as part of their conventional teaching than university teachers from Germany before the outbreak of the coronavirus pandemic; in particular, LMS platforms for bibliography ($U = 51{,}354.500$, $Z = -4.343$, $p < 0.001$), discussion forums ($U = 35{,}829.000$, $Z = -8.826$, $p < 0.001$), selected videos ($U = 45{,}014.000$, $Z = -6.112$, $p < 0.001$), self-produced videos ($U = 34{,}574.500$, $Z = -10.393$, $p < 0.001$), and online lessons via Zoom or other ($U = 28{,}191.000$, $Z = -13.447$, $p < 0.001$) were used significantly more frequently by university teachers from Argentina. During the closure of the universities (lockdown), especially web conference systems and LMS platforms were used increasingly in university teaching in Germany as well as in Argentina to set up digital discussions and group work (see Figure 1). The most striking increase in usage was experienced in online teaching via Zoom or other web conferencing systems, where their functions allow synchronous distance teaching. Across all digital media, there was an increase in use in both Germany (before: $M = 2.28$, $SD = 0.48$; during: $M = 2.95$, $SD = 0.49$; $\Delta_M = 0.678$, $t(288) = 23.287$, $p < 0.001$, Cohen's $d = 1.370$) and Argentina (before: $M = 2.79$, $SD = 0.64$; during: $M = 3.22$, $SD = 0.53$; $\Delta_M = 0.429$, $t(433) = 17.007$, $p < 0.001$, Cohen's $d = 0.816$). University teachers from Argentina show a higher extent of digital tool use in general (before: $t(711.214) = -12.337$, $p < 0.001$, Cohen's $d = -0.885$; during: $t(721) = -6.893$, $p < 0.001$, Cohen's $d = -0.523$), both before and during the lockdown.

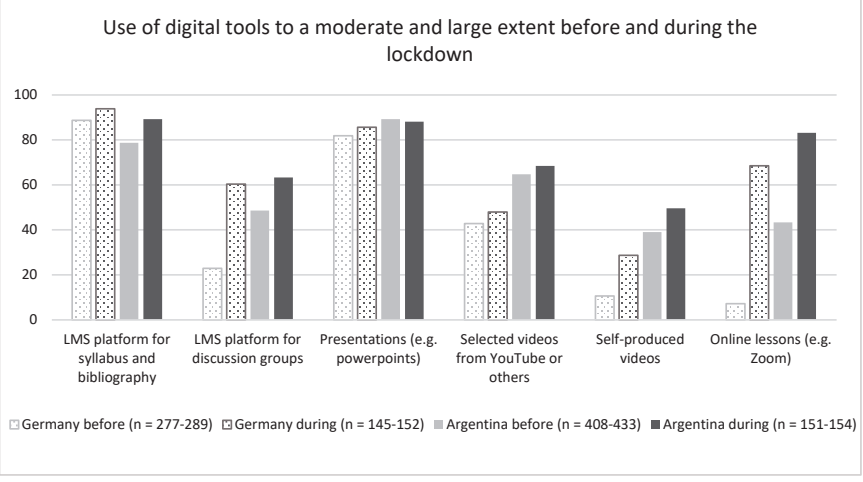

Figure 1. Use of digital tools to a moderate and large extent before and during the lockdown. Valid percentages indicated (agreement).

Overall, the experience of the switch to online teaching is perceived ambivalently by the respondents (see Figure 2). In both groups, the experience is perceived as a positive experience, while university teachers from Argentina rate it even more positively than the German colleagues. Both samples differ significantly in their perceptions of the transition to online teaching as 'a very positive and inspiring experience' ($U = 35{,}970.000$, $Z = -12.266$, $p < 0.001$) and as 'a mostly positive and reassuring experience' ($U = 46{,}938.000$, $Z = -7.330$, $p < 0.001$). In the German sample, the greatest agreement to the question "How would you describe your experience during the coronavirus-related teaching situation (CRTS)" is found for the statement that the transition of teaching was 'a mostly positive and reassuring experience' (49.7%); in the Argentinian sample, the greatest agreement was found for the statement that the transition to online teaching was 'a complex experience; it requires investment beyond what is expected' (57.3%). The teachers at German universities agreed with this statement (33.9%) significantly less often ($U = 48{,}738.000$, $Z = -6.199$, $p < 0.001$). On the other hand, the proportion of university teachers who perceived the transition to online teaching as 'a frustrating experience' was significantly higher at German universities than at the universities in Argentina (Germany: 13.4%; Argentina: 3.2%; $U = 57{,}198.000$, $Z = -5.160$, $p < 0.001$). For 12.7% of the respondents from Germany and 2.3% of the respondents from Argentina, the transition to online teaching was 'nothing special' ($U = 67{,}050.000$, $Z = -5.581$, $p < 0.001$).

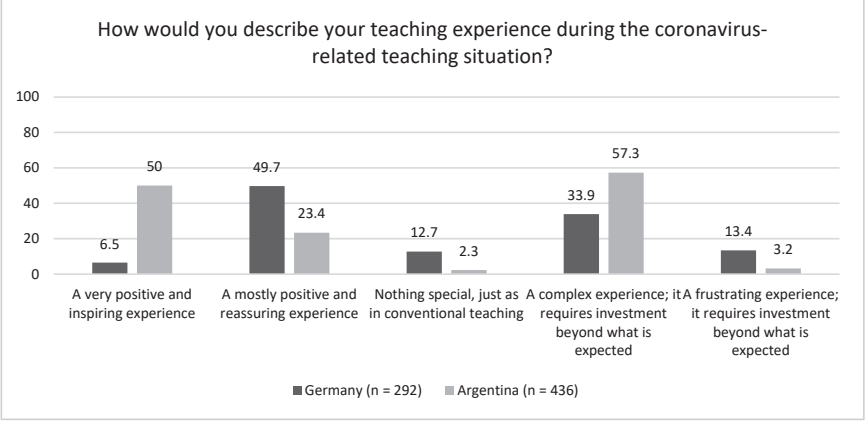

Figure 2. Perceptions of the experience of the transition to online teaching. Valid percentages indicated (agreement); significant differences between the samples were found for all items.

Retrospectively, the university teachers were asked about the need for support concerning online teaching in possible crisis situations in the future. In the event of a similar crisis in the future, most respondents in Germany (70.8%, $n = 197$) and Argentina (91.5%, $n = 369$) expect more time and resources to be able to prepare for the transition of teaching (agreement to a moderate/large extent). Furthermore, university teachers expect individual support from experts in educational technologies or instructional design to assist during online teaching (Germany: 68.4%, $n = 189$; Argentina: 84.4%, $n = 346$). Finally, a majority of university teachers in both countries have an expectation of receiving monetary compensation over and above their salaries for preparing to teach online (Germany: 57.3%, $n = 155$; Argentina: 57.3%, $n = 223$).

4.2. Success of Online Teaching and Self-Efficacy Beliefs

Although the experiences with online teaching differ slightly between university teachers from Germany and Argentina (see Figure 2), the preparation process for the immediate transition of teaching is rated similarly overall by university teachers from both countries, and most of them did not perceive it as a major difficulty. In both countries, the great-

est agreement was found for the statement that the preparation process was reasonable (Germany: 37.6%; Argentina: 45.1%). Furthermore, 42.9% of German participants and 41.3% of respondents from Argentina rated the preparation for online teaching as simple or very simple. In both samples, only a small number of university teachers found the preparation for online teaching difficult or very difficult (Germany: 12.4%; Argentina: 5.3%). In line with this, the first lessons with Zoom or other web conferencing systems were predominantly assessed positively by the university teachers surveyed. Slightly less than half of the university teachers from both German universities (40.4%) and Argentinian universities (40.3%) assessed their first online teaching during the lockdown as very successful or successful. More than one-third of the respondents from both countries rated the implementation of their first online lessons as reasonable. While 21.9% of the respondents at German universities felt that there is room for improvement, this is true for only 10.6% of the respondents at Argentinian universities.

The university teachers attributed the success of their online teaching mainly to internal, personal aspects, such as own technological skills and the competency for addressing students' problems (see Figure 3). However, the groups differ significantly from each other in the perceived extent of different reasons' relevancy to their success in online teaching. In the German sample, the statement that the success of teaching was determined by the need to do it ad hoc (external condition: sense of emergency) was rated to a higher extent than in the Argentinian sample. Less important for the success of online teaching during the lockdown were external factors of institutional support (e.g., technological pedagogical support of the academic institution and the availability of tutorials). German participants in particular attributed their teaching success to institutional support only to a small extent; the agreement is significantly lower than in the Argentinian sample ($t(697) = -11.148$, $p < 0.001$, Cohen's $d = -0.860$).

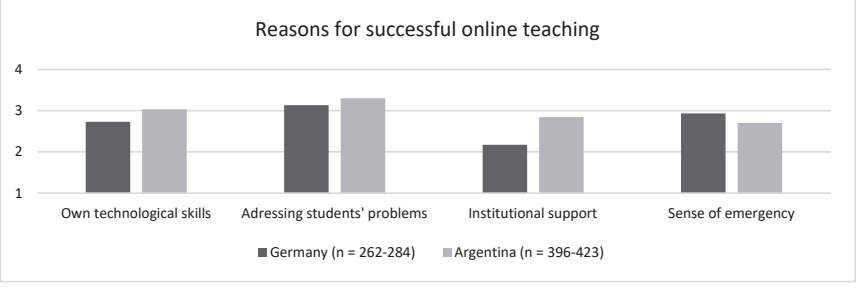

Figure 3. Perceptions of reasons for successful online teaching. Mean values based on a scale from 1 (not at all) to 4 (to a large extent); significant differences between the samples were found for all items.

University teachers' beliefs about their competencies in digital teaching were captured using a self-efficacy expectancy scale (see method section), which included questions about the extent to which university teachers are confident in their ability to successfully teach online during university closures (see Figure 4). Overall, the results indicate that there is a high self-efficacy expectation for online teaching among the university teachers, and they present themselves as being confident to teach successfully even under the more difficult conditions. As we can see from the mean values for the items (see Figure 4), the Argentinian university teachers rate their self-efficacy concerning online teaching even higher than the German respondents. Accordingly, we found a significant difference between the mean scores of Argentinian university teachers ($M = 3.37$; $SD = 0.45$) and the German respondents for the self-efficacy scale ($M = 3.06$; $SD = 0.48$; $t(720) = -8.809$, $p < 0.001$, Cohen's $d = -0.669$).

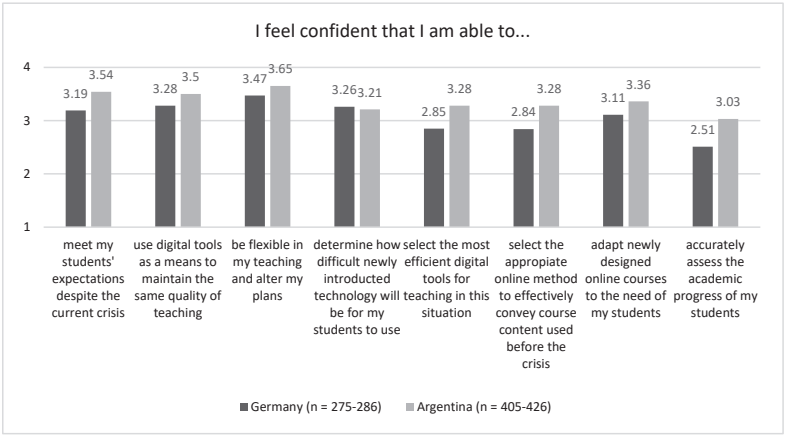

Figure 4. Self-efficacy beliefs concerning online teaching. Mean values based on a scale from 1 = "not at all" to 4 = "completely agree".

Further explorative analyses indicate a correlation between self-assessed competency in online teaching and the use of digital tools. Overall, it can be stated that the more self-efficacious the university teachers rate themselves, the more extensively do they use digital tools for online teaching. The correlation between the extent of digital tool usage before as well as during the lockdown and the self-assessed ability to teach online proved to be low, but statistically significant for both the German sample (before: $r = 0.243$; during: $r = 0.239$; $p < 0.001$) and the Argentinian sample (before: $r = 0.216$; during: $r = 0.227$; $p < 0.001$).

4.3. Predictors of the Perception of Self-Efficacy in Online Teaching

To examine the relevance of personal characteristics, experience, and support needs to the perceived self-efficacy in online teaching, a multiple stepwise regression was conducted for the German as well as for the Argentinian data.

The first model included only personal characteristics (Germany: $F(3195) = 4.617$, $p = 0.004$; Argentina: $F(3311) = 0.382$, $p = 0.766$). In the Argentinian sample, neither years of occupational experience nor gender and age proved to be significant predictors, and the explanatory power was rather low (adj. $R^2 = -0.006$). In the first German model (adj. $R^2 = 0.052$), gender ($\beta = -0.219$, $p = 0.002$) and years of experience ($\beta = 0.198$, $p = 0.040$) proved to be significant predictors of self-efficacy; whereas, age did not play a role.

In the second model, internal and external reasons for successful online teaching were integrated as dummy variables while controlling for personal characteristics. A significant increase in the explained variance emerged for the German sample ($F(7191) = 6.139$, $p < 0.001$) as well as for the Argentinian sample ($F(7307) = 6.081$, $p < 0.001$). In the German model (adj. $R^2 = 0.154$), institutional support ($\beta = 0.192$, $p = 0.005$) as well as own technological skills ($\beta = 0.194$, $p = 0.004$) were relevant for the university teachers' self-efficacy; significant effects were also shown for the controlled personal characteristics, gender and years of experience ($p < 0.05$). Moreover, the sense of emergency proved to be predictive of German university teachers' self-efficacy ($\beta = -.184$, $p = 0.006$). In the Argentinian model (adj. $R^2 = 0.102$), we likewise found a positive effect on the self-efficacy for own technological skills ($\beta = 0.228$, $p < 0.001$). Further, addressing students' problems was a significant predictor of self-efficacy ($\beta = 0.193$, $p = 0.001$).

In the final regression model (Germany: $F(10,188) = 4552$, $p < 0.001$; Argentina: $F(10,304) = 6077$, $p < 0.001$), support needs for future crisis situations were integrated, and a significant increase in the explained variance emerged for the Argentinian sample only. In the German model (adj. $R^2 = 0.152$), none of the added variables were predictive for the self-efficacy of university teachers; whereas, in the Argentinian model (adj.

R^2 = 0.139) the support needs compensation (β = 0.110, p = 0.044) and more time to prepare (β = −0.180, p = 0.003) were significant predictors of self-efficacy.

In both final models, institutional support (external reason for success) and own technological skills (internal reasons for success) were predictors of self-efficacy in online teaching (see Table 2). In addition, gender and years of experience were predictive of self-efficacy in German university teachers; whereas, in the Argentinian data personal characteristics had no influence. Further analyses illustrate, that female teachers from Germany (M = 3.14; SD = 0.41) in particular rate themselves as competent and differ significantly from the male respondents in their self-efficacy (M = 2.96; SD = 0.53; t (172,034) = 2.938, p = 0.004, Cohen's d = 0.391). In the Argentinian survey, however, this gender difference is not evident (t(426) = 0.173, p = 0.862, Cohen's d = 0.017). Moreover, the sense of emergency proved to be predictive of German university teachers' self-efficacy; whereas, for Argentinian university teachers' self-efficacy, addressing students' problems, as well as the support needs compensation and more time to prepare were relevant.

Table 2. Final regression models—dependent variable self-efficacy beliefs concerning online teaching.

	Germany (n = 199)		**Argentina (n = 315)**	
	B	**β**	***B***	**β**
personal characteristics				
age	−0.003	−0.009	0.023	0.057
gender	−0.174	−0.185 **	0.010	0.012
years of experience	0.199	0.217 *	0.004	0.004
competence and support				
own technological skills	0.183	0.196 **	0.223	0.216 ***
Addressing students' problems	0.031	0.027	0.305	0.216 ***
institutional support	0.123	0.214 **	0.074	0.129 *
sense of emergency	−0.178	−0.183 **	−0.049	−0.056
support needs				
more time to prepare	−0.110	−0.104	−0.269	−0.180 **
professional support	−0.009	−0.009	−0.078	−0.066
compensation	0.080	0.087	0.096	0.110 *
F	4.552, p < 0.001		6.077, p < 0.001	
adjusted R^2	0.152		0.139	

Notes. * p < 0.05, ** p < 0.01, *** p < 0.001

5. Discussion

Comparisons between diverse contexts concerning the perception of the pandemic-related ERT and the concept of self-efficacy beliefs are still scarce. Therefore, the present article focuses on the perception of the transition to online teaching during the first lockdown, and on the relevance of individual and institutional predictors for self-efficacy beliefs in online teaching, comparing the perspectives of university teachers from German with those from Argentinian universities in the context of the CRTS Study.

Results reveal a significant change in the use of digital tools by university teachers in Argentina and Germany when comparing the time before and during the first lockdown, especially for online lessons, discussion groups and self-produced videos. Although the transition to online teaching was a demanding phase with ambivalent experiences reported by university teachers, the overall picture of the presented analysis reveals a mostly successful implementation of online teaching by university teachers in both countries, providing interesting insights and valuable information for developing digital university teaching. These findings are in line with previous analysis in the respective countries, as well as analysis from the CRTS study in other European samples [5,6,27]. When comparing our results with former studies on online teaching in higher education [95], we can see a significant shift towards a higher usage levels of interactive online teaching methods. Concerning the success in online teaching with Zoom or other web conferencing systems,

university teachers from Argentina and Germany mostly consider themselves successful. When comparing both groups, the evaluation of this new experience is slightly more positive in the Argentinian sample than in the German sample. Further differences become apparent when looking at the use of digital tools: Argentinian university teachers report realizing a higher level of usage of online tools before the ERT than their German peers. Furthermore, Argentinian university teachers show higher ratings of their self-efficacy beliefs when compared with their German colleagues. The higher level of self-efficacy beliefs in online teaching might be due to the higher level of digital tool experience of the Argentinian university teachers before ERT; hence, the differences can be interpreted as differences in prior digital experience between the samples, which would be in line with self-efficacy research and actual findings in the context of ERT studies [57]. Differences in the level of ratings could also be a result of differing item interpretations between the Argentinian and German university teachers, which might have had an impact on their rating when confronted with the presented items [67].

The results of the regression analysis brought about further insights in understanding the connection between self-efficacy beliefs and individual and institutional factors. The findings support the idea of a connection between perceived competency in the use of technological tools in teaching and self-efficacy beliefs in online teaching [37,96]. The individual knowledge concerning technological tools is a relevant predictor for efficient online teaching [46,58]. In addition to self-reported ratings on technological competency, institutional support seems to be of general relevance for self-efficacy beliefs for both German and Argentinian university teachers. We see the general relevance of institutional support for digital teaching in both samples, meaning that universities should provide helpful infrastructure in terms of technologies, training measures and manuals to support their staff in mastering digital tools and digital didactics [57,63]. This finding underlines findings from various previous studies [6,50,58]. Furthermore, some kind of compensation or positive reinforcement for the implementation of digital teaching might be additionally motivating, as results from the Argentinian sample suggest.

The regression models for the prediction of self-efficacy beliefs in online teaching also hint at some slight differences between the samples. While for the Argentinian university teachers, the addressing of students' problems seems to be relevant for their self-efficacy beliefs, this is not the case within the German sample. This correlation between teacher-student relationship and self-efficacy beliefs in online teaching for Argentinian university teachers might hint at a specific relevance of the teacher-student relationship when compared with the German sample. In the German sample, we can see a negative correlation between the sense of emergency in the situation and a high perception of self-efficacy in online teaching. Those German colleagues who experienced a strong sense of emergency in the context of ERT reported lower self-efficacy beliefs in online teaching; in the Argentinian sample we do not find this correlation. This finding could hint at ERT as being a stressful event, especially for those university teachers who do not feel well-prepared for the ERT situation. As mentioned before, we found a higher rate of prior experience in online teaching and a more positive perception of the ERT situation in the Argentinian sample when compared with the German sample. Hence, the sense of stress might have been higher for the German university teachers in general; those who did not feel well prepared felt more distressed and reported lower self-efficacy beliefs. However, at the same time, this may also indicate implicit differences in attitudes towards digital tools in general (which also go hand-in-hand with the respective usage behaviors), which we cannot capture based on our data, but which need to be examined more closely in further studies.

Furthermore, we can see in the Argentinian sample that those respondents who reported needing more preparation time and who declared a need for compensation also reported lower self-efficacy beliefs in online teaching. Interestingly, this correlation is not significant for the German sample. German university teachers might not see the need for more preparation time as being relevantly connected with their conception of self-efficacy

in online teaching. This result might be related with different salary levels in both countries, with the Argentinian university teachers having lower salaries and generally having a higher need for receiving additional compensation than their German colleagues.

In line with findings from the US [62], and in contrast with other studies [60,61,97], which indicate higher self-efficacy in online teaching for male university teachers, our findings hint at gender differences concerning self-efficacy in online teaching in the German sample, with female university teachers reporting slightly higher levels of self-efficacy. In the Argentinian sample, we do not find these differences. Our results point at the heterogeneity of findings concerning online teaching and gender.

6. Conclusions

In conclusion, the relevance of individual experience and training as well as the relevance of supportive institutional conditions for self-efficacy beliefs can be noted for both samples. For future development of digital teaching in higher education, the promotion of support offers seems continuously relevant. Didactic offers should be made to support the potential use of digital tools, to foster experience, and develop positive attitudes. Furthermore, the expansion of technological infrastructure is a relevant precondition which has to be addressed continuously. Technology skills from both students and university teachers will have to be fostered in order to achieve digital transformation in higher education [95] and motivational aspects need to be addressed [44].

Still, our data leaves some open questions: How can we understand the differences in the perception of ERT between the samples? From a cross-cultural psychology perspective, one could argue, that Argentinians might generally be more prepared for the coping with ambivalent and unknown situations than Germans [98]. However, from the perspective of our study, we do not have data on differences in cultural values or coping strategies. From the point of view of data available in our study, we can see that Argentinian university teachers report more experience in online teaching prior to the ERT. This certain leading edge might have had a positive impact on their ERT experience. The Argentinian colleagues might have had more experience in digital teaching and hence were better prepared for online teaching in ERT. Furthermore, they reported receiving more support for their teaching, which in sum might make them experience this new situation as less stressful than their German peers. A further surprising result in the German sample is that female university lecturers reported higher self-efficacy beliefs than their male German peers; this is not the case for the Argentinian respondents. How can we explain this surprising result? We have more female participants in the German sample than in the Argentinian one. We might argue that self-selection processes might have played a relevant role; maybe more self-confident female university teachers participated in the German study, and maybe those who took the time to participate were more self-confident than their male peers. As the German sample is slightly younger, the results might also point at generational differences in online teaching self-efficacy beliefs.

The presented results should be interpreted carefully, as the study has several limitations. The most relevant limitation is the different sample sizes and sample compositions from both countries. Due to the voluntary nature of participation in both samples, self-selection processes could have led to a biased sample. It is possible that mainly lecturers with a generally positive attitude towards the digitalization of studies and teaching took part in our study. Overall, the present samples cannot be assumed to be representative of lecturers in Germany and Argentina. Some of the scales did not reveal high internal reliability, which also limited the opportunities for analysis. Furthermore, causal conclusions cannot be drawn from the cross-sectional design; it only allows an exploratory analysis of correlations within the data. Nevertheless, the results show interesting differences and similarities between the two contexts under research. Concerning the explanation for online self-efficacy, the regression models only explain 13–15% of the variance, hence there is a need to integrate further relevant variables into the model; for example, prior experience with digital tools. For further research, it would be helpful to gather larger samples and to

integrate longitudinal and qualitative perspectives into the design to learn more about the underlying beliefs and processes in both contexts.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data available on request due to restrictions eg privacy or ethical The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Survey items and answer option.

Survey Items	Answer Options
To what extent did you use digital tools in teaching before the coronavirus-related teaching situation (CRTS)? To what extent do you use digital tools in teaching during the coronavirus-related teaching situation (CRTS)? - LMS (learning management system) platform for syllabus and bibliography (e.g., Moodle, Adam, Ilias, Olat, Blackboard) - LMS platform for discussion groups - Presentations (e.g., PowerPoint, voice-recorded presentations) - Selected videos from YouTube or others - Self-produced videos - Online lessons through Zoom or other tools	1 = not at all 2 = to a small extent 3 = to a moderate extent 4 = to a large extent
Based on your general teaching experience in online teaching in particular, how would you describe your teaching experience during the CRTS? - A very positive and inspiring experience - A mostly positive and reassuring experience - Nothing special, just as in conventional teaching - A complex experience; it requires investment beyond what is expected - A frustrating experience; it requires investment beyond what is expected - An overwhelming experience; I hope this ends soon	0 = not selected 1 = selected
In order to teach online, you had to learn to use advanced web conferencing systems, such as Zoom, or others. How was the preparation process?	1 = very difficult 2 = difficult 3 = reasonable 4 = simple 5 = very simple

Table A1. *Cont.*

Survey Items	Answer Options
How do you consider your first lessons using Zoom or other web conferencing system?	1 = unsuccessful 2 = could be better 3 = reasonable 4 = successful 5 = very successful
To what extent would you expect support of your institution in time of a future crisis? - More time to prepare for online teaching - Support from professionals to assist you to teach courses online - To provide compensation for preparing courses online	1 = not at all 2 = to a small extent 3 = to a moderate extent 4 = to a large extent
I feel confident that I am able to: - meet my students' expectations despite the current crisis. - use digital tools as a means to maintain the same quality of teaching. - be flexible in my teaching and alter my plans. - determine how difficult newly introduced technology will be for my students to use. - select the most efficient digital tools for teaching in this situation. - select the appropriate online method to effectively convey course content used before the crisis. - adapt ne newly designed online courses to the needs of my students. - accurately assess the academic progress of my students.	1 = not at all 2 = somewhat disagree 3 = somewhat agree 4 = completely agree
To what extent do you think that the success of your online teaching in the current context is due to any of the following reasons? - My own technological skills - Acknowledging and addressing issues faced by the students - Sense of emergency - Technological pedagogical support of the academic institution - Existing online tutorials - Support and encouragement of administration/senior management of the institution	1 = not at all 2 = to a small extent 3 = to a moderate extent 4 = to a large extent

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Article

Teachers' Perceptions of Remote Learning during the Pandemic: A Case Study

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Abstract: The closure of higher education institutions (HEIs) due to the outbreak of the COVID-19 pandemic led to visible changes in pedagogical practices. With the lockdown, there was ambiguity and disagreement about the workload of teachers and students, and about what to teach and what strategies to select. For most instructors, the first challenge was to recreate the face-to-face experience. Worldwide, most universities have speedily adopted synchronous and asynchronous communication modes. Google Classroom, Microsoft Teams, Cisco, Webex, Zoom, and Moodle were among the most used tools. The present study is based upon a quantitative approach, and it intends to analyse teachers' perceptions of remote teaching during the first pandemic period. Data were collected through an online questionnaire during June and July 2020. The questionnaire had 27 questions divided into three main sections: sociodemographic characterization, e-Learning strategies, and remote assessment. The study population was teachers of a Portuguese HEI. A random sample was used with 547 participants. The main conclusions show that the less experienced teachers are, the more satisfied they feel with remote classes and remote assessment. On the other hand, the most experienced teachers used more tools during the remote teaching period and developed more strategies to perform remote assessment. Regarding the overall assessment of the emergency remote teaching, the participants consider that it was a positive period, and they were moderately satisfied with remote classes and the strategies and tools used during this period.

Keywords: remote teaching; higher education; assessment; teacher's perceptions; levels of satisfaction

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1. Introduction

On 11 March 2020, the World Health Organization (WHO) officially declared the existence of a coronavirus pandemic. All over the world, face-to-face classes were suspended, and social isolation was applied with the aim of slowing down the advance of the pandemic. More than 90% of students around the world saw their schools closed.

The closure of higher education institutions (HEIs) naturally implied inevitable changes in pedagogical practices. The knowledge accumulated over decades about digital education, governmental and institutional guidelines, the process of fast adaptation to an education system in which students and teachers are physically distanced, led to the so-called emergency remote teaching [1].

The creation of an educational system online (e-learning), implies much more than separating students and teachers from their physical learning space. In a very general way, in addition to the physical distance between those involved in the training process, e-learning implies a pedagogical redesign of a course and the preparation of social and cognitive interaction systems online.

In contrast, the remote teaching and learning system tends to implement traditional teaching and learning practices in a digital environment, without the prediction of methodological changes [1].

With this study, we intend to analyse the perception of teachers in the implementation of emergency remote teaching, in the context of a Portuguese HEI.

Therefore, this paper aims to know the teachers' perception of remote learning during the COVID-19 pandemic; to know the e-learning tools used during the pandemic COVID-19; to identify the satisfaction regarding e-learning tools used during the COVID-19 pandemic; to know distance assessment strategies used during the pandemic COVID-19; and to distinguish teacher profiles according to the overall evaluation of the lessons in remote learning and the evaluation of the assessment process in remote learning.

1.1. Teaching in the Outbreak of an Emergency Remote Environment

Over the years, researchers in distance learning instructional design, and education technology carefully struggled to define terms such as online learning, distance learning, blended learning, and hybrid learning [2], and to build and test technology-based educational models. Suddenly, the COVID-19 threat abruptly transformed higher education and the role instructors were used to performing. Pressed by the need to suspend the traditional face-to-face delivery mode, most teachers worldwide moved their classes online in order to address the severe global public health crisis [3,4].

In this way, the utopian desire of extending the people-centric classroom experience in space and time has finally come true [5], forcing teachers to embrace remote digital strategies and tools. The change was disruptive in a deep sense. Because it succeeded a catastrophic event, there was no logic or natural evolution. Ali [3] believes that the coronavirus has revealed emerging vulnerabilities in education systems around the world and that it is now clear that instructors need to adapt themselves to flexible education systems.

In fact, moving instruction online was a very quick, non-voluntary, and overwhelming process, as stated by Hodges et al. [1]. Given these dimensions, the authors proposed to coin this move "Emergency Remote Teaching" (ERT), a distance and online instruction designed and delivered in pressing circumstances.

Before the pandemic context, online education and collaborative work had already been regarded as a valuable means to exchange ideas and mental frameworks and to develop a shared understanding of topics by involving participants in working together [6]. However, with the lockdown, there was ambiguity and disagreement about the workload of teachers and students and about what to teach and what strategies to select. Instructors were engaged in adopting different sorts of strategies to improve students' emotional and cognitive involvement. They were also forced to deal with formal and informal virtual settings that started to occur simultaneously.

The concept of instructional strategies (also named teaching strategies) is complex and, to a certain extent, fuzzy. It can relate to interventions guided by top-down, centralized control used by instructional designers, teachers, and trainers to plan lessons or blocks of instruction. It can, on the other hand, be grounded in and driven by epistemological orientations and theoretical foundations that are primarily constructivist and connectivist in nature [4].

For several decades, the design of instructional strategies was linear and micro levelled, regarding the importance given to analysing particular learning outcomes, aligning them with suggested instructional strategies, and then delivering instruction in straightforward ways to elicit desired responses [7]. However, the coronavirus created an unprecedented

opportunity for instructors to carry out different sorts of experiments, as for the first-time, entire student bodies have been compelled to take all of their classes online.

During 2020 and 2021, a great deal of individual and institutional studies have been published [4]. Most of them recognize that the primary objective in these circumstances was not to recreate a robust educational ecosystem but rather to provide temporary access to instruction and instructional support systems [1]. This way, the available technology, the class size, and the lack of time to plan and design a consistent model constrained the strategies the instructor could use to facilitate delivery.

Bannan et al. [7], claim that "we need to modernize our conceptualization of 'instructional strategies,' and expand these principles to support a more open, flexible, and personalized learning ecosystem". In fact, the role of the instructor became multidimensional due to the context, and naturally expanded its scope to encompass other roles as facilitator, adviser, and mentor, among other dimensions.

According to Slusky [8], the sudden move from face-to-face (or brick-and-mortar approaches) to remote instruction brought other sudden transitions. Innovative pedagogical strategies have certainly been put forward. An extensive range of pedagogical concerns emerged during this disruptive period that were not that central in the pre-pandemic period. For instance, the importance of voice and pitch management, the encouragement of the practice of remote feedback, the transformation of a large-class lecture course to smaller modules, the recording of lectures, as well as other strategies for student engagement in conferencing and synchronous planning, started playing a central role.

The quick and non-voluntary experiment in emergency remote teaching we went through alerted instructors to the ways in which online redesign requires additional time and resources to provide meaningful learning experiences and to create distinctive learning environments with the help of digital technologies.

For most instructors, the first challenge was to recreate the face-to-face experience [4,9]. Worldwide, most universities speedily adopted mediated communication modes (synchronous or asynchronous): Google Classroom, Microsoft Teams, Cisco, Webex, Zoom, and Moodle, among other tools.

Around the world, the 2020 Spring semester was a testing ground for the adaptability and flexibility of higher education in their day-to-day online teaching and learning communication. Despite different teaching styles and course formats, one of the tools that has become crucial was video conferencing. During the lockdown, videoconference tools (VCT) were embraced by teachers as a temporary solution to an urgent problem. As stated by Peters [10], most universities were unprepared in terms of online delivery modes, so an expedient default was the replacement of face-to-face lecturing with the use of the Zoom. Despite several other available technologies, Zoom managed to hold 36% of the market share [11], making it the most used platform for video conferencing.

Before the pandemic context, VCT was regarded as a way to expand learning opportunities, as they assist online learning and teaching through supporting, watching, and interacting both in a formal and informal way. In fact, the increasing availability of video conferencing tools enables multisensory experiences and offers valuable opportunities for complex multimodal and multiliteracies expression. As stated by Thorne and May [12] "multimodality is an omnipresent feature of much communicative activity in online environments". It implies a semiotic complexity that can include written and spoken language, image, gesture, and haptics, among others.

According to Burnett [13], digital modes of communication have much to offer to pedagogy. They call for new discourse skills to overcome the lack of embodiment. Regarding the role of the teacher as a communicator, speaking directly to a camera, knowing that there are multiple viewers, having attentiveness and empathy to listen to our interlocutors with rare care and focus is also vital. Digital communication also creates pedagogical scenarios that are open and dialogical. Nevertheless, the author also states that, in terms of a more classic conception of teaching, status, self-perception, control, and authority can all be at risk.

During the pandemic, the use of digital tools related to communication technologies was in many instances involuntary.

Ali [3] states that meta-synthesis of relevant literature reveals that in recent years, there has been an increasing interest in the development and use of multimedia-enhanced content through the use of ICT to enhance the quality of teaching and learning. However, the point was that the transition to online teaching, under the circumstances, ideally required digital-savvy teachers and quick online adaptability. Yeigh et al. [14] state that creativity is needed to capitalize on affordances of technology, and also that time is required to learn how to integrate these tools into existing educational practices. In our opinion, regarding the current and future instructional scenarios, instructors need time to fully understand and manage multimodal communication tools.

Unlike video conferencing tools, learning management systems (LMS) have been central in higher education for more than two decades [15]. They can be defined as web-based platforms for administration, documentation, tracking, reporting, and delivering courses or training programmes. Furthermore, the underlying assumption of these platforms is to provide a constructivist theory-based instruction, focusing on flexibility and learner autonomy.

Before the pandemic crisis, for most teachers, LMS were clearly regarded as a catalyst for a paradigm shift from traditional educational environments to online educational environments. Implementing and using LMS was also part of strategic plans in several faculties and departments, to promote changes induced by digital technologies and to improve and integrate the hybrid and web-enhanced teaching and learning environments. Furthermore, according to Dobre [16], it was also fully recognized by instructors and scholars that LMS facilitate interaction and support higher-order learning, such as critical thinking, problem-solving, and collaboration.

However, in most cases, instructors tended to use LMS in a narrow fashion, as a repository, i.e., as an organizational infrastructure for learning materials relevant to a given course, making materials easily accessible, copied, and downloaded, primarily serving the purpose of supporting face-to-face teaching. LMS are indeed a powerful medium for enabling personal asynchronous learning, not only used to provide content to the students but also to incorporate alternatives to encourage their autonomous learning. According to Dias [17], expediency and flexibility are the two most valuable features.

Several years ago, Norberg et al. [18] had already stated that students' asynchronous work can be supported much more effectively with learning management systems, by using a wide range of resources, such as assignments, drop boxes, forums, and other tools.

During the remote emergency context, instructional design and organization played a very important role and teachers were forced to become designers and tutors overnight, hence, LMS became the core of the teaching and learning process [19]. LMS were a vital structure for ensuring educational sustainability, allowing teachers to track, report, and respond to learners' needs. They also became a primary organizing construct for education in an emergency technology-supported environment and not a mere supplemental resource for asynchronous activities.

As pointed out by Ali [3], overall, technology has become a powerful force in transforming the educational landscape. However, preparing to move education outside of traditional physical classrooms in response to COVID-19 instructors required a great deal of thought, coordination, and careful decision-making [3].

In terms of pedagogical implications, one can expect that the post COVID-19 period will place greater emphasis on virtual learning and the role of the teacher and learners will significantly change. In this fashion, LMS allow different forms of teaching, by interconnecting, accelerating, condensing, monitoring, and supporting—with many possible combinations of instructional strategies encompassing substitution and integration.

Therefore, we can notice that somehow all the institutions and teachers implemented strategies and adopted technologies to react to the lockdown imposed by the COVID-19 pandemic. Nevertheless, we cannot find any study about teachers' perception concerning the implementation of those strategies and technologies, and the learning process in all

that period. This perception can be crucial to understanding what can possibly change in the post COVID-19 era and what could be an effective transformation in the learning and teaching processes.

1.2. Teaching and Assessment Methodologies in Situations of Crisis

In the context of remote teaching and learning, the pedagogical methodologies to be applied constituted a dimension on which many doubts were raised. The range of teaching methodologies available to the teacher is vast, from more traditional methodologies to more innovative and active methodologies. These methodologies can include a variety of teaching strategies ranging from exposition, interrogation, and action, such as problem-based learning, problem-solving, project-based learning, peer-reviewed learning, design thinking, case study, flipped classroom, among others. Gómez-Pablos et al. [20] shows that the use of active methodologies with digital technologies improves the digital skills of teachers defined in the European framework for the digital competence of educators.

Digital competence has gained a strong prominence in the educational context. There is a growing interest in knowing the state of the digital competences of university teachers, that is, the set of knowledge, skills, and attitudes necessary for a teacher to make effective use of technologies [20].

Another factor related to emergency teaching and learning, which worried teachers and students during the time of the pandemic, is related to the distance assessment processes.

Assessment in the context of higher education is a complex issue that has always concerned teachers, students, managers of HEIs, and other players in educational processes. Assessment influences the way students organize their study and develop their skills [21], and even the way students understand the processes involved in acquiring their learning [22].

Often, the assessment process is seen solely as a way of measuring whether or not students have achieved the objectives of a given course.

In the context of higher education, the most implemented assessment instrument is the traditional written exam, wrapped in a classification and a hierarchy system. Usually, these written exams take place at a pre-defined time and focus on the results achieved during the training process, that is, they focus essentially on the product with a target on individual learning [10]. The existing literature essentially describes two distinct assessment methods: the traditional method and alternative methods that essentially differ in their focus on teacher-centred practices and student-centred practices [21]. Teacher-centred assessment practices circumscribe the focus on teacher assessment of the learning product. Student-centred assessment methods describe the focus on students' self-assessment of the learning process itself. These methods allow the development of technical and transversal skills such as the ability to solve problems and the involvement of students in the process itself. Usually, these methods involve more global learning activities that are developed over the duration of the course, individually and in groups, focusing on both the product and the process, encouraging each student's autonomy and responsibility [14]. These methods can also cover practical laboratory work, projects, and reflections [23]. The Bologna Process itself stimulated reflection on assessment and the need to implement more challenging, interactive, and creative tools and learning opportunities [24,25].

Thus, there are more and more advocates of an assessment that does not consider only one or more moments of assessment but includes reflection on the processes of acquiring knowledge and competencies, in a perspective of continuous and holistic learning (e.g., [23,25,26]). McDowell [27] emphasizes the instrumental characteristic of assessment as a form of learning and adds the responsibility of the students themselves in this process, understanding the assessment as an integral part of learning [25].

In this context of continuous assessment throughout training, teachers also need to play a role, essentially as a facilitator of a collaborative teaching and learning process, through projects and the collective production of knowledge. Flores and Veiga Simão [24] refer to the importance of making the learning process more creative, looking for innovative ways to structure teaching and assessment [21].

There is also the importance of rethinking HEIs as a space for thinking, and for cognitive and social interaction capable of generating knowledge [28].

According to Means et al. [29], the assessment of learning in the context of online education is not done by the simple application of a learning measurement instrument and consequent release of a grade in the system. This process, which is of concern to all those involved in the training processes, today more than ever, requires the need to reflect on the assessment, essentially as a process and not as a product. Thus, the complexity of the process requires a great concern about the method of planning and execution, considering different criteria and modalities, including new times and individual and social spaces, in order to expand the potential to measure the acquisition of knowledge and skills in a reliable manner.

The active methodologies based on a critical process, self-assessment, network learning, problem-based and project-based, among others, are considered essential in these environments. As an example, it is possible to assess the degree and type of participation in a forum or digital portfolio, always offering constructive personalized feedback from the active teacher and learning mediator. Some of the individual oral exams may be implemented via videoconference, for example for the demonstration of knowledge, understanding, practical skills, and argumentation.

In an emergency teaching and learning context, all these considerations were of particular concern. There were many operational difficulties reported by teachers during the online assessment process. One of the major concerns is regarding the guarantee of students' identity as well as the demonstration of some practical skills. In response, new software has popped up on the market that intends to address these concerns, namely online supervision systems (for instance, Proctortrack) which bring together advanced features such as [8] real-time supervision of students during an exam through artificial intelligence, implementing continuous and peripheral scans of hardware to detect virtual machines and other restricted devices, disabling keys and applications that cannot be used during the online exam, facial recognition, and detection of attempts to receive outside help or to use unauthorized sources (devices, course materials), ways to mark attempts of searching the web for answers, the possibility of intervention by the watchman, blocking the browser, multi-factor biometric authentication, facial scan, etc.

In fact, online supervision still offers many challenges. Unlike an in-classroom exam, online monitoring requires students to have access to adequate technological infrastructure. Without that, the surveillance program will not function accurately. Naturally, this creates a separation between students who have and those who do not have the necessary technological infrastructure. There are also concerns about video recording processes, such as how it will be used and by whom.

It is unlikely that these problems will vanish in a short amount of time, which means that online supervision can only be offered as one more solution alongside other options. As advocated by Hussein et al. [30], this type of assessment should not be promoted as the only solution, and it should be adopted and used carefully and selectively in contexts and situations in which it is the best solution. According to the FCCN (Scientific Computing Unit of the Portuguese Foundation for Science and Technology), currently, there are still no remote assessment systems, proctoring systems, data protection and identity assurance that are sufficiently tested, that serve the current purposes of Portuguese HEI and that guarantee compliance and consent by the General Data Protection Regulation (GDPR).

In this context, it is urgent to deepen the research and development in this area, which, according to Arnò et al. [31] represents a crucial challenge to improve the quality of the current automated supervisory systems.

On the other hand, some studies have shown that the absence of stability of the teachers and their age seem to be factors related to the introduction of innovative practices in the teaching process [32], whereas HEI with a stable number of teachers and older and senior teachers seem to introduce more innovative methods in their practices.

Moreover, it is also necessary to understand the level of satisfaction of teachers with the assessment methods they adopt during the pandemic period, knowing that in most cases they use the least worst assessment strategy, but without being satisfied with it.

2. Materials and Methods

The described theoretical framework served as a support for carrying out the study now presented, in which it is intended to understand the perception of teachers of a higher education institution regarding emergency remote teaching.

2.1. Study Design

A quantitative, transversal, descriptive, and correlational study was performed to answer the research question: what is the teachers' perception of remote learning during the COVID-19 pandemic?

Our main objectives were: (1) to know the teachers' perception of remote learning during the COVID-19 pandemic; (2) to know the e-learning tools used during the COVID-19 pandemic; (3) to know distance assessment strategies used during the COVID-19 pandemic; (4) to distinguish teacher profiles according to the overall evaluation of the lessons in remote learning and the evaluation of the assessment process in remote learning.

2.2. Instrument

A questionnaire was organized to answer the research question. This questionnaire had 27 questions divided into three main sections: sociodemographic characterization, e-learning strategies, and remote assessment. The sociodemographic section had questions such as gender, age, professional status, professional category, teaching course, and year. The second section, teaching strategies, presented a list of tools such as Moodle, Zoom, Microsoft Teams, Google Forms, Wetransfer, Socrative, Kahoot, Skype, Youtube, and Social Media, among others, and the participants had to select the frequency and the satisfaction level with the tool. There were also a set of questions about the frequency and satisfaction with Moodle activities and with Microsoft Teams. The answers were presented in a four-point Likert scale. There were a set of questions regarding positive and negative aspects during the remote period, short training courses attended by teachers, organizational support perceptions, and general assessment. The third section, distance assessment, had questions related to tools used for assessing learning. For teachers' that used online tests, there was a set of questions about frequency and satisfaction with tools. The tools listed were: Moodle, Socrative, Exam.net, Kahoot, Google forms, Microsoft forms, Quizizz, PowerPoint, and Word/Excel. Additionally, there was a question about positive, negative, and general perceptions regarding remote assessment.

2.3. Sample

The study population was teachers of a Portuguese Higher Education Institution. This institution has eight schools teaching in the areas of engineering, accounting, health, education, media and arts, tourism and hospitality, technology, and music. It has 58 undergraduate courses, 77 masters, and four PhD programs in partnership with other universities.

Regarding this study, a random sample was used with 547 participants. Our sample had a 95% confidence level and a 3% margin of error [33]. Regarding gender, 257 (47%) were male and 290 (53%) were female. The mean age was 46.09 (SD = 9.4) years, 315 (57.6%) were full-time professors and 232 (42.4%) were part-time professors. Most of the teachers were from graduation (n = 474; 86.7%) and masters (n = 238; 43,5%) courses. Regarding the professional status, 254 (46.4%) were assistant professors; 168 (30.8%) assistants; 98 (17.9%) invited assistant professors, and 26 (4.8%) were associate professors.

2.4. Procedure

Our study was disseminated through an institutional email for all the professors of the higher education institution, explaining the objectives of the study and with the link for the online survey. Data were collected between June and July 2020.

A quantitative analysis was conducted using IBM SPSS version 26.0. Descriptive measures were performed for every variable. To understand the differences in perceptions among teachers, a cluster analysis was developed. Cluster analysis is a multivariate technique whose purpose is to group objects based on the characteristics they possess [34]. This technique allows us to find teacher profiles who share the same perceptions about remote emergency teaching and who differ from the rest. To define the similarities or dissimilarities between the teachers, a likelihood distance was used, which was defined taking into consideration the variables that best characterise the teacher's professional experience, such as labour contract, professional category, and age. The professional category variable represents the type of teacher employment contract and has five categories: Invited Assistant; Assistant; Invited Assistant Professional; Assistant Professor; and Associate Professor. The labour contract variable has two categories: full-time and part-time. The age variable is numeric and includes values ranging from 22 years old to 67 years old.

3. Results

Our results showed that the most frequent tools used during remote learning were Zoom (n = 458; 83.7%), Moodle (n = 390; 71.3%) and Microsoft Teams (n = 135; 24.7%), as we can observe in Table 1. Regarding the satisfaction level with the tool used, most of our participants referred that they were satisfied with their options (cf. Table 1).

Regarding the use of Moodle, the most frequent activities are file (n = 492, 89.4%), test (n = 353; 64.2%), forum (n = 329; 59.8%), and assignment (n = 328; 59.6%) as we can observe in Figure 1.

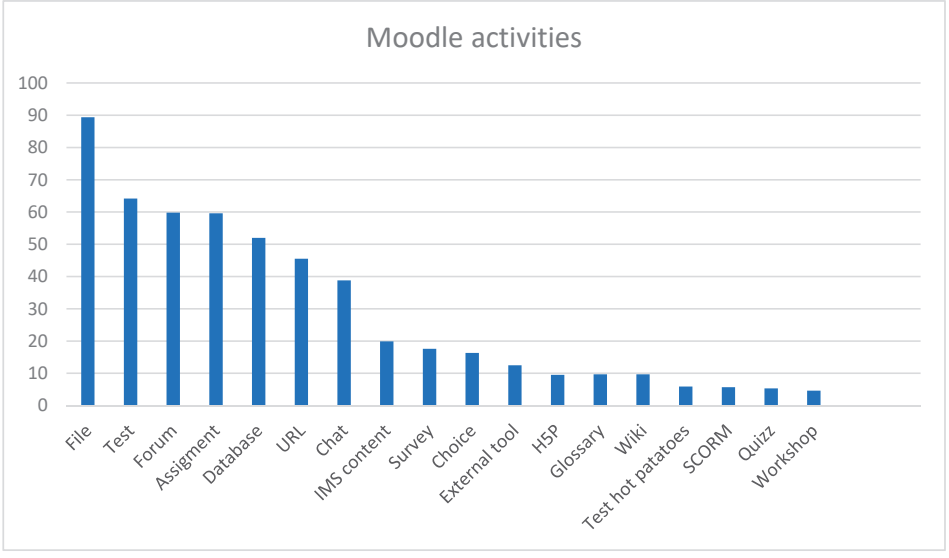

Figure 1. Frequency of use—Moodle activities.

Regarding the use of Microsoft Teams, videoconference was used by 66% (n = 277) of the participants, file sharing by 47.2% (n = 230), chat by 50.5% (n = 247), and notebook by 26.3% (n = 127).

Table 1. Tools used during remote learning and their satisfaction level.

Frequency	Moodle		Zoom		Microsoft Teams		Microsoft Forms		Google Forms		Wetransfer		Socrative		Kahoot		Skype		Youtube		Whatsapp		Social Media		Others	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Never/Rarely	77	14.1	30	7.3	342	62.5	503	91.9	4806	87.8	3910	71.4	530	96.9	511	93.4	451	82.5	351	64.2	411	75.1	477	87.2	536	97.9
Sometimes	80	14.6	49	9	70	12.8	36	6.6	56	10.2	115	21	13	2.4	25	4.6	67	12.2	129	23.6	60	11	43	7.9	9	1.6
Several times	390	71.3	458	83.7	135	24.7	8	1.5	11	2	41	7.5	4	0.7	11	2	29	5.3	67	12.2	76	13.9	27	4.9	2	0.4
Satisfaction level																										
Very unsatisfied/Unsatisfied	28	5.8	28	5.4	39	13.6	18	22.6	14	12	17	7.3	17	36.4	21	29.5	28	15.2	19	7.7	24	11.7	25	20.3	18	3.3
Satisfied	194	39.8	152	28.9	140	49	42	50	58	50	70	30	11	25	27	30	88	47.8	107	43.3	74	36.3	58	47.2	12	2.2
Very satisfied	265	54.4	346	65.8	107	37.4	23	27.4	44	37.9	146	62.7	17	38.6	23	32.4	68	37	121	49	106	52	40	32.5	7	1.3

We also asked our participants if they felt supported by the higher education institution. Most of the participants (n = 463, 84.6%) reported the institution's support. Additionally, most of the teachers (n = 343, 62.7%) did training in learning and distance assessment. This training was positively evaluated (Mean = 3.94, SD = 0.97).

When asked what the most positive factors were during remote teaching, our participants referred to better interaction with students (n = 109, 20%), better time management (n = 86, 15.7%), and effective learning (n = 73, 13.3%). Curiously, the negative aspects were worse interaction with students (n = 239, 43.7%), worse organization (n = 56, 10.2%), and less effective learning (n = 49, 10.2).

The general assessment about the remote teaching period was very positive (Mean = 6.96; Range: 1 to 10; SD = 1.96). This assessment was made firstly by administrative issues (n = 400, 73.1%), secondly by technical issues (n = 343, 62.7%), and thirdly by pedagogical issues (n = 354, 64.7%).

3.1. Distance Assessment

To understand the strategies used by teachers to perform assessments we asked about the frequency of use of several assessment strategies. As we can observe in Figure 2, the most frequent strategies were essay (n = 265; 48.3%), presentation (n = 176; 32%), project (n = 139; 25.2%), and exam (n = 138; 25%).

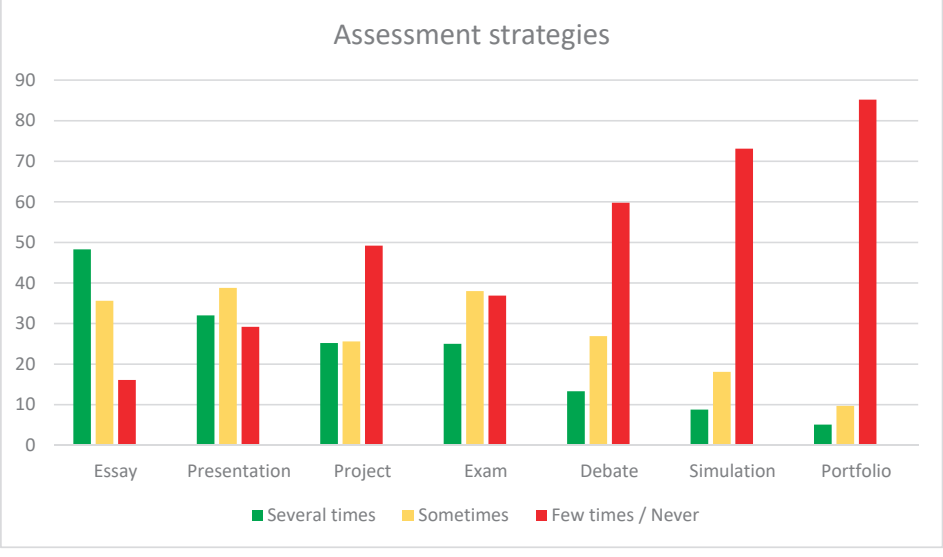

Figure 2. Frequency of use—Assessment strategies.

We also tried to identify what platform was used to conduct online exams and their satisfaction level. As we can observe in Table 2, most of our participants have used Moodle (n = 201; 36.7%) and are satisfied with the use of it.

Comparing the use of the exam with the use of essays to perform the class distance assessment, our participants reported a satisfaction level, on average, of 3.08 (Range: 1 to 5; SD = 1.09).

Table 2. Tools used to conduct exams and satisfaction levels with the tools.

Frequency	Moodle		Socrative		Exam.net		Kahoot		Google Forms		Microsoft Forms		Quizizz		Powerpoint		Word/Excel	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Never/Few Times	51	13.9	327	98.5	318	95.8	328	98.8	319	96.1	326	98	329	99.1	303	91.3	272	81.9
Sometimes	80	14.6	4	1.5	10	3	3	0.9	9	2.7	2	0.6	2	0.6	17	5.1	32	9.6
Several Times	201	36.7	0	0	4	1.2	1	0.3	4	1.2	4	1.2	1	0.3	12	3.6	28	8.4
Satisfaction level																		
Very unsatisfied/Unsatisfied	25	8.5	14	70	12	42.9	15	71.4	14	50	15	68.2	12	70.6	11	25.5	16	22.3
Satisfied	150	50.5	4	20	6	21.4	4	19	9	32.1	3	13.6	3	17.6	18	41.9	29	40.3
Very satisfied	122	41.1	2	20	10	35.7	2	9.5	5	17.9	4	18.2	2	11.8	14	32.6	27	37.5

When asked about the most positive aspect of distance assessment, participants reported greater convenience and ease in assessment (n = 95, 17.4%), although 10% (n = 57) referred to the absence of positive aspects. Regarding the negative aspects of distance assessment, one in three participants (n = 185, 33.8%) referred to less control over fraud and identity, and less equity (n = 14, 5.2%), lack of interaction (n = 28, 10.4%), more work/harder (n = 29, 10.7%), and digital problems (n = 12, 4.1%).

Most of the participants in the study (n = 430, 66.5%) stated positive perceptions regarding the distance assessment during the pandemic period.

3.2. Cluster Analysis

In order to verify the existence of meaningful groups of individuals within the database with similar perceptions about remote teaching and assessment, a two-step cluster analysis was developed using categorical and continuous variables that characterize the teachers. The two-step cluster analysis uses a hierarchical agglomerative clustering procedure in which individual cases are successively combined to form clusters whose centres are far apart [34]. Likelihood distance was selected because it is especially appropriate when categorical variables are used. The likelihood function was computed using the normal density for continuous variables and the multinomial probability mass function for categorical variables. All variables—two categorical variables (labour contract and professional category) and one continuous variable (age)—were treated as independent.

The analysis allowed us to extract two clusters of similar sizes: cluster one includes 314 teachers (57.6%) and cluster two includes 231 teachers (42.4%). The clustering quality was considered good (average silhouette measure equal to 0.7).

Three input variables were used, and the labour contract was the predictor with the highest importance for the creation of the clusters, followed by the professional category, and finally the age.

In terms of cluster characterization (see Figure 3), cluster one includes full-time teachers, mostly in the professional categories of assistant professor and adjunct professor and with an average age of approximately 50 years; cluster 2 includes part-time teachers, mostly in the professional category of invited assistant, and with an average age of 41 years.

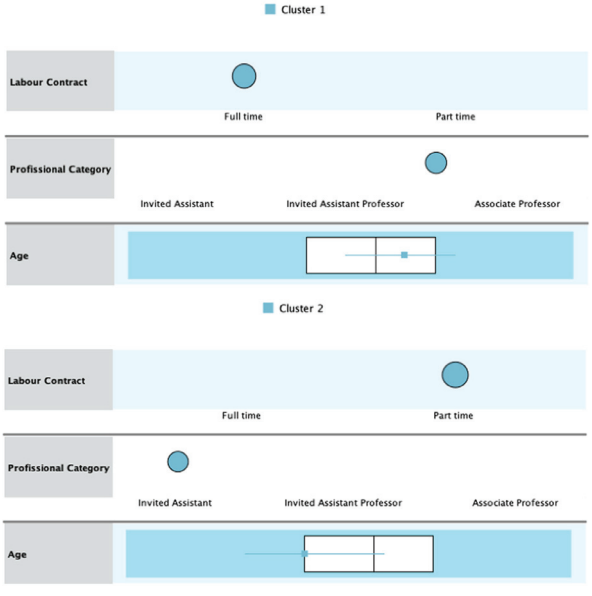

Figure 3. Cluster characterization.

The major evidence of this data reduction into two clusters is that cluster one comprises the teachers with more professional experience, stronger employment links and higher ages when compared to the teachers in cluster two.

After determining the two clusters, we aimed to understand whether the overall evaluations about the way the lessons and assessment took place in the remote learning period were different between the two groups. To achieve this objective, two-sample t-tests for the equality of means were carried out (see Table 3).

Table 3. Two-sample t-tests for equality of means.

Variables	Statistics		Levene's Test for Equality of Variances		t-Test for Equality of Means		
	Mean		F	Sig.	t	df	Sig. (2-Tailed)
	Cluster 1	Cluster 2					
Overall evaluation of the lessons in remote learning	6.79 (n = 314)	7.19 (n = 231)	11.138	0.001 [1]	−2.423	539.450	0.016
Overall evaluation of the assessment in remote learning	5.96 (n = 314)	6.54 (n = 231)	7.700	0.006 [1]	−3.145	530.693	0.002

[1] Equal variance not assumed.

The variables "Overall evaluation of the lessons in remote learning" and "Overall evaluation of the assessment in remote learning" were measured using a 10-point scale, where one represents the greatest dissatisfaction and ten the greatest satisfaction. The means analysis shows that the teachers with less professional experience (cluster two) have higher mean levels of satisfaction when compared to the teachers in cluster one. The t-tests for equality of means show that the differences observed between the two clusters are statistically significant.

Subsequently, we tried to understand whether the number of tools used in remote teaching and the number of strategies used in the assessment process was the same across the clusters, using descriptive data analysis (see Figures 4 and 5) and a two-sample t-test for the equality of means (see Figure 4).

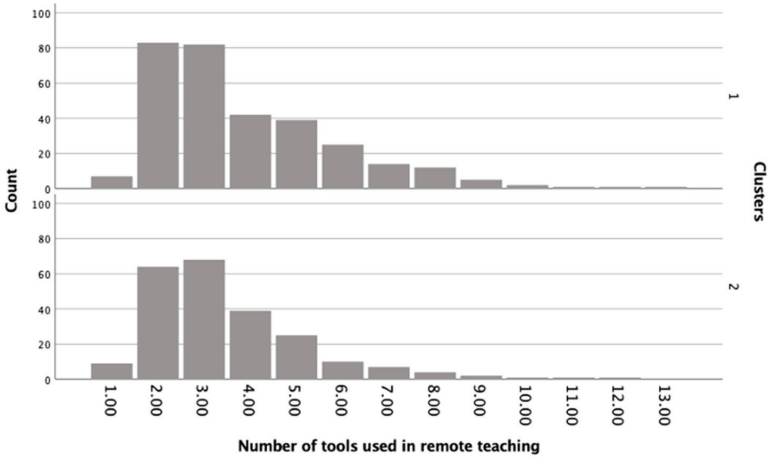

Figure 4. Number of tools used in remote teaching by cluster.

Regarding the number of tools used in remote teaching, we can see that the data distributions are similar between the two clusters. In both clusters, the most frequent values are the use of two or three tools in remote teaching.

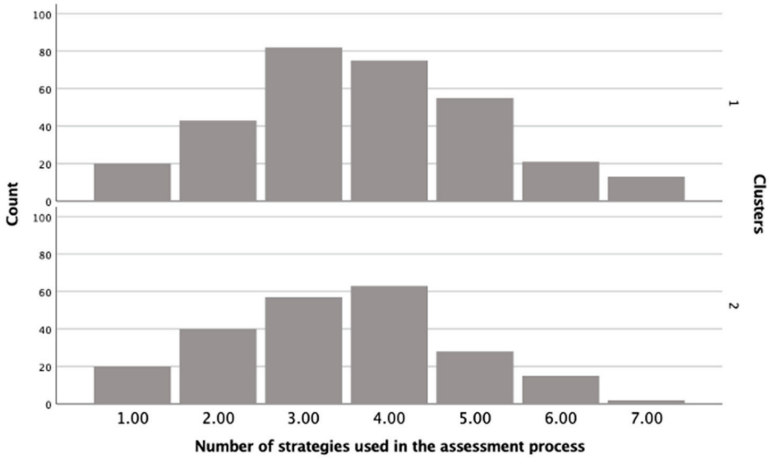

Figure 5. Number of strategies used in the assessment process by cluster.

Regarding the number of strategies used in the assessment process, the data distributions of the two clusters are also similar. In both clusters, the most frequent values are the use of three or four strategies in the assessment process.

The means analysis shows that the teachers with more professional experience (cluster one) use, on average, more tools and strategies to support lessons and assessment in remote teaching compared to the teachers with less professional experience (cluster two). The t-tests for equality of means show that the differences observed between the two clusters are statistically significant for both variables. Thus, there is statistical evidence to state that the teachers' behaviour regarding the use of tools and strategies was different between the two clusters (see Table 4).

Table 4. Two-sample t-tests for equality of means for the frequency of use of tools and strategies.

Variables	Statistics		Levene's Test for Equality of Variances		t-Test for Equality of Means		
	Mean		F	Sig.	t	df	Sig. (2-Tailed)
	Cluster 1	Cluster 2					
Frequency of use of tools to support lessons in remote learning	3.91 (n = 314)	3.52 (n = 231)	6,019	0.014 [1]	2.317	526.928	0.021
Frequency of use of strategies for assessment in remote learning	3.70 (n = 309)	3.41 (n = 225)	0,703	0.402 [2]	2.342	532	0.020

[1] Equal variance not assumed; [2] Equal variances assumed.

4. Discussion and Conclusions

This study aimed to understand the teacher's perspective about emergency remote teaching and emergency remote assessment during the COVID-19 pandemic. A cross-sectional quantitative study was performed during June and July 2020 in a higher education institution.

Our results, in line with previous studies [10,11], showed that Zoom was the most used tool by teachers. Zoom was used for videoconference classes, replacing face-to-face regular interactions, which suggests that the change of paradigm from traditional education to innovative one's were short.

The needs of a teacher are not limited to face-to-face time with students. Therefore, the use of other platforms is urgently needed. In this case, Moodle is the most used platform for sharing files, assignments, to perform exams, but also to implement asynchronous interactions with students, as previously argued by Ozadwicz [35]. On the other hand, Microsoft Teams was also used by some teachers, namely the videoconference tool, file sharing, and chat. The combination of asynchronous and synchronous strategies in one single platform seems to be perceived as useful by the teachers [34]. Although teachers used Moodle and were satisfied with it, we notice that they used it mostly for sharing files, receiving essays, forums, and doing tests. These results can indicate that strategies used were more related to emergency remote teaching, as a quick way to answer an education need, than using online education strategies with planned combination of asynchronous and synchronous activities.

Regarding the overall assessment of the emergency remote teaching, and despite all the uncertainty and the lack of knowledge related to remote teaching and the use of different platforms, the participants in the study consider that it was a positive period, and they were moderately satisfied with remote classes and the strategies and tools used during this period.

Assessment seems to be the highest challenge to teachers during the pandemic period. Our results about remote assessment are in line with previous studies (e.g., [23,24]) defending that remote assessment should integrate different strategies. The participants mentioned the use of exams, projects, oral presentations, and essays to perform remote assessment. Therefore, the use of exams as a strategy to perform remote assessment was very frequent in our sample, as previously argued by several studies [10,26]. To perform the exams, Moodle was the most used platform in our study. Ozadwicz [35] stated that Moodle was frequently used to perform exams.

Regarding the positive and negative aspects of the remote assessment, teachers identified as positive aspects the ease of performing assessments, and the increase of autonomy enabling the combination of several types of strategies. These arguments are in line with the positive aspects of remote assessment referred to by Flores & Veiga Simão [24], although remote assessment presents many issues and questions to teachers. The most negative aspect reported by teachers was issues related to fraud and identity control. These issues were widely discussed by the scientific community, highlighting that teachers recognized the absence of certain digital skills, especially those related to the evaluation of educational practices [20]. It is relevant to notice that this "good" perception of teachers may be related with being in a pandemic lockdown period, and where the expectations regarding this issue were low. Therefore, more research is needed about assessment strategies and teacher's confidence in applying them, without being in a forced remote teaching process, but as taking part of an integrated assessment process according to online education principles.

Analysing our results according to teachers' characteristics, such as labour contract, professional category, and age, it was possible to observe two different groups of teachers. The less experienced teachers are more satisfied with remote classes and remote assessment. On the other hand, the most experienced teachers employed more tools during the remote teaching period and used more strategies to perform remote assessment as stated by previous studies [32]. Despite this finding, our study found that in general teachers use technology to a limited extent, as is also highlighted in other previous research [20,36].

Therefore, this study has important implications for higher education. Firstly, the pandemic period brought the need to rethink distance learning, namely concerning methodologies, strategies, and assessment. Secondly, it is important to consider different learning modes, such as e-learning, remote learning, hybrid contexts, and in-presence environments. Additionally, it is crucial to invest in the acquisition of software and teaching tools more adequate for virtual environments. Moreover, to achieve continuous improvement it is crucial to implement training programmes on pedagogical and digital issues for higher education teachers, as also advocated by Gómez-Pablos et al. [30]. It can also be concluded that teachers made a huge effort to use new educational technology in their classes and

assessment process, although the results denote that this may be a onetime effort to answer to a world emergency. Further research is needed to understand if HEI are using the experiences and efforts made during this period to consistently introduce policies that potentiate that teachers adopt new and innovative methodologies such as those preconized by online education in their teaching processes.

This study has some limitations. On one hand, it is a case study analysing the teachers' perspective within a higher education institution. On the other hand, we did not consider the knowledge domains either in terms of teaching methodologies or for the assessment process, and it should be considered that there might be some changes and specificities in these processes according to the knowledge domains taught. Therefore, for future studies it is important to analyse the knowledge domains and to consider their perspective over time, in a longitudinal perspective, because we are only considering a transversal perspective in a very specific moment—the 2020 pandemic period.

In this study we have focused on discussing the teachers' perspective, but it is also relevant to consider other perspectives, namely the students' perception about the learning process during the 2020 pandemic period. Moreover, it is also relevant to analyse the governance board perspective, including their policies about remote learning and remote assessment and the guidelines given to teachers and students during remote and hybrid periods of classes and assessment.

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Article

Factors Constraining Teachers' Wellbeing and Agency in a Finnish University: Lessons from the COVID-19 Pandemic

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Abstract: The COVID-19 pandemic forced teachers to undergo a sudden shift toward technology-enhanced teaching and learning, challenging their capacities for change in many ways. This study explores those factors constraining teachers' wellbeing and agency that influenced their capacities as teachers in a Finnish university during the first year of the pandemic. Two sets of data were collected, with an online survey in the spring (n = 297) and autumn (n = 246) of 2020. At both times, challenges with workload, time management, and interactions with colleagues were found to be the most constraining factors. Difficulties with work–life balance and home office facilities seemed more of an issue in the spring, whereas transforming teaching and adopting new technological tools were reported as more burdensome in the autumn. The findings show the need for teachers to be heard and holistically supported, particularly when extensive changes in teaching arrangements are expected on a rapid schedule.

Keywords: COVID-19; emergency remote teaching; university teachers; wellbeing; agency

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1. Introduction

The COVID-19 pandemic outbreak forced educational institutions to undergo sudden and unexpected changes in how teaching and learning were arranged. Teaching rapidly shifted from campus-based learning to emergency remote teaching without the opportunity for structured planning [1]. This sudden change was a stressful experience, resulting in negative effects on teacher and student wellbeing [2,3]. The rapid change from onsite to online education was reported as causing an exceptional workload for both teachers and students [4,5].

A systematic mapping review describing the characteristics of 282 primary empirical studies on emergency remote teaching in higher education in the first months of the COVID-19 lockdown concluded that most of the studies focus solely on student experiences of online learning [6]. There is, however, a growing body of research on teachers' experiences of emergency remote teaching, indicating that the sudden change to an online mode put teachers' wellbeing to the test. Teachers reported suffering from stress, anxiety, exhaustion, and burnout due to information overload, their workload, and time pressures [7,8]. Moving from onsite to online teaching required, for instance, reshaping the curricula, creating online assessment methods, and formulating replacement assignments for students to complete the courses [4].

Teachers may, however, exercise agency to adapt, promote, or resist change [9] and to manage wellbeing [10] in exceptional circumstances. At the time of the initial COVID-19 outbreak, teachers were found to be capable of exercising transformative agency and having a positive attitude, willingness, and ability to cope with a challenging situation [11]. A survey-based study of university teachers in the first month of the COVID-19 lockdown

reported that teachers' agency varied, from an iterative, non-transformative agency that noted constraints but did not actively manage them, to the projective and transformative agency that actively managed constraints and used new methods and software in their teaching [12]. Badiozaman [7] claims that strong agentic competence, including resilience, goal-setting, and adaptive behavior, was an important factor influencing teachers' readiness for emergency online teaching. In addition, teachers exercised their agency by reducing their workload and safeguarding the wellbeing of both their students and themselves [13].

Studies reporting teachers' experiences of wellbeing in the long term during a pandemic are still rare. An exception is the study by Lavonen and Salmela-Aro [14], which revealed that the number of teachers considering themselves to be fully engaged was found to have dropped in the period from the spring (41.8%) to the autumn (30%) of 2020, while the number of teachers feeling severe burnout rose from 9.8% to 20%. Dinu et al. [15] suggest that the teachers' workload continued to be high when preparing online teaching materials for the 2020/21 academic year, as it became apparent that returning to campus was not viable.

The present study focuses on the identifying factors constraining university teachers' wellbeing and agency at two different time points in the first year of the pandemic. The additional value of this study is twofold. First, we need to identify teacher-experienced constraints, in order to develop support practices for teachers to overcome them and enhance their agency and overall wellbeing. This is expected to improve both student wellbeing (see [16]) and high-quality teaching practice (see [17]). Second, we perceive that it is important to acquire more longitudinal knowledge of this topic to evaluate the possible changes in factors constraining wellbeing and agency. Thus, we base our analyses on the data collected at the first stage of the initial COVID-19 outbreak and then, after the pandemic had already become a more permanent part of people's daily lives and teachers were likely to be more accustomed to online teaching.

In this study, teachers' wellbeing and agency are seen as being intertwined: fostering teachers' wellbeing supports their role as agents of change [18]; in turn, teachers' strong agency supports their wellbeing [19]. As concluded by Vähäsantanen [20], teachers' opportunities and power to influence work practices are likely to foster wellbeing, while a lack of agency over one's work, time, and social resources may lead to exhaustion. Possibilities for influencing practices vary, depending on sociocultural and material circumstances [21]. In circumstances such as the COVID-19 pandemic, individuals' and communities' agency are strongly constrained by external factors that have to be accepted without being able to influence them. This alone may negatively affect wellbeing.

This article analyzes university teachers' experiences of the factors that influenced their wellbeing and agency during the first year of the pandemic. The following research questions were set:

- What factors do teachers experience as being constraining for their wellbeing and agency in the spring and autumn of 2020?
- What are the most common factors in teachers' experiences that can be found in the spring and autumn of 2020?
- The focus is on the lessons learned from the COVID-19 pandemic that could be applied in post-pandemic higher education instead of merely returning to pre-pandemic "normal" [22].

2. Conceptualizing Wellbeing and Agency

This study conceptualizes both teacher wellbeing and agency as contextually situated. Furthermore, teacher wellbeing and agency are viewed as interrelated and even partly overlapping.

First, our conceptualization of wellbeing is in line with that of Dodge et al. [23], considering it to be a state of equilibrium between the individual's psychological, social, and physical resources and existing challenges. That is, there is a need for adequate resources to meet a particular challenge. In a similar vein, according to the theory of

self-determination [24], satisfying basic physiological and psychological needs (autonomy, belongingness/relatedness, and competence) has an effect on motivation, social development, health, wellbeing, and work performance. The need for autonomy refers to ownership and self-actualization; belongingness refers to close relationships and support; competence refers to feeling capable of achieving the desired outcomes and effectively coping with challenges [24]. Naidoo et al. [25] concluded that during the pandemic, the sense of an external locus of control lowered faculty members' feelings of autonomy, a lack of social connection influenced relatedness, and competence was also put to the test. In line with Acton and Glasgow [26] (p. 100), we position teacher wellbeing within wider social and professional contexts and the "complex interplay between individual, relational and external factors that affect, constrain and mediate the wellbeing of teachers". Individual factors refer to the need for autonomy and a sense of competence, a healthy work–life balance, happiness, and satisfaction. Relational factors entail the quality of staff and student interactions and working environments, connectedness, and belonging. External factors include policy initiatives, work intensification, and organizational culture.

Second, our conceptualization of agency follows the ecological view proposed by Biesta and Tedder [27]: agency is seen as the personal capacity to act in a specific environment that sets conditions for one's actions. Individual agency and social context are seen as being analytically separate but mutually constitutive and highly interdependent [21]. As defined by Eteläpelto et al. [21] (p. 62), teachers' professional agency is practiced and manifested when individuals and communities "exert influence, make choices, and take stances in ways that affect their work and/or their professional identities" in specific sociocultural and material circumstances. These circumstances can constrain or enable both teachers' professional agency [21] and their wellbeing [26]. Agency and wellbeing at work can also be linked with the way that professional capacity is employed in an unexpected situation. In particular, collegiality and collaborative capability are found to be important factors in coping with pressure and uncertainty [28,29].

Several studies have demonstrated the overlap of wellbeing and agency. For instance, wellbeing is related to a sense of autonomy, environmental mastery, the realization of one's potential, and the ability to fulfill goals [23], which are also viewed as fundamental in exercising agency. Ryan and Sapp [30] connect wellbeing with agency by relating it to an individual's vitality, ability to thrive within one's everyday environment, capacity for optimal functioning, confidence in being able to fulfill goals, and the motivation and energy to persist despite encountering obstacles. Taylor [31] adds to this definition the concept that wellbeing and agency, or "agency for wellbeing", refers to self-fulfillment and the capability or capacity to act in the context of specific social relations.

Constraints in teachers' circumstances may include the curriculum, professional and power relationships with colleagues and management, and the dominant culture in educational institutions, while available material circumstances or resources include equipment, instructional methods, ICT devices, and so on [9]. Alternatively, as defined by Priestley et al. [32], teacher agency is constrained or supported by cultural aspects, such as beliefs, values, and aspirations, that direct intrapersonal and interpersonal communication, material resources and physical environments, and social and relational resources.

In the conceptualization of agency, an individual's belief in their capability of controlling events and their quality of life plays an important role [33]. As described by Hargreaves and Fullan [29], capabilities—meaning the skills and qualities that lead to accomplishment—build confidence and support teachers in becoming active agents of change. In the context of remote working, both the individual's belief regarding capability and the actual capacity to control life events are being challenged. For instance, work–life balance has been experienced as being difficult to manage [34]. In addition, in online teaching, the lack of face-to-face contact with students has led teachers to feel less control over how to manage their classes [35]. Agency depends on an individual's experiences and interpretations of contextual factors, such as the opportunities provided for participation, influencing, and making choices [36]. While teachers' agency is constrained, for instance,

by the available resources, these constraints are not completely out of teachers' control but depend on their interpretation of the contextual constraints within which they enact their teaching [9]. In spring 2020, teachers were, however, forced to switch their teaching to an online mode, which may have also lowered their sense of control over their teaching. This, together with the pandemic, which is likely to affect everyone's sense of agency and control over life events in general, is also likely to influence teachers' wellbeing.

Damşa et al. [12] viewed teachers' conduct as a dynamic relationship with their environment, entailing varying resources, tools, institutions, infrastructures, and communities. They argue that in emergency circumstances, such as a pandemic, notions of agency should consider both the individual or contextual background constraints, including limitations in digital or pedagogical skills, technical infrastructure, institutional support, or time. Our study deepens the earlier work by Damşa et al. [12] by extending the analysis of the constraints to both wellbeing and agency inherent in emergency online teaching, as well as by examining the teachers' experiences at the beginning of the COVID-19 outbreak in spring 2020 and after they had gained experience of implementing their whole courses under pandemic circumstances by autumn 2020.

3. Materials and Methods

3.1. Context of the Study

The study was conducted at a Finnish multidisciplinary university. The university has six faculties and five independent institutes and comprises approximately 2600 staff members and 14,000 students. The study was designed and conducted as part of preparing the university's education development program, which aimed to involve the university community in the development of pedagogically and digitally relevant teaching practices and environments in multiple forms and over several sites.

The university campuses were closed due to the COVID-19 pandemic on 16 March 2020. With three days' notice, the university switched to distance learning mode for the rest of the spring term. Autumn 2020 began by alternating between remote work and working on campus, limiting the group sizes and courses offered onsite, and offering hybrid teaching. Since the further acceleration of the pandemic at the beginning of December 2020, the share of time spent working and studying on campus decreased further. This situation offered an opportunity to gather information on the preparedness of the university community to work remotely and to identify needs as well as resources that are required to support teachers in transforming teaching and guidance (or supervision) to an online or hybrid mode.

3.2. Participants

The invitation to participate anonymously in the questionnaire was sent to all university staff members who were in charge of teaching or providing guidance (herein referred to as teachers) during the spring and autumn of 2020: 1062 persons in the spring of 2020 and 1042 persons in autumn 2020. In the spring, there were 297 respondents and in the autumn, there were 246. At both times, most of the respondents were university teachers (65%), followed by researchers (20%) and professors (15%) with teaching or supervising responsibilities. Most of the respondents (68%) in the spring reported having no or very little online teaching experience. The respondents represented all six faculties. Of the independent institutes, most of the respondents represented the Center for Multilingual Academic Communication (Table 1).

3.3. Materials

The data analyzed in the present study are part of a larger dataset on the experiences teachers have had regarding teaching and guidance during the pandemic in 2020. The analysis of this study utilizes one structured and one open-ended question dealing with the theme of Personal resources and sense of control, which examines the teachers' perceptions of available resources and their control over their work and life (see [9,23,33]), affecting

both their wellbeing and agency. Both questions focused on identifying the interrelated individual or psychological factors; social, relational or (socio)cultural factors; and physical, material, or external factors (see [21,23,26,32,37]) that could have constrained both the wellbeing and agency of university teachers.

Table 1. Numbers of respondents according to faculty/unit and their proportion of the data.

Faculty/Unit	Spring 2020		Autumn 2020	
	n	%	*n*	%
Humanities and Social Sciences	70	23.6	55	22.4
Education and Psychology	51	17.1	39	15.9
Mathematics and Science	45	15.2	43	17.5
Center for Multilingual Academic Communication	41	13.8	39	15.9
Sport and Health Sciences	32	10.8	20	8.1
Information Technology	23	7.7	18	7.3
Business School	20	6.7	18	7.3
Other (e.g., university services, open university, open science center)	15	5.1	14	5.6
Total	297	100	246	100

The structured question was, "How well have you managed to control the following during the COVID-19 period of spring/autumn 2020?" (1 = very poorly, 5 = very well). This question focused on teachers' beliefs of their capabilities to control [33] factors that can be viewed to influence not only their agency but also their wellbeing and "agency for wellbeing" [31]. The query items for this question were formulated based on the earlier literature on both remote working in general (e.g., [34]) and online teaching in particular [35], as well as on teachers' professional capital [29], which topic the research team saw as particularly applicable to the sudden change from onsite to online teaching. The items were (a) organizing one's work; (b) organizing one's time; (c) life management and coping; (d) adopting new technological tools; (e) offering support to one's colleagues; and (f) aligning work and free time. These six items were used as independent variables in the analyses. The open-ended question, "What aspects were the most burdensome for you during the COVID-19 remote teaching period?" allowed the respondents to describe their own thoughts concerning the issues they perceived as challenging, particularly for their wellbeing ("burdensome factors"). Burdensome factors are likely to influence an individual's ability to thrive within their everyday environment, also with negative consequences for their sense of agency [30].

3.4. Data Analysis

Responses to the structured question (sense of control) in the spring and autumn were analyzed separately. Mean values were used to examine the average level of control in the measured items. To obtain more detailed knowledge of the distribution of responses for each item on the rating scale, the frequencies for each rating were calculated. We were especially interested in frequencies rated as either 1 or 2, which indicated the respondents' sense of weak control over their work.

Responses to the open question were analyzed using data-driven thematic analysis [38]. The length of the responses varied from a few words or a single sentence to more than ten sentences covering several themes. The second author first coded the data by marking the emerging themes and naming them. Then, the identified themes, their coding criteria, and naming were discussed and refined. Next, each response was coded by two authors who classified them independently, according to the agreed themes. These classifications were compared to find interrater reliability, which was found to be strong, with the immediate agreement of coding of between 78% and 86%. When the coding differed, the authors discussed and agreed upon the final coding.

Finally, the results of the structured and open-ended questions were considered side by side, to see whether they coincided with each other. From the responses to the structured question, the aggregated frequencies and proportions indicating difficulty in managing control (rated as 1 = very poorly or 2 = poorly) were compared with the frequencies and proportions that were calculated in the context of the thematic analysis of the open responses.

4. Results

4.1. Sense of Control over Remote Working

In both the spring and autumn of 2020, the teachers considered that they had, on average, better control (1 = low control; 5 = high control) over organizing their work (T^1 M = 3.74, SD = 1.05; T^2 M =3.63, SD = 0.97) and adopting new technological tools (T^1 M = 3.88, SD = 0.98; T^2 M = 3.47, SD = 1.13) than they did over time management (T^1 M = 3.20, SD = 1.20; T^2 M = 3.19, SD = 1.07), life management, and coping (T^1 M = 3.07, SD = 1.13; T^2 M = 2.90, SD = 1.14), offering support for their colleagues (T^1 M = 3.15, SD = 1.00; T^2 M = 3.04, SD = 1.03), and aligning work and free time (T^1 M = 2.99, SD = 1.21; T^2 M = 3.00, SD = 1.16).

When considering the proportions of responses for each item on the rating scale, approximately one-third of the respondents experienced a low or a very low sense of control over organizing their time, managing and coping with problems in their lives, and aligning their work and free time (Figure 1). Half of the items were rated as difficult to handle (ratings 1 and 2) by more respondents in the spring survey than in the autumn one. These were: *organizing my work* (13% in spring; 10% in autumn), *organizing my time* (32% in spring; 26% in autumn), and *aligning work and free time* (39% in spring; 32% in autumn). On the other hand, half of the items were rated by more respondents as being more difficult to handle in the autumn than in the spring. They were *life management and coping* (34% in spring; 37% in autumn), *adopting new technological tools* (9% in spring; 20% in autumn), and *offering support to my colleagues* (25% in spring; 28% in autumn).

4.2. Burdensome Factors in Remote Working

Next, based on the analysis of responses to the open question, Table 2 summarizes the themes describing those factors that teachers viewed as burdensome in terms of their work during the pandemic. It also presents the frequencies of the responses according to the theme, and their proportions to the total number of responses, separately in the spring and autumn of 2020.

Seventeen themes were identified in the analysis. The teachers most frequently reported issues related to *workload and time management* as being burdensome (38% of the respondents in the spring; 33% in the autumn). Various respondents commented that there was an increased workload and burden due to more challenging and time-consuming tasks. They had to re-design courses in a short time and deal with their feelings of inadequacy. Some respondents mentioned that they had to work excessively long days, including weekends, and still felt that they would have not accomplished everything that was needed. As one teacher stated: 'Feeling that you always have to be available in front of the computer causes overload.' Feelings of overload due to extensive working days also seemed to continue in the autumn, when online teaching continued after the summer break.

Regarding a problem partly linked to workload and time management, a growing proportion of the respondents mentioned *study administration* (3% in spring; 7% in autumn) and *research* (1% in spring; 5% in autumn) as burdensome factors in their work. In relation to finding time for research, one teacher commented in the autumn: "It is very hard to manage extra teaching responsibilities and keep up research, with limited access to the laboratories and students demanding a lot of time".

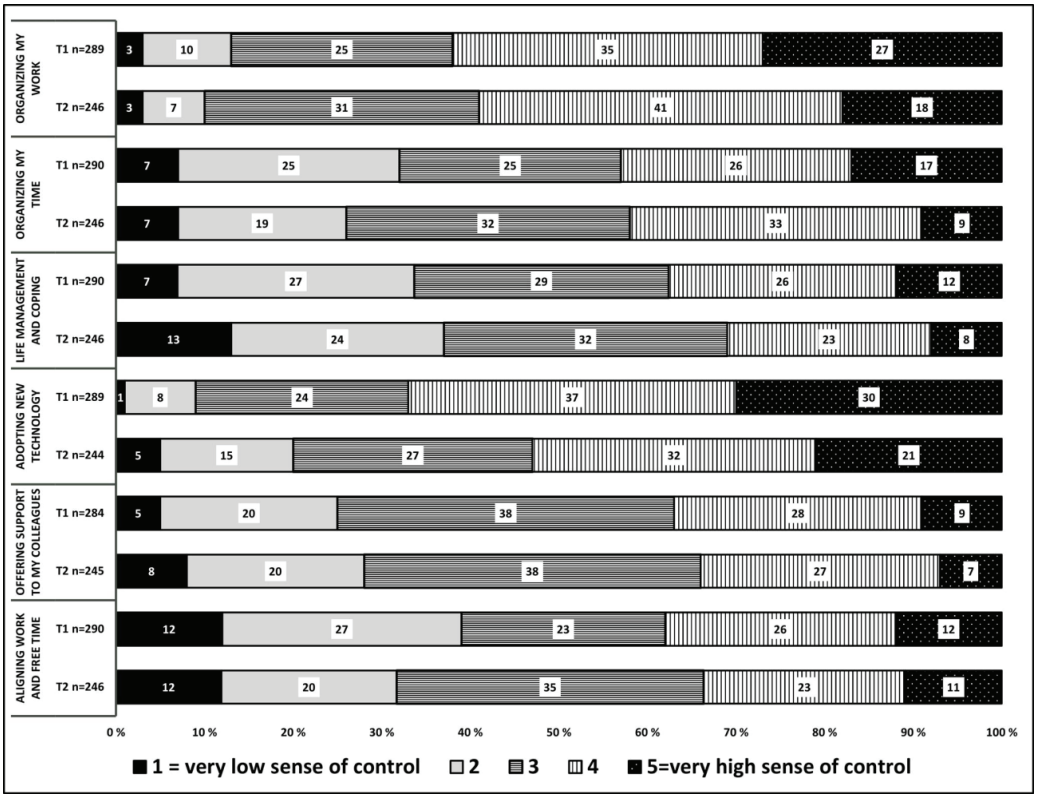

Figure 1. Burdensome factors in remote working. Note 1: The number of respondents for each item varied in spring (T1) between 284 and 290 respondents, and in autumn (T2), between 244 and 246 respondents, as it was not mandatory for participants to respond to all items. Note 2: Numbers in bar charts refer to the proportions of responses on the rating scale.

Table 2. Themes of the burdensome factors, frequencies of responses according to theme, and their proportion of the total number of responses in the spring and autumn of 2020.

Theme	Spring 2020 (*n* = 297)		Autumn 2020 (*n* = 246)	
	f	% of *n*	f	% of *n*
Workload and time management	114	38	81	33
Work–life balance	81	27	25	10
Interaction with colleagues	68	23	53	22
Transforming teaching	58	20	66	27
Psychological and physical wellbeing	45	15	32	13
Learning new technologies	32	11	21	9
Student guidance, scaffolding, and support	26	9	24	10
Facilities at the home office	25	8	11	4
Online meetings	22	7	15	6
Problems with technology	22	7	15	6
Offering and asking for support	22	7	21	9
Interaction with students	17	6	32	13
Leadership	16	5	23	9
Worry about students	12	4	12	5
Uncertainty	9	3	14	6
Study administration	9	3	16	7
Research	4	1	12	5
Miscellaneous (e.g., “nothing to mention”, “new staff members”, “a new work role”)	68	23	59	24

Work–life balance was the second most frequent challenge in the spring (27%). The participants reported difficulties in finding a balance between work and their personal life, including free time, home duties, family, children, spouses, and aging parents. As one teacher commented:

> *"At some point, I felt I was always at home doing nothing else than working and sleeping; before, with having an office on campus, I could more easily separate work and private life. Now I respond to student emails even in the middle of the night, which was not my style before."*

Particularly in spring 2020, when schools were under nearly complete lockdown, teachers with children found it difficult to combine work and taking care of their children. In the autumn, when children were back to daycare and school, fewer respondents (10%) referred to work–life balance as a challenge. Children were, however, still at home more often than usual, due to different symptoms, outbreaks, or quarantine restrictions. As one respondent commented: "Children returned to daycare at the beginning of autumn and during the first month there were many sick leaves, but now everyday life is running smoothly again".

Lack of *interaction with colleagues* was also among the most frequently mentioned challenges (23% of the respondents in spring; 22% in autumn) when working from home. The respondents missed their spontaneous and unplanned face-to-face encounters and felt that many things that were easy and quick to arrange when face-to-face were more difficult in online communication. Online encounters limited their creativity and innovation. As one teacher stated: "Spontaneous coffee-break conversations are missing, developing and ideating new things is rare".

Seven percent of the respondents in the spring and six percent in the autumn mentioned *online meetings* as being burdensome. The participants felt that there were too many online meetings in a row, and it was more difficult to concentrate online than when face to face. Too-short breaks between meetings made it difficult to make progress with other work. As one teacher commented in the spring: "You have to be so intensively present there, that they burden you more than face-to-face meetings". Another respondent wrote in the autumn that there were "a huge number of online meetings, which impedes doing other tasks during the workday".

Psychological and physical wellbeing was also a concern that was directly mentioned by many participants (15% of the respondents in spring 2020; 13% in autumn 2020). Participants were worried about both their physical and mental health and recovery. As one teacher commented:

> *"The most challenging aspects were related to wellbeing. I did exercise regularly and tried to have reasonable hours dedicated to work each day (but initially there were long days). However,* [the number of] *changes and the amount of work I had to do at the time caused great stress. I could not really shake off the stress."*

Closely connected to psychological wellbeing, 3% of responses in the spring and 6% in the autumn mentioned *uncertainty* as being stressful. Uncertainty was related both to the continuity of work (e.g., renewing contracts or achieving research funding) and to the general insecurity provoked by the pandemic. One participant noted in the spring: "The stress [was] provoked generally by the state of emergency, insecurity about the future and, for that reason, the impossibility [of planning] anything".

Every fifth respondent in the spring survey (20%) reported challenges related to *transforming teaching*. Adapting course objectives, tasks, and activities to fit online teaching in such a short period of time was viewed as challenging. The teachers were concerned about how to maintain high standards and achieve the course objectives. Forced and sudden changes in their teaching environments affected the teachers' sense of agency, such as how they perceived the possibility of their influencing their work and tailoring their pedagogy to adapt to new circumstances. Consequently, the need for rapid changes affected teachers' overall wellbeing. As one teacher described in the spring survey:

> *"Teaching is always intensive. Online teaching is much more so, if you aim to do the same as face-to-face, that is, discuss* [and] *recognize students' feelings and needs. My work has become more burdensome as I have not wanted to compromise when it comes to objectives. I have also had to redesign previously designed courses, new applications, new materials, and so on. The workload has increased also in that sense."*

The additional workload related to changes in teaching seemed not to be over but may even have increased after the summer break. Namely, every fourth respondent commented on this challenge in the autumn (27%). They felt they did not have enough time to design and develop their courses. Creating new materials such as recorded video lectures was considered to be time-consuming.

Apart from teaching itself, the factor of *student guidance, scaffolding, and support* was mentioned as overloading by 9% of respondents in the spring and 10% in the autumn. The respondents saw that there was a need for individual online sessions and extensive email interchange, providing additional instructions and materials for students. As stated by one respondent in the spring survey, the attention was particularly on "supporting the learning processes of students who had had difficulties [acting] during the pandemic". Another respondent commented in the autumn survey: "Different individual challenges among students have clearly increased this autumn". Various participants also commented that supporting students online was challenging and time-consuming.

In addition to guiding students in their studies, some respondents (6% in spring) expressed there were challenges in the factor of *interaction with students*. This category included concerns related to activating students and supporting group work when teaching online. There were also responses referring to the challenge of being isolated from students. As commented by one teacher in the spring survey: "Having direct contact with the people in teaching situations feels more natural and communicatively remote work is strange." The percentage of respondents (13%) mentioning challenges in interacting with the students increased in the autumn survey in comparison to the spring. As one participant commented:

> *"It is very difficult to know the best way to stay in contact with students and students* [who] *complain about not getting sufficient information. In the spring, the students were a bit more active, trying to stay on top of things, but now I think they are a bit more passive, 'waiting for information/instructions'."*

Furthermore, 4% of respondents in the spring and 5% in the autumn surveys expressed the sense that they were *worrying about students.* This category included concerns related to students' learning, wellbeing, loneliness, drop-out, off-grid students, and the technical aspects of attendance. As stated by one respondent:

> *"*[I] *worry about how students are coping and if they have opportunities to do their work as well as they want to. How well they can access the resources and how to consider this in the evaluation . . . "*

Learning new technologies was considered burdensome, particularly in the spring (11%) due to the sudden change from face-to-face to online teaching. One respondent described the change as follows: "You are supposed to study the use of remote technology and it feels like something excessive in an otherwise busy working situation". One teacher mentioned that the lack of being accustomed to dealing with technology caused "stressful situations, which made me even more clumsy with it". Similar concerns seemed, however, to persist in the autumn (9%), despite having more experience with online teaching.

Along with the need to learn about the use of technologies, *problems with technology* (e.g., with different applications or poor internet connection) were mentioned by 7% of respondents in the spring and by 6% in the autumn. There were also some comments related to constraints related to *facilities at the home office* (8% of the respondents in the spring; 4% in the autumn). These comments were linked to physical health (e.g., ergonomics) and infrastructure (e.g., available office furniture, technology, or the internet). As commented by one participant: "You basically work all the time in front of the computer—this is surprisingly burdensome".

Offering and asking for support was called burdensome by 7% of respondents in the spring and by 9% in the autumn. In some cases, respondents felt that they had to learn to use new technologies and adapt their teaching methods without much support. This was perceived as time-consuming and burdensome. The respondents said that it was difficult to access particularly prompt support when facing difficulties. On the other hand, helping others caused an additional burden. One participant in the spring survey described it as follows: "I also had to offer IT support to my colleague and to create our joint course platforms on Moodle and Zoom by myself".

Some participants felt that they had not received enough support from their superiors: 5% of respondents in the spring and 9% in the autumn wrote about challenges related to *leadership*. One teacher commented in the spring survey: "[In terms of] personal support for organizing teaching, there was no support from a superior, but one had to figure out things by oneself." Others felt that management had not succeeded in communication. Some claims were seen as erroneous, unclear, or contradictory. There were either not enough instructions or they were too detailed and trivial, even patronizing. As reported by one respondent in the autumn: "The university's constantly changing corona rules and requirements have forced us to redesign [the] curriculum already many times." Some participants expressed their disappointment that no extra compensation was even discussed, despite the additional efforts that teachers were making.

4.3. Comparison of Results from the Structured Question and Open-Ended Question

Finally, the results seemed to be very much in line when comparing the frequencies of themes and their proportions in the structured question, especially those scoring 1 (very poorly) and 2 (poorly) that indicated difficulties in managing to control remote working, with the frequencies and proportions of responses to those themes reported as burdensome (see Figure 1 and Table 2). In addition to supporting and giving more insight into the results related to items rated as being difficult to manage, responses to open-ended questions revealed additional themes that were considered to be burdensome. Figure 2 demonstrates how items in the structured question can be linked to themes identified in the responses to the open question.

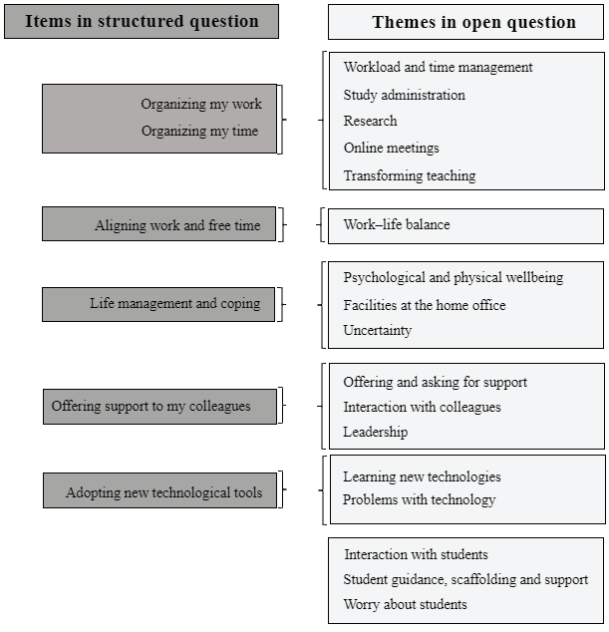

Figure 2. Linking of items in the structured question to themes in the open question.

First, a slightly descending proportion of respondents rating *organizing work* and *organizing time* as being difficult to handle in the autumn in comparison to the spring was in line with the responses coded under *workload and time management*. Responses to the open-ended question indicated that difficulties with organizing work were related to dividing time between *study administration*, *research*, *online meetings*, and more directly teaching-related responsibilities, namely, *transforming teaching*.

Second, *aligning work and free time* was rated as being difficult to handle by somewhat more respondents in the spring survey than in the autumn. In the open-ended question, the proportion of responses referring to difficulties with *work–life balance* was even more remarkably lower in the autumn than in the spring.

Third, the theme of *life management and coping* was rated as difficult to handle by a growing proportion of respondents in the autumn in comparison to the spring. This challenge was confirmed by challenges coded under *psychological and physical wellbeing*. In open-ended questions, responses coded under *facilities at the home office* and *uncertainty* can also be seen to have challenged life management and wellbeing.

Fourth, *offering support to colleagues* was considered to be difficult to handle by a slightly growing number of participants in the autumn in comparison to the spring. In the open-ended question, we identified challenges related to *offering and asking for support* in both the spring and the autumn surveys. In addition to this, challenges related to *interaction with colleagues* and *leadership* were seen as constraining.

Fifth, *adopting new technological tools* was considered difficult to handle by a growing number of respondents in the autumn in comparison to the spring. This was not the case with responses coded under *learning new technologies* and *problems with technology*.

Finally, apart from themes in the open-ended question that can be seen as closely related to items in the structured questions, three themes related to teacher–student relationships and communication were identified as burdensome in responses to the open-ended question. They were *interaction with students*, *student guidance*, *scaffolding and support*, and *worry about students*.

5. Discussion

The results of this study indicate that during the first year of the pandemic, university teachers' wellbeing and agency were constrained by various interrelated individual or psychological factors, social, relational or (socio)cultural factors, and physical, material, or external factors (see [21,23,26,32,37]). When comparing our results with articles reporting the constraints experienced in different parts of the world, we could see that many of them were internationally shared but some of them could also be related to the specific context of our study.

Workload and time management was found to be the most commonly reported constraint. This was confirmed by the proportion of respondents rating *organizing their work and time* as being difficult to handle. Similar results have also been reported elsewhere [4,5,39]. Damşa et al. [12] found that, in particular, the transition from onsite to online teaching was considered burdensome. In our study, challenges related to *transforming teaching* were mentioned somewhat more frequently in the autumn than in the spring. This is surprising, as one might think that by the autumn of 2020, teachers would already be used to and more familiar with online teaching. This result may be explained by the growing demands for organizing high-quality online teaching instead of offering quick solutions for emergency remote teaching. Hietanen and Svedholm-Häkkinen [5] found that during the transition to distance education, extra time was taken, particularly from research projects (see also [25]), other tasks, and spare time. Our results suggest that the pressure of balancing teaching with other duties, such as in *study administration* and *research*, was higher in the autumn when the exceptional circumstances seemed set to continue. An obligation for transforming teaching and dealing with the constraints related to research may have been particularly burdensome for teachers in countries such as Finland, in which teachers traditionally have strong academic autonomy, as well as freedom of teaching and

research (see [40]). In line with other studies [15,39], overabundant *online meetings* were also seen as burdensome. Based on the results of our study, it seems that overload was affecting individuals' ability to thrive within their everyday environment [30] over the long term, with negative consequences for both wellbeing and agency.

Work–life balance is considered an important individual factor affecting wellbeing [26,34]. In this study, it was the second most reported constraining factor in spring 2020. There were fewer comments related to this theme in the autumn. Moreover, *aligning work and free time* was rated as somewhat easier to manage by a greater proportion of respondents in the autumn of 2020 than in the spring. In our study, the more commonly experienced constraints in the spring may be explained by the complete lockdown, which included closed schools and daycare.

Life management and coping were rated as being difficult to manage by around one-third of the respondents in both the autumn and spring of 2020. This challenge was also confirmed by responses describing issues with *psychological and physical wellbeing*, as well as *uncertainty*. Indeed, supporting both teachers and students in coping with the consequences of the pandemic, such as stress, fatigue, anxiety, and depression, should be prioritized [19] in order to safeguard both the quality of life and education in the long run. Interrelations identified between staff and student wellbeing indicate that the focus should be on supporting the wellbeing of the whole university community [16]. In this study, constraints in material circumstances [9,32] related to *facilities at the home office*, such as the accessibility of resources and equipment, the lack of optimal workspace and ergonomics (see also [15]), were viewed as burdensome by fewer participants in the autumn than in the spring of 2020. This may be because teachers had more time to arrange and equip their home offices.

Reduced *interaction with colleagues* was among the most mentioned relational factors (see [26]) perceived as burdensome during the first year of the pandemic (see also [25]). In line with other studies [41], participants seemed to wish that post-pandemic universities would pay attention to the development of a sense of community in physical spaces. There were also a few participants rating *offering support to colleagues* as difficult to manage, writing about the challenges related to *offering and asking for support*. These results suggest that due to differences in teachers' online teaching competencies, there was more workload involved in either searching for or offering support. When in balance, helping or receiving digital help from others can, however, be perceived as positive interaction and a mutual learning opportunity among colleagues [15] that also affects their belongingness (see [24]). Support by the administrative staff has been viewed as essential, particularly during the transition from onsite to online activities [42]. In this study, comments referring to the importance of good *leadership* suggest there is a need for long-term support from the management when developing new practices. It is evident that teachers need adequate training and support for using educational technology effectively [43]. In the context of the COVID-19 pandemic, teachers have been found to display agentic competence, resilience, and enthusiasm by requesting professional development opportunities and training related to the discipline- and pedagogy-specific uses of ICT [7].

In our study, the availability of technology did not emerge as a constraint of teachers' agency (cf. [9]). This may be explained by the good availability of technological equipment in the Finnish context. Instead, *adopting new technological tools* or *learning new technologies*, as well as *problems with technology*, were found to be burdensome (see also [12]). Coping with suddenly changed circumstances when having insufficient competence to use the learning technology needed to teach remotely is also likely to cause technostress, which is defined as an inability to cope with the use of new technologies in a healthy manner, or as stress experienced while using information technology [44]. This may also have affected their self-efficacy as competent teachers, which could have reduced their sense of agency.

The quality of teacher–student interaction is seen as an important relational factor for teachers' wellbeing [26]. In the current study, additional information was gained from the open-ended questions, where teachers could report their concerns related to

student guidance, scaffolding and support, and *interaction with students*. The lack of personal contact with students was found to be the teachers' greatest pedagogical challenge also in a study considering the transition to distance education in 2020 [5]. Dinu et al. [15] found that at the beginning of the emergency remote teaching period, there was decreased student attendance, participation, and limited feedback from students; however, over time, interaction increased. The longitudinal data in the current study shows, however, that the students' need for support and interaction increased from the initial emergency mode in the spring, due to the prolonged remote learning period. Teachers were also *worrying about students* and conscious that the pandemic had affected some students to a greater extent, who were in need of additional support. During the emergency remote teaching period, students' perceived competence and autonomy, but also their belongingness, were identified as relevant to their wellbeing [2]. This calls for action in supporting these students' basic psychological needs [24] while not forgetting teachers' own needs in this regard [25].

Earlier studies suggest that having agency, that is, the opportunity to influence, as well as the ability to be flexible and to adapt to changes, are among the key factors in preserving wellbeing in the midst of disruption [20]. Put another way, we argue that educational institutions should provide flexibility in teaching arrangements, in order to support both teachers' and students' wellbeing and agency. Many studies (e.g., [1,43]) suggest that a blended approach combining onsite and online education to accommodate the changing needs of students and teachers would be the most desirable option for future higher education.

One limitation of the current study is that our data analysis focused on the teaching staff's general experiences, rather than on the differences between respondents representing different demographic or employment factors, such as age, gender, or academic position (cf. [15,25]). These are factors that could be considered in future studies. We also acknowledge that the respondent rate was relatively low. It is possible that those teachers who experienced more difficulties during the pandemic found responding to the survey to be an additional burden and refrained from answering. Methods such as teacher interviews could provide additional insight into the constraining factors that are also present among teachers struggling with many challenges, as well as how to overcome these constraints. Furthermore, while the focus of this article was on burdensome factors in teaching during the pandemic, we acknowledge that emergency remote teaching experiences have also created opportunities to develop the future of higher education, for instance, toward more versatile and flexible modes of working (see also [22]). This is what we aim to focus on in our future studies.

In terms of practical implications, we present the following recommendations to foster teachers' wellbeing and agency in higher education. First, it is important to support teachers in finding a balance between teaching, research, and administrative duties. Second, more flexible models of work need to be implemented to better support the work–life balance. Moreover, teachers' psychological (e.g., coping with uncertainty) and physical wellbeing (e.g., adequate working facilities) should be cared for. Third, the management should ensure that working time is allocated to different forms of receiving and offering training and (peer) support, for instance, on innovative pedagogies and using technology effectively. Informal face-to-face meetings between colleagues should be promoted, while excessive online meetings should be avoided. Fourth, it is important to further develop and evaluate methods for offering students guidance, scaffolding, and support, and to maintain interaction with the students in both face-to-face and online environments.

Although the development needs that we have identified became more apparent in the exceptional circumstances caused by the pandemic, it is vital to consider them in all circumstances. It will also be essential to build on this momentum, take advantage of the lessons learned, and focus on restoring teachers' wellbeing and agency in post-pandemic working life. However, rethinking the existing structures, particularly the transition to teaching in multiple sites and forms, requires sufficient resources and time, as well as a significant amount of support for both teachers and students.

6. Conclusions

This study contributes to the understanding of which factors constrained teachers' wellbeing and agency during the sudden external demand for changes in teaching practices as a result of the pandemic. Based on this study, it is clear that the initial lockdown in the spring of 2020 put teachers in survival mode; as the pandemic continued, the negative impact on teachers' wellbeing and agency became more apparent. These findings confirm the interrelation between teachers' wellbeing and agency. They demonstrate how sudden changes in teaching, including the urge to learn new technological skills and transfer teaching into an online environment, made teachers feel that they lack the necessary competencies, a lack that then negatively affected their wellbeing and agency. Despite this impact, teachers were able to exercise their professional agency, although it did need to be re-evaluated under the constraining circumstances. This accumulated understanding should be carefully considered when deciding upon courses of action concerning the development of higher education. In addition to the practical recommendations for supporting teachers that are presented above, the findings highlight the importance of hearing and considering teachers' internationally shared as well as locally specific needs for support, not only when extensive changes in teaching are expected on a rapid schedule but also at all times.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and Finnish Advisory Board on Research Integrity and instructed by the University of Jyväskylä Ethical Committee. Informed consent was obtained from all subjects involved in the study. Personal data were not linked to responses. For this reason, there was no need for an additional Institutional Review Board Statement.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The datasets used and analyzed in the current study are available in the Finnish language from the corresponding author upon reasonable request.

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Article

Teaching and Learning in Higher Education in Bangladesh during the COVID-19 Pandemic: Learning from the Challenges

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Abstract: The higher education sector globally has gone through a transition because of the coronavirus outbreak, and as a result, many traditional higher education institutions across the globe have been forced to go online to provide education and arrange assessments so that their students could continue their education and complete their courses. Unlike developed countries, at the beginning of the lockdown, most of the higher education institutions in Bangladesh shut down their operations, and a few universities started moving toward online distance teaching and learning activities. Based on an empirical study, this article discusses the challenges of teaching and learning in higher education in Bangladesh during the COVID-19 lockdown. It also identifies good practices to overcome those challenges. An online survey was conducted to collect data from university teachers throughout the country. Findings from this study show that it was a great challenge for most universities to adopt online teaching and learning models at the beginning of the pandemic. Many factors, such as preparedness, limited resources including financial means, low digital literacy, internet connectivity and suitable physical and virtual infrastructure affected this transition. However, the findings also show that the COVID-19 pandemic created new opportunities for educators and practitioners to explore various professional development activities by trying out different digital pedagogies through practice and reflection. This article also highlights the immediate effect and long-term impact on teaching and learning regarding preparedness for future approaches to education in emergencies.

Keywords: Bangladesh; challenges; COVID-19; digital pedagogies; education in emergencies; emergency remote teaching and learning; higher education; higher education institutes; online distance teaching and learning; opportunities; future directions

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1. Introduction

The COVID-19 pandemic has changed the landscape of higher education across the globe [1,2], including in Bangladesh [3–6]. Traditional face-to-face classrooms around the world have been replaced by emergency remote teaching and learning (using combinations of online, hybrid, and digital education systems) because of the sudden closure of educational institutions such as schools, colleges, and universities to prevent the spread of the coronavirus [7,8]. This widespread technological adaptation or diffusion was long-overdue; the pandemic was a catalyst for the transition and transformation of education systems to adjust to the technological advancements of the 21st century. This pedagogical transformation could be termed as a 'rebirth' and included new perspectives on education as serving new purposes through new pedagogical approaches and new practices (refer to 3NPs) [9]. Country-wide lockdowns showed how vulnerable traditional education systems are to emergencies and their various shortcomings [10].

The COVID-19 situation has challenged the deep-rooted notions of time, place, and methods of teaching and learning, i.e., when, where, and how education programmes can

be delivered and the role of educational institutions in providing educational programmes and learning opportunities. It also shows the importance of continuing education as a lifelong learning process and of educators to become reflective practitioners [11]. This unprecedented situation has also clearly distinguished between the traditional and non-traditional mindsets of educators and learners. As a result, different pedagogical models have emerged, and in the process of transition and transformation, both teachers and students have been working as change agents. As the teachers are integral parts of this transition and transformation, more educators are exploring the possibilities of distance teaching and learning as an effective pedagogical method in these challenging times [12].

The higher education sector in Bangladesh, with a growing body of private universities, was not prepared to deliver teaching and learning under these emergency conditions [6]. Most public universities were closed for a long period during COVID-19 because of the inadequate technology and pedagogical support [13]. However, later, several public university faculty members conducted online classes on their own [6]. Some higher education institutions used pre-recorded video lectures uploaded on YouTube, which students could access via devices such as desktops, laptops, tablets, and smartphones [6]. In this context, studies identified some problems regarding online education in Bangladeshi higher education institutions, such as lack of adequate devices for all students, limited availability of broadband connections in households, and expensive internet data rates [5,14–17]. While several studies discussed the barriers mainly from the technical and technological aspects, evidence on how teachers continued their good practices to overcome the challenges of limited resources is still unexplored, and this study aims to fill that gap. The study, therefore, explores the challenges of teaching and learning during the COVID-19 lockdown and identifies the good practices used by the higher education institutions to overcome these challenges.

2. Literature Review

2.1. Online Teaching and Learning during an Emergency

Digital technologies make distance teaching and learning more collaborative and impactful [18]. Emerging technologies, i.e., high-speed internet, cloud-based software, and online educational resources, blur the lines between remote and in-person teaching and learning. Cutting-edge technologies push the boundaries further, as educational institutions are advancing toward the era of Education 4.0 [19]. In the global north, blended learning approaches are becoming more popular in the context of higher education [20,21]. With the adaptation of emerging technologies in everyday life, teachers in higher education must be able to integrate technology with their expertise to foster an interactive and supportive learning environment for their students. As digital natives, the new generation of techno-savvy students should also be encouraged to engage in collaborative peer-to-peer study outside of allocated class time [21]. This helps students to gain a better understanding of course content through shared discussions and creates a university-based learning culture, as they feel more easily able to interact with each other.

In response to the COVID-19 pandemic, many educational institutions implemented social distancing interventions, such as initiating closure, developing plans for teachers to work remotely from home, and switching teaching and learning from their face-to-face classroom environments into virtual online learning environments [2,6,14,22,23]. Though online distance teaching and learning is not a new concept [24], many traditional universities across the globe, including in Bangladesh, were forced to switch to online teaching for the first time because of the global pandemic and subsequent lockdown and social distancing rules [6]. Online distance teaching and learning is also known as distance education or e-learning [25]; its popularity is increasing due to emerging technologies as well as the associated flexibility and cost-effectiveness [26,27]. With online education, teaching and learning take place anywhere at any time, using the internet and collaborative synchronous or asynchronous tools [26].

Studies [28,29] show that the number of students who have had online learning experiences has continued to increase each year. Online education is growing in popularity by virtue of convenience, technological advancement and the availability of the internet [30]. However, the abrupt switching to emergency remote teaching and learning because of the COVID-19 pandemic has created concerns about the pedagogical soundness of this mode of delivery. This switch has been a significant change for administration, teachers and students at traditional higher education institutions and has called into question the resultant quality of teaching and learning activities and the assessment of learning among many beneficiaries and stakeholders. In addition, the switch has also revealed inequalities when it comes to the types of students served as a result of the accessibility of provided education [31].

It is essential as higher education institutions move forward with online instruction that policies and strategies need to be put into place to help support and meet all constituents' needs, both under normal operations and when unprecedented situations arise [32]. To describe the worth of emergency e-learning in creating an equitable opportunity for all, Murphy [33] argued that emergency e-learning could be extended after any pandemic so that wider access to education is created for those who are unable to attend full-time in-person classes due to personal and financial considerations. Thus, it is crucial to explore the experiences of teachers, students and policymakers to understand current trends and future directions of higher education in Bangladesh.

With the declaration of COVID-19 as a global pandemic in March 2020, all educational institutions' campuses in Bangladesh were closed. Educational institutions in most developing and developed countries were consequently moved to teaching and learning online [34,35]. Even when university campuses were reopened, teachers and learners had to continue practising physical distancing and continued some of their works online. However, the situation created by the COVID-19 pandemic has been a wake-up call for stakeholders (educators, learners, policymakers and society at large) to acquire a more holistic understanding of the challenges and opportunities of the mainstream educational systems around the world [36]. Fundamentally, the pandemic has caused higher education institutions to challenge (i) the inherent notions of how, when and where to deliver education, (ii) the holistic role of higher education institutions, (iii) the significance of lifelong learning and reflective practice, and (iv) the particularity of traditional and non-traditional learners concerning time, space and the context of learning [37–43].

2.2. Teaching and Learning in Higher Education in Bangladesh during COVID-19 Lockdown

During the COVID-19 lockdown, the government of Bangladesh, especially the Ministry of Education and the University Grants Commission of Bangladesh, played important roles in addressing the issues to provide access to education across the education sector in Bangladesh. As mentioned above, immediately after the declaration of the coronavirus as a global pandemic, unlike in the developed world, most universities in Bangladesh just shut down their operations, leaving students without instruction for an extended period. Later, a few universities started adopting online distance teaching and learning activities to allow students to continue to study, helping them to progress and finish their courses. In general, all Bangladeshi higher education institutions mostly follow a face-to-face mode for providing education, training and research, except for the Bangladesh Open University and the newly established Bangabandhu Sheikh Mujibur Rahman Digital University [44]. Only these two universities have approval from the government and the University Grants Commission of Bangladesh (UGC), the government's regulatory body under the Ministry of Education to oversee higher education, to provide higher education using a distance mode [45,46]. At the beginning of the pandemic, the UGC instructed private universities that they could run their teaching and learning activities online, but they could not complete assessments using a distance learning mode [47].

Later, driven by the uncertainty caused by COVID-19 and the global outlook of transitioning traditional face-to-face teaching and learning into an online format, the government

asked all Bangladeshi higher education institutions to set up 'online programmes' [6,48]). The online learning platforms were new to most teachers and students; they had to familiarise themselves with emerging technologies and fulfil the technological requirements for integrating those emerging technologies into their teaching and learning contexts [49]. The unprecedented lockdown of the COVID-19 pandemic revealed inequalities (i.e., rural vs. urban students, public vs. private university students and teachers, males vs. females, lab and field-based disciplines vs. other disciplines) in the educational system and the specific effects of inequities when it comes to teaching and learning online [3,31]. For example, many students do not have access to adequate tools to attend online classes and access digital learning content as their financial situation does not allow this [16]. Students who did not participate in online learning activities faced 'systematic' or 'structural' discrimination. Many students do not have a sufficient learning space or environment at home because of their low socioeconomic backgrounds [50]. Furthermore, a considerable number of students reside in remote areas where neither electricity nor internet access is available [3].

Compared to other parts of the world, Bangladesh played a reluctant role in responding to the emergency situation caused by the COVID-19 pandemic. While Bangladesh declared the campuses closed, some overseas higher education institutions adopted innovative strategies, for example, a medical college in the USA adopted flipped classrooms, social media-based classrooms, online practical classes, academic conferences via teleconference and so on. Facilitators also used surgical videos to teach their students [51]. Moreover, a case study of a Chinese university found that teachers adopted various strategies to ensure students' learning achievement during the pandemic, for example, ensuring a high relevance between the online instruction and students' learning, ensuring effective delivery of online instructional information, and finally developing a contingency plan to deal with the unexpected situation through online education [52]. In addition, researchers, for example, Murphy [53], have emphasised the psychological impact of the pandemic on students and found that almost 30% of them experienced anxiety during the pandemic for various reasons, including separation from friends and relatives, financial challenges, and illness of family members. Studies of this nature are rare in the context of Bangladesh.

The long-term closing of the higher education institutions caused by the COVID-19 crisis appeared as another form of 'session jam'. In Bangladeshi higher education culture, there is a history of political interference on campuses and shutting down institutions for long periods of time, leading to students being unable to complete their academic programmes on time. These academic backlogs are known as 'session jams' in Bangladesh. A prolonged session is usually caused by political unrest or violence [54]. Initially, students and teachers were disassociated from educational activities due to the government repeatedly extending the closure of higher education institutions due to the pandemic, creating what many saw as 'session jams'. The academic community usually does not take initiative to reactivate academic activities or reopen the universities under session jam conditions; rather, it relies on the government to find a solution in order to restart academic activities. However, over time, Bangladeshi universities used available resources to provide their service of teaching and learning and continued academic activities remotely.

3. Research Questions

The purpose of the research was to first investigate the challenges of teaching and learning in higher education in Bangladesh during the COVID-19 lockdown and then to identify good practices by higher education institutions to address such challenges. The following research questions were explored in the study:

1. What were the challenges of emergency remote teaching and learning in Bangladeshi universities during the COVID-19 lockdown?
2. What were the positive aspects and learning from the challenges of online teaching and learning in Bangladesh during the COVID-19 lockdown?
3. What lessons did Bangladeshi universities take away from emergency remote teaching and learning during the COVID-19 lockdown to prepare for future emergencies?

4. Methodology

This main research project was based on a mixed-methods multi-perspectival study design to explore the research questions from multiple perspectives, i.e., teachers, students and policy makers. According to Creswell [55], mixed-methods research helps to investigate the social complex phenomenon most effectively; therefore, the empirical study was designed to explore the complexity of higher education teaching and learning in Bangladesh. However, this article is only based on teachers' perspectives and only used the survey responses, both close-ended and open-ended questions, from the questionnaire. The questionnaire was designed to collect both quantitative and qualitative data from the faculty members of both public and private universities. Therefore, to analyse the learnings obtained from the challenges of teaching and learning during COVID-19 lockdown, this study used the descriptive phenomenology method to obtain teachers' perspectives, as this allowed us to gather the participants' descriptions of experiences as open-ended text [55,56]. Through descriptive phenomenology, it is possible to understand people's subjective experiences of an event [55], as this approach helps the researchers obtain insights into the participants' experiences of a specific phenomenon in a descriptive manner; this study used the phenomenon of teaching and learning experiences and challenges of Bangladeshi higher education institution teachers during the COVID-19 lockdown. "A phenomenological study describes the meaning for several individuals of their shared experiences of a concept or a phenomenon" (p. 57) [54]; this study explores teachers' experiences and challenges as a result of this specific situation.

4.1. Research Participants and Data Collection

Teachers of Bangladeshi public and private higher education institutions were chosen as the research participants. Following the University Grants Commission (UGC) links to websites, the publicly available email addresses of all public and private university faculty members were collected from individual university websites, and they were invited to attend the survey. For understanding the teachers' perspectives, a total of 12,468 email addresses were collected, and email invitations were sent to all of them (11,649 delivered and 819 bounced back) to participate in the survey. The survey was conducted in June and July 2020. Within an 8-week window, a total of 525 survey responses (response rate of 4.9%) were received. Such a response rate can be accepted, as the response rate for an online-based survey is usually low [57], ranging from 3% to 5% [58,59] and almost always less than 10% [60]. While there is a potentiality of bias, it is assumed that such a low response rate would not create a highly biased result [61]. However, among the respondents, 388 (73.9%) were males and 133 (25.3%) were females and 4 (0.8%) did not mention their gender. Among the participants, 291 (55.4%) were from public and 234 (44.6%) were from private higher education institutions. After cleaning the data to ensure the validity and quality of the responses, 502 responses were accepted for final analysis.

4.2. Research Tool

An online questionnaire was designed and created using the Online Surveys (https://www.onlinesurveys.ac.uk/) platform, in which both closed-ended and open-ended questions were included. The first part of the instrument provided necessary information about the study objectives and data collection procedures. This section also presented the ethical considerations, so that the participants could understand what the research was about and how the data would be collected, handled and used by the research team. Some specific demographic information of the participants, i.e., the name of their department and university, age, gender, educational qualification, teaching experiences, etc., was collected in the second part. The next part of the questionnaire held closed-ended questions regarding their teaching and learning activities during the COVID-19 pandemic, including preparation, training, assessment, etc., and several open-ended questions related to the challenges, barriers, good practices and suggestions, including the participants' consent to attend a follow-up interview.

4.3. Data Analysis

This article reports findings from a larger project regarding teaching and learning practices in Bangladeshi higher education institutions during the COVID-19 pandemic. While the survey instrument has many specific questions regarding teaching and learning practices during the COVID-19 pandemic, for this article, mostly open-ended questions related to challenges, good practices and suggestions were analysed. Inductive thematic analysis was employed to analyse the responses to open-ended questions [62]. All the responses were read by the first two authors, and coding was employed for a similar group of responses. All the authors checked the data several times to ensure the correctness of the raw data. Previous studies on the investigated issues guided the selection of coding as well. To ensure reliability in the records, the first author and the second author conducted coding separately, and the third and fourth authors did a second-time review of the records; then, the codes were compared and discussed to finalise the code list [63,64]. A more focused coding, including themes and sub-themes, was produced after finalising the code lists. Finally, the common themes that emerged were identified and finalised. In the following stage, all the codes were categorised and clustered based on their potential connection and the possibility of integration [64]. During this analysis, data reduction, coding expression/term, and verification of conclusions were conducted simultaneously until the conclusions were drawn. For the coding and analysis part, manual coding analysis was used.

4.4. Ethical Considerations

Consent was obtained from the participants at the beginning of the online survey. Throughout the research process, information was dealt with special care to ensure the data management was secure and the provided personal information was kept completely confidential. The academic ethical guidelines [65,66] were followed throughout the research process to ensure confidentiality, anonymity, and the right to withdraw from the study. The dataset was electronically stored, and personal information was excluded before processing the data for analysis by the lead researcher. Only a cleaned dataset without any personal information was shared with the co-authors for analysis and interpretation. Safeguarding of confidentiality and anonymity was ensured throughout the process of collecting, storing, sharing and analysing data.

5. Results

Both challenges and positive aspects are presented in the results section. While the findings are presented based on the responses to the open-ended questions, some quantitative information was also considered to understand the two phenomena, i.e., challenges of emergency remote teaching and learning, and positive aspects of online teaching and learning.

5.1. Challenges of Emergency Remote Teaching and Learning

5.1.1. Participation

Low participation levels of students in emergency remote teaching and learning were observed and considered as one of the major challenges by the university teachers. Among the participants who were private university teachers, 46.1% found that more than 75% of their students took part in online classes, whilst only 22.4% found that students showed their full willingness to participate. From the observations of public university teachers, fewer students were attending and participating willingly in online classes. According to the data, 13.9% of respondents from public university teachers opined that more than 75% of students attended their online classes, and 12.4% of them found students' full willingness in-class participation. The teachers mentioned a number of issues ranging from poor internet connection to students' mindset regarding the worth of online classes that had an impact while conducting the online classes. The key issues that were stated by the teachers directly were: "*poor internet connection, coverage, and facilities*", "*lack of digital*

devices like computer, smartphone, or tablet", "*financial constraint*", "*lack of logistic support from the university*", "*incompetency in terms of technological knowledge*", "*high price of internet*", "*lack of training*", "*lack of motivation and inspiration*", "*lack of adequate home setting for the online class*", "*students' mindset; they believe online teaching can never be as successful as face-to-face interactions*".

5.1.2. Pedagogy and Assessment

Many teachers voiced their concerns about the practicalities of teaching online as well as how online teaching and learning approaches would impact their students' learning. One of the concerns of the teachers was how to control the students' movement and attention and how to ensure their engagement during the lecture. They felt that there was a lack of real presence in the lecture, and full concentration was not always possible. Teachers could not identify which students were unable to follow instructions or whether it was essential to repeat any portion of the lecture. Interaction between teacher and student was unsatisfactory, according to them. There were difficulties in ensuring the participation of all students in hands-on activities. Especially in science subjects, practical lessons and lab work are essential. However, it was impossible to conduct practical lessons and lab work online in some cases. One teacher in this regard stated that "*understanding the participation of students is very difficult in online classes, especially in Mathematics classes*". A few teachers blamed the learning materials for the dissatisfactory classroom interaction. One stated that "*the learning materials are poorly designed and do not allow much interaction between students and lecturers*". This indicates a teacher-centred discussion, where the teachers prepared the materials e.g., PowerPoint presentations, without considering the scope of students' participation. Students sometimes became tired as a result of increased stresses on eyes and ears during online teaching.

Similarly, many participants expressed their doubts about assessments in online teaching and learning. According to some of the teachers, online assessments were not fully effective as there were weaknesses in the assessment mechanism adopted or advocated for adoption. Some teachers identified the biggest drawback of online teaching and learning as the lack of a strong assessment system. Assessing students justly was identified as a major problem; some expressed how they thought it was completely impossible to conduct online assessment. Often, formal assessment was not possible, and there was no guideline on online exam systems. Some of the teachers perceived that fair grading was almost impossible in the case of engineering or practical disciplines. For some, online real-time exams were almost impossible. Furthermore, some participants expressed their concerns about providing suitable feed-forward feedback, supporting their students with online assessments, and the possibility of plagiarism and cheating during online assessments. It was extremely difficult to identify cheating during online exams.

Regarding the shortcomings of the assessments, a few comments made by the participants can help us understand their feelings. Concerning online assessment effectiveness, they remarked, "*online assessment is not fully effective*", and "*the biggest drawback of online teaching and learning is the lack of a strong assessment system and internet connection*". Teachers' lack of confidence in the morality of the learners was reflected in statements such as "*online assessment is challenging in countries like Bangladesh, where the average ethics level is far below the average levels of the developed countries*". Portraying the limitations regarding supervision, one teacher stated that "*there is no central monitoring or measure for quality assessment*". Regarding the lack of training and policies on assessment, teachers reported that "*traditional assessment (i.e., exams, class tests) is difficult to conduct online since most teachers are not trained to conduct online assessment properly*" and "*there is a lack of proper assessment policies*".

5.1.3. Resources and Internet

The practicalities and logistics of running online teaching and learning were of concern from the micro to the macro level. Most of the teachers mentioned in some form that the main challenges and weaknesses of online teaching and learning were the lack of resources

(whether it be at the institution or at home) and inadequate internet availability. Many teachers could not afford to use technological kits as well as computer facilities for assisting students. As teachers felt unsupported by their institutions. According to one teacher, "*all teachers cannot afford to use technology tools*". Teaching from home was problematic for many teachers, as there was a lack of a proper learning space or environment for lectures at home, and low speed of internet connection, and an unaffordability of data, as it is costly and insufficient for live sessions. This appeared as a major challenge that needs to be addressed by institutions and stakeholders in the event of future education in emergencies.

In terms of resources and the internet, the majority of participants complained about slow internet connections and excessive internet costs. The magnitude and extent of these problems were presented in complaints such as "*slow internet speed*", "*the weak internet connection and the lack of facilities*", "*weak internet signal in rural or remote places*", "*computer and internet access is not available to all students*", "*internet data is expensive and networks are inadequate*", "*device unavailability*", "*costly internet package and unavailability of essential equipment*", "*the internet is not available everywhere with the required video streaming speed*", "*expensive cost of internet and technical gadgets*", "*absence of ICT infrastructure*", "*unpredictable electrical supply and poor internet connection*".

5.1.4. Technological Skill Sets of Teachers and Students

Another concern that teachers expressed was linked to both staff and students' ability to manoeuvre and effectively use the online tools and technological resources that were available to them. As mentioned previously, there was a lack of available resources to higher education users, and even for the few that did have resources, there were no guarantees that the teachers and students would be able to use them accurately and efficiently. The participants felt that teachers and students did not have the appropriate level of skill to navigate the online systems. Many teachers and students did not have the skills to use technologies for educational purposes, and they were not familiar with online teaching and learning. Therefore, among the many online platforms, they had little knowledge of which were appropriate to use. The "*lack of technological skill*" and "*incompetency in terms of technological knowledge and skills*" were mentioned by teachers. All teachers, especially senior ones, did not consider themselves as tech savvy. It was difficult for them to perform online teaching. This was a reasonable concern for the teachers since most were asked to move to online teaching without having the appropriate support from their departments and universities.

5.1.5. Lack of Support from Universities and Stakeholders

According to 72.8% of private university teachers, online teaching and learning initiatives were taken by their universities. Only 33.2% of public university teachers opined that online teaching and learning initiatives were taken by the teachers, i.e., as a personal initiative. In terms of financial or technical support, only 5.5% mentioned that they received full support from their department or university to run online classes. On the other hand, 21.5% and 33.8% of teachers from private universities stated that they received full and partial financial or technical support, respectively. From the analysis of the data, it can be said that private universities were ahead of public universities in Bangladesh for taking initiatives and supporting teachers to ensure online teaching and learning during the COVID-19 lockdown. In this situation, many public university teachers took the personal initiative to conduct online classes, and this inspired other institutions to follow in supporting their students' learning.

Many participants expressed their concerns about the challenges, barriers and lack of support provided by their universities, mentioning such aspects as, *"no logistics support from university", "institutional support is not available", "inadequate policy and functional support and role of the Ministry of Education (MoE) and University Grants Commission of Bangladesh", "inadequate support from government", "lack of support from the institution", "lack of willingness of authorities", "we do not have any departmental support and we are not given credit", "no policy*

from the authorities", "there is no backup mechanism for dealing with an emergency if the system fails or collapses".

5.2. Positive Aspects of Online Teaching and Learning

The purpose of the open-ended question related to the positive aspects of online teaching and learning in the survey was to elicit the teachers' perceptions of the main positive aspects. It also gave scope to talk about the challenges of online learning and teaching in higher education in Bangladesh. It is to be noted that around 30% of the data were missing from the answers to these questions, and numerous participants alluded to the idea that there were 'no positives of online learning in Bangladesh'. Nonetheless, for those who did respond, the analysis of the responses produced the following themes.

5.2.1. Health and Safety

It is imperative to remember that the world was experiencing a global pandemic, with millions of people affected worldwide, when the study was conducted. For that reason, this project was initiated, and respondents highlighted that a significant benefit of emergency remote teaching and learning was bringing the health and safety of staff and students alike to the forefront. Some participants specifically highlighted the worth of online classes during the pandemic from the perspective of health benefits. They mentioned that it was *"safer because of fewer chances of exposure to contagious diseases such as COVID-19"* and it *"reduced rapid transmission of the COVID-19 virus"* while others mentioned general physical health and safety, for instance, *"saving lives during the pandemic", "safe for teachers and students in this pandemic", "students' safety and hygiene is maximized", "staying safe at home and teaching"*. Some participants also mentioned the importance of mental health*: "It improved the mental health of students".*

5.2.2. Widening Participation and Longevity

The majority of the teacher responses were linked to the usefulness of online teaching and learning for their students. The participants highlighted how the adaptation of online learning and teaching would allow more students to engage and participate in higher education, when previously they may not have had the opportunity. Respondents mentioned that it is "*possible to learn from a distance", "poor students can attend class from anywhere in the country*", and carefully planned online teaching and learning for covering part of traditional teaching and learning might help a large number of students who work part-time: *"online education will create an opportunity for them"*. It was noted that online teaching and learning options *"can reach a wider audience", "are available for all (sick students can participate)"*and can *"reach students in remote places".*

In terms of accessibility, many of the teachers highlighted that one of the main positives of online learning and teaching was the ability to record their lectures, seminars and content, for flexibility and longevity purposes. Participants went on to explain how this could be beneficial for both students, who could learn at their own pace and convenience, and for teachers, as it would develop a kind of portfolio and archive. Participants commented as follows: *"produces retrievable teaching contents", "classes can be preserved in the archive", "for teachers, the benefit is that once they prepare the course materials (videos, handouts, practice sheets, etc.) for online teaching, they will be able to use them in the later semesters", "class lectures will be available all the time on the websites", "in the case of recorded lectures, students can go through the lectures multiple times, which leads to a better understanding of the topics", "recorded videos, students can watch any time", "students can work at their own pace, place and time can take more ownership and responsibility in their own learning", "as it has the option for recording, it is suitable for slow as well as fast learners", "absentees can watch video lectures later. For part time students, they can learn away from classes", "students can learn at a convenient time. If needed, they can watch the lecture again and again".*

5.2.3. Time and Financial Benefits

The teachers mostly reflected on the positive financial implications for staff and students and how online learning and teaching could save money and consequently time at a micro classroom level. Some examples include, *"less time consuming, less costly"*, *"minimises the cost in several ways"*, *"it saves a lot of infrastructural expenses"*, *"as it does not require any formal setup, it will save both money and time"*, *"cost-effective, by reducing excessive time consumption"*, *"saves time (travelling time) and money (living outside from the family requires extra living cost) for the students as they are living with their families"*, *"saves money for the university; providing off-campus delivery any time"*, *"time-saving, no everyday travel required, given Dhaka's traffic conditions; cost-saving, students do not have to pay for room and board in Dhaka where living cost is very high"*. Policymakers and stakeholders can take the holistic learning approach of the e-learning experience and implement it to make more efficient and financially viable decisions and assessments on a larger scale for higher education institutions.

5.2.4. Service Length and Adopting to the Change

Based on the quantitative data, the teachers who have been teaching at the tertiary level for fewer years were more involved in online teaching than experienced teachers. One teacher noted, "*a lack of will among senior teachers to conduct online teaching and learning*". For example, 68.4% of teachers who had less than one year of teaching at higher educational institutions were fully involved in online teaching during the COVID-19 lockdown. However, only 52.7% of teachers were fully involved in online teaching during this period who had more than six years of teaching experience at the university level. Among the participants, 14.3% of teachers were not involved with online teaching in any way, and the same percentage of teachers started online teaching during the lockdown for the first time. However, many could not continue because of issues such as lack of support from institutions, low participation and engagement of students, lack of policies for online teaching and assessment, etc., and 13.9% of teachers who took the initiative to deliver online teaching to students during the coronavirus outbreak could not continue.

6. Discussion

On account of the crisis, the 'new normal' involved adapting through the digitalisation of services, including education. Being traditional in thinking and practice might not help professionals, as they need to be reflective practitioners. Therefore, there is a need for re-examining the rituals and monotonous practices of the formal education culture that teachers in higher education institutions in Bangladesh follow in their professional practice.

Higher education institutions are unique for independent learning, as their learners are adults who can cope with the rigour of online work, and the majority have a minimum level of technological knowledge to traverse new platforms. The responsibilities lie in the higher education institutions at which they learn, which have adopted online modalities of learning for their offered programmes to survive the change to online teaching and learning. Nevertheless, academics worldwide struggled to sustain the same level of engagement and learning as they had in the face-to-face classroom environment [6,67]. The implementation of online tools in the past few months of lockdown was unprecedented, and universities had to find solutions to avoid a decline in their educational provision, which could have major short-term and long-term financial ramifications. In the short term, academics employed interim solutions by utilising remote instruction, as campuses were closed [68] which is also evident in the findings of the study. However, the higher education sector is slowly understanding that remote teaching and learning during the pandemic was the first step in the shift to offering online education permanently, particularly in Bangladesh. Even before the pandemic, higher education institutions from the global north had seen a decrease in enrolment of traditional-aged students in campus-based programmes, with corresponding increases in part-time online courses [69].

Resulting from the COVID-19 pandemic, higher education institutions globally have been forced to move to online distance teaching and learning [8,70,71]. The main advantages and rationale for all governments and consequently higher education providers were to safeguard their employees and their students and thus society as a whole. Teachers in this study mentioned specifically how moving to online distance teaching and learning would reduce the spread of the Coronavirus and help protect all staff and students. A further advantage of online distance teaching and learning includes students being able to learn at their own convenience, with the potential of engaging hard-to-reach students who cannot attend face-to-face traditional teaching delivery [72]. This was found to be the case in this study, where many academic and teaching staff members highlighted that online learning and teaching could provide opportunities for families and individuals who were struggling in higher education or even for those who would not have had the chance to study higher education altogether.

The opportunity to record lectures was also considered as a positive aspect of e-learning by the teachers, who argued that it would allow students to learn at their own speed and convenience. Such kinds of resources can only be helpful to the students when they have good quality in terms of technical aspects such as sound and video clarity, the depth of information and most importantly the rigour of the pedagogical outline followed by the teachers. Furthermore, such content needs to be sufficiently self-explanatory since students would not have any chance to ask questions until they communicated with the teachers virtually or physically. Therefore, preparing such digital content with proper quality is even more challenging for teachers, especially in the COVID-19 context, when teachers are more prone to anxiety and fatigue [73].

Furthermore, higher education institutions are finding ways to be more streamlined and efficient with their already stretched finances and resources. The teachers in this study noted that online e-learning would be time and cost effective for staff and students. Therefore, it could be more lucrative and appealing at the micro (teacher and students), macro (university stakeholders and governors) and meso (University Grants Commission of Bangladesh and government) levels. Teachers' arguments regarding the worth of online classes was consistent with Murphy [33], which reported that e-learning creates greater access [74] for those students who cannot attend face-to-face classes for various reasons. This change could be highly beneficial for higher education institutions in Bangladesh, as this transfer to emergency remote teaching and learning forced many to be better prepared for using alternatives in the case of emergencies, including pandemics, common tropical weather challenges and political disruptions.

Despite many positive aspects of online teaching and learning, online e-learning can present many barriers to teachers, students and administrative staff. However, there is a necessity to acquire technological competencies in planning, implementing and assessing the performance of students. Higher education institutions need to provide teachers with the required training and resources to effectively implement learning through online delivery [75]. Similarly, institutions and policymakers must consider the appropriateness of the resources, especially the feasibility and availability of the internet for their staff and students, if they want to maximise the potential of online teaching and learning. The majority of the respondents in this sample mentioned the lack of resources available to staff and students, including the lack of technological devices and insufficient and expensive networks [76,77]. This lack of resources needs to be addressed, as this may lead to an even larger educational and economic divide between the rich and poor if access is only available to the middle and upper classes. The technology, design of the programme, choice of instructors, responsive curriculum, and supportive stakeholders in developing training programmes are necessary and significant for the successful delivery of teaching in an online e-learning environment [49,77]. If the government and stakeholders are serious about the transfer to online teaching and learning, long-term financial planning is needed; if used correctly, Bangladesh could become a strong player in the international online higher education market.

Universities and policymakers must provide swift, clear administrative and policy steps linked to online distance teaching and learning, access to resources, financial support and technological and e-learning training to staff and students. Therefore, integrating cutting-edge e-learning technologies to assist and strengthen both teaching and learning is one of the major difficulties faced by universities in the digital era [8]. This needs to be done at the national but also the localised level, with a more collaborative yet strategic agenda for education and research. It is fundamental that universities boost their collaboration in teaching, researching, joint financing and community service, proactively listen to concerns, and work with higher education institutions users.

There is also a need to encourage and support staff and students in building quality assurance systems to create new networks between higher education institutions and other educational providers in the region to develop best practices [76]. The University Grants Commission of Bangladesh and policymakers need to ensure to keep the physical and mental health of staff, students and society at the forefront of all decisions and consider ways to employ online teaching and learning to widen participation for those who may not traditionally have the opportunity to attend higher education institutions [32].

According to Coman et al. [8], the most significant concerns are technological issues, followed by teachers' lack of technical abilities and a teaching style that is not appropriate for the online setting. This situation was new to Bangladesh, and the country did not have previous experience in virtual education at the time of the emergency. Therefore, many teachers and students did not know how to use these resources effectively, which creates a demand for training. Both the students and teachers could be provided with rigorous training and support on how to use software, learning tools and other resources effectively [75]. However, the pedagogy for online teaching and learning is different from traditional face-to-face instruction. Therefore, teachers should be trained on how to conduct effective online classes, addressing the aspects of technological and pedagogical issues [75].

Based on the findings of this study, the government and policymakers need to ensure adequate training is in place for staff and students when adopting online learning and teaching. Higher education institutions must also provide financial support in the form of appropriate technologies and platforms to assist in the high-quality delivery of learning; otherwise, this be a hollow transition. Follow-up studies could generate student-centred views, as students' perspectives may highlight that they deem different technologies to be useful for significant growth. Further studies might also examine blended learning instead of fully online teaching and learning to determine whether a mix of face-to-face and online learning could be valuable for staff and students.

Both the teachers and students need to be provided with the necessary resources and training to continue education if an emergency occurs [78]. Considering the context of Bangladesh, it is recommended to provide high-end computing devices to faculty members, including the necessary software. Both the university administration and the University Grants Commission of Bangladesh could take the initiative to provide laptops and other devices for educational purposes. As an alternative, they could provide interest-free loans with easy and flexible instalment opportunities to teachers. The University Grants Commission of Bangladesh could confirm an agreement between the higher education institutions and computer companies, and commercial banks could also be involved in providing loans for buying computing and internet devices.

For the students, both the university authorities and the University Grants Commission of Bangladesh could take the initiative to provide computing and internet devices with the help of zero-interest loans. The universities could take initiatives so that the necessary IT infrastructure can be established on the university campus, and it could support both teachers and students remotely. Other resources, such as teaching and learning materials as well as digital copies of text and reference books, journal papers, reports and so on, could be provided to the teachers and students at no cost. During the pandemic, many teachers and students in Bangladesh could not access the resources they required, which created a problem in ensuring effective online teaching and learning procedures. Hence, this study

recommends providing these resources to both groups; this could be a core task of the university administration.

Adequate internet facilities could be ensured for both the teachers and students. The University Grants Commission of Bangladesh could play a substantial role in providing sufficient internet facilities. As broadband services are minimal countrywide [79], it is necessary to start a discussion with the broadband providers on how they can extend their coverage and provide internet service to teachers and students. The University Grants Commission of Bangladesh should arrange a discussion with the telecom operators so that they can provide 4G internet service all over the country. Findings show that while many students and teachers had devices, due to reduced internet speed, they could not attend online classes. Therefore, by ensuring proper internet services, it is possible to bolster online learning. The ministry and telecom operators must work closely together to ensure this. Lessons can be learned from the example of China, where the Chinese government asked the telecom operators to provide the necessary internet facilities for people to continue their education during the pandemic [80–82]. The price of data should be decreased and the duration of using the data pack should be increased. For the sake of educational development, telecom operators can provide special offers to students and teachers for educational purposes. For example, they could remove data charges for using Google Meet, Zoom, Microsoft Teams, or such conferencing software or services.

For ensuring an effective online teaching and learning process, necessary policies and guidelines should be prepared, considering the strengths and weakness of the national context [81,82]. For instance, the country, as well as the university, should decide whether to use a full-fledged online system or a blended learning procedure. It is important to establish policies and guidelines according to this decision. Based on this decision, both the curriculum and syllabus should be established for the students. The assessment procedure for the online learning system is still not clear to many teachers, according to the findings. The universities of Bangladesh did not have any specific policy on assessing students while conducting online classes [6]. Therefore, forming relevant policies and guidelines is important. There was no specific policy or guideline on how to continue education during an emergency [83]. However, the University Grants Commission of Bangladesh recently developed a 'Policy on Blended Learning for Bangladesh' [84]. A countrywide policy or guideline needs to be developed and incorporated, including training the teachers by the ministry so that higher education institutions follow up with customisation [85].

Higher education is about self-administered learning journeys, where teachers facilitate and learners take active roles to bridge their knowledge gap and develop their skills for the future [3,86]. The COVID-19 lockdown period can be considered a wake-up call for educators, institutions and students alike to place less importance on physical attendance in the classroom as the sole way to gain formal accredited qualifications. Instead, viable alternatives can be held up as examples of the future of education. This, in turn, could go a long way to help address the inequalities that currently exist in the higher education system, as access becomes more easily scalable and is democratised as a result of demand for education in emergencies such as the COVID-19 lockdown.

An important question remains unanswered for many teachers: how would they develop the use of technologies in a resource-constrained environment to transform their teaching and research in higher education settings? Higher education institutions need to create a culture that supports and values learning and teaching along with student engagement and achievement, where students learn how to generate and critique existing and evolving knowledge and professional transformation [87]. In the process of online distance teaching and learning, the 4Cs (connect, communicate, collaborate and co-create) strategy [88] does not work, as many teachers and students do not have access to technology and the internet, particularly in Bangladesh [6], nor the skills to use the required technologies for teaching and learning. Therefore, it is important to make creative use of a wide range of technological tools for teaching, learning and research through synchronous

and asynchronous communication and share those innovative approaches across the learning communities.

Teachers need to think outside the box regarding assessment, going beyond the traditional paper and pencil exam system. Therefore, it is important to reconsider assessment techniques to make them fair, manageable and 'fit for purpose' in emergency remote online teaching and learning [89]. During the COVID-19 pandemic, alternative assessment methods and different innovative assessment techniques were adapted in many universities in the global north [90]. These alternative methods include open-book format, take-home long-period exams, problem-based case studies, concept maps, online quizzes, online presentations, multimedia submissions, and written essays. Based on Universal Design for Learning (UDL), one could ensure an effective assessment design that is inclusive and incorporates a variety of assessment methods.

Teachers' main aim is to transfer knowledge and skills as well as create new knowledge and skills to bridge the gap in preparing the new generations to overcome the challenges ahead [91–93]. Technologies could be used as the vehicles as well as the tools to transform teaching, learning, assessment and research activities; at the same time, they must build bridges by supporting the development of technological fluency across the digital divide to prevent educational exclusion [3,31]. However, teachers and students alike are facing a digital divide in resource-constrained environments; this needs to be addressed at institutional and societal levels [3–5].

7. Implications of the Study

This study presents the challenges teachers faced during the COVID-19 pandemic and identifies the positive aspects of online teaching and learning in Bangladeshi universities in low-resource settings. It is evident that while the teachers faced several challenges, dominated by technical problems, a number of positive issues were also identified. From the responses of both public and private university teachers, this study provides a snapshot of how university teachers respond in an emergency, without having the necessary preparation and prior training. The results of the study, therefore, establish a baseline of the teachers' response to online teaching and learning. This result could help the university authorities and the government to understand the overall situation, and based on this, authorities could take the necessary initiatives to overcome existing challenges. Higher education institutions can understand the level of teachers' enthusiasm about continuing online teaching and learning activities. If teachers receive appropriate training and access to technical resources, they could more effectively organise and design teaching and learning activities during an emergency. One of the critical discussions of this article is to ensure the pedagogical knowledge of the teachers in line with technological adaptation and blended approaches to delivery. The universities could take the opportunity to revise their curriculum, pedagogical approaches and assessment procedures so that integrated teaching and learning activities are possible.

The study also identifies a lack in terms of proper guidelines from the authorities. This realisation of the teachers could help the university authorities and the University Grants Commission of Bangladesh formulate specific policies for online education. In addition, the university could also think about implementing blended learning approaches in which online learning activities are an essential part. While the University Grants Commission has produced a general guideline for blended learning, based on the findings of this study, the universities could realise the potential of blended learning and how to support its faculties and students.

8. Limitations of the Study and Scope for Further Research

The study adds value by presenting the voices of teachers, both from public and private universities in Bangladesh, particularly considering how they coped with the challenges of a new situation without having adequate preparation. The findings might be helpful, particularly for countries with limited resources to run online teaching and learning

activities. However, the study has some limitations. Firstly, due to the low response rate, the findings might not be generalised, though a snapshot of the online teaching and learning practices is provided. Secondly, this study presents the views and opinions of the teachers only, not the students and administrators; hence, the holistic challenges and learning from these challenges in Bangladeshi universities are yet to be understood. Thirdly, the study addressed the issues only from the participants whom we could reach through the only survey. Those who did not have online access were not included. Responses from both teachers and students could provide more insights.

Along with these limitations, the study creates some scope for further studies. Firstly, it could be understood more deeply how the teachers and students continued their activities during the pandemic without training and in a low-resource setting. Bangladeshi university teachers showed their interest in running online learning activities. The reasons behind their enthusiasm in a resource-constrained environment could be further understood. Secondly, how the practice of online teaching and learning activities could be continued in normal times might be another area of investigation. Remarkably, considering the characteristics of blended learning and massive open online courses (MOOCs), how teachers, students and administrators could continue the good practices of online activities can be investigated. Particularly, one study shows that Bangladeshi students have a great interest in learning from MOOCs [94]; therefore, university administrators could consider this learning modality. Finally, a more extensive study needs to be carried out to understand the universities' strengths and weaknesses in training their staff on technological pedagogical content knowledge and how to use it effectively in teaching and supporting their students.

9. Conclusions

For many teachers and students, switching to emergency remote teaching and learning online has become a transformative learning experience. In conjunction with the COVID-19 pandemic and this new learning experience, higher education institutions have struggled to cope with the educational needs of students and the training needs of teachers. The stress created by the pandemic and the tension of learning loss severely hindered the whole system of higher education. Although some Bangladeshi universities have taken a few initiatives to continue their teaching and learning activities online, it is still unclear whether teachers managed to enhance student engagement and participation. It is also unclear what the impact is on students' learning outcomes. Without having a proper understanding of these, it might not be possible to conclude how this transformative learning experience affected the lives of teachers and students. Consequently, it is not possible to form appropriate policies to face future emergencies as they have multifaceted complexities and multidimensional priorities.

The pandemic highlighted the need for an alternative online approach to teaching. Without a solid understanding of online teaching and learning, it is difficult to understand how to benefit from it. This could be acquired through adequate research. The current study explored various issues of online teaching and learning in the COVID-19 context. More studies of a similar kind can help us realise the reality on the ground more in-depth. It would be beneficial if the experiences of the practitioners, e.g., teachers, could be analysed and the generated insights could be applied to redesign online activities accordingly. Therefore, allocating research funding to teachers for carrying out practitioner research for pedagogical innovation in using emerging technologies is essential for formulating effective policy and practice.

In reality, student success depends on the ownership of their learning and how they involve themselves as co-creators of knowledge and curriculum. Therefore, it is highly important to engage the students both in the teaching and learning process as well as the research. The issues raised by the teachers while conducting online classes could be further analysed to design online sessions in a more student-friendly way by addressing the challenges teachers face. It is important to keep in mind that online teaching and learning is relatively new for many in Bangladesh; this was greatly advanced by the pandemic. That

is why, it can be considered as a new opportunity for the changing the landscape of higher education. A thoughtful, thorough, and research-based policy formulation focusing on the use of educational technologies in emergencies is the most crucial task to cope with the new normal situation. The present study identified a number of challenges and portrayed the scenario of teaching and learning in a holistic manner. The way forward is to learn from this unpresented situation for adopting appropriate policies and strategies to support teachers to deal with the present needs to prepare themselves for future emergencies.

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Article

Three Stressed Systems: Health Sciences Faculty Members Navigating Academia, Healthcare, and Family Life during the Pandemic

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Abstract: The purpose of this study was to explore the impact of the COVID-19 pandemic on the academic productivity of health sciences faculty members in one graduate school in the United States. Thirty-two faculty members completed an electronic survey comparing academic productivity in the year prior to the pandemic to a year during the pandemic. In total, 90.7% of respondents agreed or strongly agreed that time dedicated to teaching increased, and 81.2% agreed or strongly agreed that they prioritized teaching over research during the pandemic. Participants presented an average of 2.72 peer-reviewed papers at an academic conference the year before and 1.47 during the pandemic, with females more adversely affected than males. Journal submissions with survey participants as the first or last authors decreased during the pandemic. Twelve faculty members including genetic counseling, nursing, occupational therapy, physical therapy, and speech and language pathology participated in one-to-one interviews. Three themes emerged from qualitative data analysis: stressed systems, balancing act, and meaningful connection. Faculty members were faced with an external locus of control during the pandemic and noted a lack of autonomy and pressure to help students graduate on time and maintain the quality of teaching while dealing with uncertainty in both their professional and personal lives. The pandemic disproportionately impacted women and junior faculty members as connectedness and mentorship declined. Collaboration and research mentorship must be prioritized moving forward to continue to advance healthcare and health sciences education.

Keywords: health sciences; academic productivity; pandemic

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1. Introduction

The novel coronavirus 2019 outbreak was declared on 30 January 2020, by the World Health Organization [1] and has been ongoing for more than 2 years [2]. There have been more than 260 million confirmed cases of COVID-19, over 5 million deaths worldwide, and five variants of concern [2]. Omicron, the fifth variant, was identified in November 2021 in more than 60 countries and spread rapidly [3]. In late 2021 and early 2022, there was rapid transmission in the United Kingdom and the United States. To stop the spread of the variant, mandatory masking and stay-at-home orders were reimplemented in the UK and the US [4,5]. In the US, some colleges and universities reverted to remote learning in January 2022 to help reduce community spread [6].

Throughout the pandemic, health sciences programs transitioned to virtual or hybrid models of curriculum delivery. These programs were uniquely challenged due to the required hands-on skills and apprenticeship in the clinical environment [7]. Transitioning to this type of educational model required adapting pedagogy in real-time while trying to maintain expected levels of excellence [7,8]. Distance learning, taking models to scale, and personalized instruction were the biggest challenges facing educators, in addition to providing students with the opportunity to practice their new skills [9]. The closure of campuses and the transition of classes to virtual models required that the faculty complete

teaching and other academic responsibilities from home. On average, 88.5% of Americans have at least one child during their working years [10]. While social distancing measures were in place, schools and childcare facilities were also closed, and faculty members worked from home while simultaneously teaching, caring for children and providing substantial assistance with schoolwork [11]. There were also gendered differences in the pandemic's impact on the working parent [12]. Restricted access to childcare during the pandemic and increased work demands took a greater toll on women at early stages in their careers [13]. The health sciences (clinical practice and academia) have a workforce that is predominantly female [14], so the pandemic may have uniquely impacted this field, warranting further study.

Health sciences faculty members have responsibilities outside of teaching also dedicating time to clinical practice, community outreach, administration, committee work, and research [15]. Many supervise students in the clinical environment and are responsible for securing clinical placements for students in an overburdened health system. Demands and the challenges of the pandemic led to poorer quality of life, burnout, and the motivation to leave academia for some faculty members [7,15,16]. Work-from-home orders and a lack of childcare contributed to a gender gap in perceived work productivity and female academicians reported being less satisfied with their job [11]. The pandemic has continued to amplify the gender gap in the publication of medical literature [13]. Health sciences faculty members aim to advance healthcare and health professions education through their research [17] and the impact of the pandemic on their scholarly productivity has far-reaching implications for advancing patient care and education. However, to date, no study has examined the effect of the COVID-19 pandemic on the productivity of health sciences faculty members outside of academic medicine. Additionally, few studies have used qualitative methodology to explore how the pandemic affected health sciences faculty members' productivity. Therefore, the purpose of this mixed methods study was to explore the impact of the COVID-19 pandemic on the academic productivity of an interprofessional group of health sciences faculty members in one graduate school in the northeast region of the United States.

Theoretical Framework

Changes in personal and professional life can greatly impact perceived quality of life. During the pandemic, educational challenges and increasing student needs significantly increased the demand and expectations placed on faculty members. When the relationship between one institution's nursing faculty's quality of life, resilience, and associated factors during the pandemic was examined, resilience was the strongest predictor of physical health as well as psychological and social relationship quality of life domains [15]. Resilience was defined as, "the ability to recover from perceived adverse or changing situations, through a dynamic process of adaptation, influenced by personal characteristics, family and social resources, and manifested by positive coping, control, and integration" [18]. While there has been increased attention paid to burnout during the pandemic, researchers have encouraged shifting attention away from burnout and wellness and instead focusing on the interplay between individual and organizational resilience [19]. When investigating the factors affecting resilience in health professionals, four main themes emerged: (1) individual factors such as individual traits, sense of purpose, and self-determination; (2) environmental and organizational factors such as workplace culture; (3) specific approaches to one's profession, and (4) educational interventions that foster resilience [20].

There is a dynamic interplay between resilience, self-efficacy, and self-determination [20–23]. Whereas self-efficacy is the individual's belief in their ability to succeed in a given situation [24], self-determination entails not being overwhelmed by feelings of hopelessness [23]. When faced with adversity (such as a pandemic), individuals must be motivated to act and persevere; hence, the theoretical framework which guides this study is self-determination theory [25,26]. Self-determination theory distinguishes between different types of motivations, the goals and drivers of action, and captures the

continuum from amotivation to extrinsic motivation to intrinsic motivation. Intrinsic motivation involves completing a task for satisfaction because it is inherently interesting, compared with extrinsic motivation where one feels externally pressured. The three basic psychological needs that support intrinsically motivated behaviors include competence, autonomy, and relatedness. Individuals feel competent when they are developing skills and mastering those skills. Autonomy differs from independence and is instead linked to the internal locus of causality which is the belief that human beings have influence over their own lives [27]. Along with autonomy, task value can be heightened if there is a sense of connectedness to a peer group, society, or family. To promote internalization, there must be relatedness, i.e., the sense of belonging, or connectedness to a group and goal [26]. Both resilience and self-determination encompass how social and environmental factors influence the individual [21,22,26]. We hypothesize that due to pandemic-related changes to the academic and clinical environments where health sciences faculty members work, the three basic needs were not met, and intrinsic motivation and productivity were negatively impacted. A secondary hypothesis is that health sciences faculty members who identify as female faced increased changes to their immediate environment with the closure of schools and childcare facilities. We anticipate that female faculty members will report additional changes to their motivation and productivity. This study will therefore explore the health sciences faculty members' experience of the pandemic through the lens of resilience and self-determination.

2. Materials and Methods

This study leveraged a sequential mixed methods (qualitative dominant) study design to enroll health sciences faculty members from one graduate school. Located in the northeast region of the US, the context is a non-tenure track institution with a Carnegie classification of special focus institution: other health professions schools. The promotion criteria at the institution were revised in 2010 with greater emphasis placed on scholarly dissemination and impact. Expectations for promotion differ by rank.

The research questions in this study were:

(1) What was the effect of the pandemic on the scholarly productivity of faculty members in health sciences programs?
(2) What types of motivation served as barriers/facilitators to health sciences faculty members' academic productivity during the pandemic?
(3) How did the experience of producing scholarship during the pandemic differ for faculty members who identified as female vs. those who identified as male?
(4) How did a sense of connectedness or lack thereof contribute to faculty motivation to produce scholarship during the pandemic?

Inclusion criteria for faculty members included full-time and part-time core faculty members employed at the institution since April 2019 (approximately one year prior to the start of social distancing measures in the US). Subjects were recruited to complete an electronic survey and indicate whether they would be willing to participate in a one-to-one interview. All faculty members who completed the survey and agreed to participate in a one-to-one interview were interviewed by the first author. To eliminate the effect of coercion between the researchers and fellow faculty members, program staff distributed all recruitment materials via email.

Quantitative data were collected using an electronic survey adapted from Krukowski et al. [12] exploring scholarly productivity in the 12 months preceding the pandemic (1 April 2019–31 March 2020) compared with 12 months during the pandemic (1 April 2020–31 March 2021). During the first stage of survey validation, researchers conducted a cognitive interview with an adjunct faculty member at the institution. The survey was then modified based on this virtual interview. Thereafter, the survey was pre-tested by a survey design expert and two of the researchers. After final revisions, the survey included 33 items.

The interview protocol used in the qualitative arm of the study was modified from a protocol used in a prior study examining the effects of the COVID-19 pandemic on physical therapist faculty members [7]. After revisions, the final interview protocol included three consent questions and seven open-ended questions (see Appendix A). The brevity of the interview protocol helped to keep the focus on the participant's experience of the phenomenon under study, i.e., the effect of the pandemic on academic productivity [28].

Ethical approval was granted by the institution's Human Research Committee Institutional Review Board. Data collection began in September 2021 and ended in December 2021. Subjects provided consent electronically, completed the survey, and scheduled a one-to-one virtual interview. Subjects reviewed the interview protocol in advance of the interview which was audio-recorded and transcribed. Researchers descriptively analyzed survey data using IBM SPSS version 25.0 (IBM Corp, Armonk, New York, NY, USA). Each survey item was interpreted on its own (and not collapsed into scales). Two of the researchers checked the qualitative data (transcripts) for accuracy, removed any identifying information and then thematically analyzed the interview data and field notes using NVivo qualitative software (QSR International Pty Ltd., Doncaster, Australia, 2020). The researchers independently coded two interview transcripts using descriptive coding to summarize the data in short words or phrases. Each researcher kept separate codebooks which included codes, descriptions, and data excerpts. The researchers then met to share their codebooks, resolve conflicts, and agree on one set of predetermined codes before completing first cycle coding of the remaining transcripts. However, the authors also used open coding to allow for new codes to emerge from the data analysis. After second cycle coding, the researchers met to collapse codes into pattern codes which formed the basis of data-driven themes [29].

The researchers leveraged researcher triangulation, data triangulation, and an audit trail to increase trustworthiness [30]. Researcher triangulation included two researchers coding independently and then meeting to achieve intercoder agreement. Data triangulation included the use of multiple sources of data (survey data, interview data, and researcher field notes,) to inform data analysis. Finally, all research materials were kept in a central location, which produced an audit trail that allows for the study process to be replicated.

3. Results

3.1. Survey Data

Recruitment materials were distributed to 103 faculty members a total of three times. Thirty-two completed surveys were received, representing a 31% response rate. The majority of participants were at the rank of Assistant Professor (43.8%), had a full-time equivalent of 1.0 (93.8%), identified as female (81.3%) and identified as White (non-Hispanic) (90.6%) or Black/African American (6.3%) (See Table 1). The mean respondent age was 49.03 years and 90.6% were married/living with a partner. Twenty-one participants (65.6%) had children younger than 18 years of age living at home.

Table 1. Demographic characteristics of survey respondents.

Demographic Characteristics (n = 32)	
Age [M, (SD)]	49.03 (11.26)
Married or living with a partner [M, (%)]	29 (90.6%)
Rank [Number, (%)]	
Instructor	5 (15.6%)
Assistant Professor	14 (43.8%)
Associate Professor	9 (28.1%)
Professor	3 (9.4%)

Table 1. *Cont.*

Demographic Characteristics (n = 32)	
FTE (Full-time equivalent) [Number, (%)]	
0.25	1 (3.1%)
0.75	1 (3.1%)
1.0	30 (93.8%)
Race/ethnicity [Number, (%)]	
Black; African American	2 (6.3%)
White (non-Hispanic)	29 (90.6%)
Other	1 (3.1%)
Gender identity [Number, (%)]	
Female	26 (81.3%)
Male	5 (15.6%)
Prefer not to respond	1 (3.1%)

Prior to the pandemic, most participants with children relied on school (28.1%) or a childcare center (18.8%) as their primary means of childcare most days of the week. While stay-at-home orders were in place most participants either shared childcare responsibility with a partner/co-parent (43.8%) or took primary responsibility for childcare (15.6%) (see Table 2). In total, 100% of those who took primary responsibility for childcare identified as female. Three participants (9.4%) had a dependent other than a child living at home during the pandemic and either cared for the dependent themselves (6.3%) or shared caregiving responsibilities with a partner (3.1%).

Table 2. Characteristics of faculty members with children living at home between 1 April 2020 and 31 March 2021.

Faculty with Children Younger than 18 Years Old [n = 21 (65.6%)]	**Number (%)**
Number of children younger than 18 years at home	
1 child	6 (18.8%)
2 children	6 (18.8%)
3 children	8 (25.0%)
5 children	1 (3.1%)
Primary means of childcare **before** stay-at-home orders/social distancing measures in place [Number (%)]	
Care was provided by a relative (may include older siblings)	2 (6.3%)
Shared responsibility with a partner/co-parent	3 (9.4%)
Relied on a childcare center	6 (18.8%)
School	9 (28.1%)
Primary means of childcare **while** stay at home orders/social distancing measures in place [Number (%)]	
Care was provided by a babysitter/nanny	1 (3.1%)
Shared responsibility with a partner/co-parent	14 (43.8%)
Took primary responsibility for childcare	5 (15.6%)

RQ 1: To what extent did the pandemic affect the scholarly productivity of health sciences faculty members?

3.1.1. Transitioning to Virtual Models of Teaching

Between 1 April 2020 and 31 March 2021, participants reported that between one and six courses of their courses transitioned from fully in-person to a virtual or hybrid learning format (M 3.06, SD 1.26) (see Table 3). One participant reported that 100% of the clinical education courses they were responsible for transitioned to a virtual format. Most participants (90.7%) either agreed or strongly agreed that the time dedicated to teaching

(including course preparation) increased. In addition, 81.2% of participants either agreed or strongly agreed that they prioritized teaching over research and 78.2% of participants either agreed or strongly agreed they prioritized teaching and course preparation over activities outside of work. When asked whether they had more time to dedicate to teaching because of little to do outside of work due to social distancing measures, 56.3% of participants either disagreed or strongly disagreed.

Table 3. Transition to virtual modes of learning.

Likert Style Questions: (1-Strongly Disagree, 5-Strongly Agree)	Mean (SD)	Strongly Agree *n* (%)	Agree *n* (%)	Neither Agree Nor Disagree *n* (%)	Disagree *n* (%)	Strongly Disagree *n* (%)
For courses I was involved in (as a primary or secondary instructor or guest lecturer), the time I dedicated to teaching (including course preparation) increased	4.56 (0.84)	23 (71.9%)	6 (18.8%)	1 (3.1%)	2 (6.3%)	0
When I think about how I spent my work hours, I prioritized teaching (e.g., transitioning courses to a virtual platform) over research (either planning, implementing or writing up research)	4.25 (0.98)	17 (53.1%)	9 (28.1%)	3 (9.4%)	3 (9.4%)	0
When I think about how I spent my time, I prioritized spending time teaching or preparing to teach (e.g., transitioning courses to a virtual platform) over activities outside of work	4.13 (0.97)	14 (43.8%)	11 (34.4%)	4 (12.5%)	3 (9.4%)	0
I had more time to dedicate to teaching while social distancing measures were in place because there was little to do outside of work	2.56 (1.43)	4 (12.5%)	6 (18.8%)	4 (12.5%)	8 (25.0%)	10 (31.3%)

3.1.2. Scholarly Productivity

In the year prior to the pandemic, participants attended an average of 2.29 in-person conferences. In contrast, during the pandemic period under study, participants attended zero in-person conferences and 1.74 virtual conferences (see Table 4). While participants presented an average of 2.72 (SD 2.21) peer-reviewed works at an academic conference the year before, this number dropped to 1.47 (SD 1.58) during the pandemic, with female respondents more adversely affected than the male participants. Journal submissions with survey participants as first or last authors also decreased from 1.10 to 0.97 and 0.91 to 0.59, respectively. Co-authored articles increased from 1.34 in the year before the pandemic to 1.50 during the pandemic. Grant submissions remained stable between the two time periods with an average of 0.26 submitted in the year before the pandemic and 0.25 submitted during the pandemic year, although male respondents submitted no grant applications during the pandemic.

Table 4. Faculty productivity changes from pre-pandemic (1 April 2019 and 31 March 2020) to post-pandemic (1 April 2020 and 31 March 2021).

Academic Productivity	Pre-Pandemic M (SD); Range	Pandemic M (SD); Range
Number of conferences attended in-person	2.29 (1.488); 0–7	0
Female	2.12 (1.333)	0
Male	2.20 (0.447)	0
Prefer not to respond	7	0

Table 4. *Cont.*

Academic Productivity	Pre-Pandemic M (SD); Range	Pandemic M (SD); Range
Number of conferences attended virtually		1.74 (1.264); 0–6
Female		1.64 (1.036)
Male		1.40 (0.894)
Prefer not to respond (gender identity)		6
Presented peer reviewed work at an academic conference	2.72 (2.129); 0–8	1.47 (1.586); 0–7
Female	2.58 (2.176)	1.12 (1.211)
Male	2.60 (0.894)	2.20 (1.095)
Prefer not to respond	7	7
Served as a peer reviewer on a journal article	2.88 (4.689); 0–25	2.22 (2.636); 0–10
Female	2.96 (4.919)	2.08 (2.399)
Male	2.40 (4.336)	2.00 (3.464)
Prefer not to respond	3	7
Served on a review panel for funding	0.16 (0.448); 0–2	0.97 (4.099); 0–23
Female	0.12 (0.326)	1.08 (4.525)
Male	0	0
Prefer not to respond	2	3
Submitted a new journal article as the senior author	0.91 (1.467); 0–5	0.59 (1.160); 0–5
Female	0.96 (1.587)	0.62 (1.235)
Male	0.60 (0.894)	0.20 (0.447)
Prefer not to respond	1	2
Submitted a new article as a co-author (not as a first or last author)	1.34 (1.807); 0–9	1.50 (1.741); 0–7
Female	1.38 (1.981)	1.46 (1.772)
Male	1.00 (0.707)	1.00 (0.707)
Prefer not to respond	2	5
Submitted or resubmitted a research grant	0.26 (0.682); 0–3	0.25 (0.568); 0–2
Female	0.20 (0.50)	0.31 (0.618)
Male	0.60 (1.342)	0
Prefer not to respond	0	0

"Prefer not to respond" indicates any participant who declined to share gender identity.

3.2. Qualitative Findings

Twelve subjects (four instructors, four assistant professors, three associate professors, and one full professor) participated in a one-to-one interview with one of the researchers. Participants from the following programs: genetic counseling, nursing, occupational therapy, physical therapy, and speech and language pathology, had held academic appointments between 2–27 years (M = 11.33 years). Three themes emerged from the analysis of qualitative data which included interview transcripts and research field notes: stressed systems, balancing act, and meaningful connection.

RQ 2: What types of motivation served as barriers/facilitators to health sciences faculty members' academic productivity during the pandemic?

3.2.1. Theme 1: Stressed Systems

Participants described the initial adrenaline rush in March 2020 when campus closed to limit the spread of the virus. As health care providers and public health specialists, many participants were aware that the pandemic would not be short-lived. Even so, while participants anticipated needing to temporarily prioritize teaching over research, they did

not anticipate that two years later they would still be facing challenges. The workload related to converting fully in-person classes online and securing fieldwork placements for students in an already overburdened health care system increased exponentially:

> *The first word that comes to mind is challenging. Because it is. We're already pulled in so many different directions in terms of expectations, both in terms of what we by necessity have to spend time on and then also what expectations are and [we] have to do it all well. But no matter what, at the end of the day, the student experience and teaching . . . needs to be first.* (Participant 11)

Faculty members described how much cognitive load (which pre-pandemic time could be devoted to research) went into teaching. Participants pointed out that the overused term "pivot" described not only a change in direction but also a necessary halt. Many aspects of their personal and professional lives paused to prioritize teaching. Faculty members in newly established programs or who were novice educators were teaching courses for the first time online. Others were converting courses in the space of one week:

> *Most evident is just how much cognitive energy had to be spent. It wasn't even just time spent on things like switching courses to virtual, or researching new methods or platforms, or all these things, but it was just how much of our mental effort had to be spent on it. It was like all of the days had to go towards figuring out these problems . . . there was no easy task at that point.* (Participant 9)

Faculty members were creating and innovating teaching health sciences online. The small nimble nature of the institution lent itself well to innovation, and the need to research these innovations was not lost on the faculty. However, participants described lacking the time and bandwidth to dedicate to research. Once the semester was over, it was time to start planning the new semester without investigating whether the "pilot project" had worked:

> *Working on what seems like 100 projects that are all innovative twists and necessary adaptations to the pandemic. But the challenge is not having time to bring them to the scholarly phase. The constant stream of change clearly is fodder for study. Is it better than it was? Worse than it was? Did we successfully meet our curricular objectives for our students who had to go through these changes? All of those questions need to be answered and studied. I feel like that is where I'm missing out. Perhaps haven't had the time to be as thoughtful about that as I would like.* (Participant 8)

Many participants were also working as clinicians in an overburdened healthcare system. Those not directly involved in patient care were collaborating with clinical partners who were also facing competing demands on their time and prioritizing patient needs. Faculty members also lost research opportunities in the stressed healthcare system where patient care took precedence. Supervising students either in clinical or research environments was not a priority for clinical partners. However, faculty members persisted because student learning needs were a priority: "When we are reaching out to our pool of health professionals for field work, or scholarship, they were like "Are you really asking us to keep hosting students right now?" But that absolutely had to be our focus" (Participant 11). Conducting research was often outside of the typical workday to begin with, but became increasingly deprioritized during the pandemic as faculty members dedicated time to keep students progressing and on track for graduation.

RQ3: How did the experience of producing scholarship during the pandemic differ for faculty members who identified as female vs. those that identified as male?

3.2.2. Theme 2: Balancing Act

Faculty members defined themselves as scholars in everyday life, engaging and innovating in the classroom but acknowledged that scholarship is often defined by deliverables that can be listed on a curriculum vitae, like grant applications and manuscripts. Senior faculty members described that when they first entered the academy, producing disseminated materials felt like an ego-driven race. However, with time they came to appreciate

scholarship as having a larger impact and value. Through research, participants were able to advance not only their careers but also the health sciences field. Research helped to meet the institution's mission to transform healthcare and meet the needs of a diverse society. Participants described thinking about scholarship in terms of both process and product, "I define scholarly productivity by advancing research, meaning you are submitting a grant, submitting a paper, advancing a study from one stage to the next, moving from completing data collection to data analysis, data analysis to writing" (Participant 3). Newer faculty members described that tangible products helped increase their perception of job security during the pandemic. They described feeling as if the product (like a manuscript) showed how they had been spending their time:

> *It's something that can't be taken away from you. I felt that pressure to get stuff out. But that's what has stuck with me, it has been so memorable. Fear isn't the right word, but wanting to kind of show your worth in some way . . . I did something. Not like I [just] taught my classes and I survived the last six months.* (Participant 5)

While some participants were driven by a self-described imposter syndrome, others struggled to balance research and service commitments. Participants lost growth and networking opportunities that come from serving on national committees and engaging in research due to a lack of time and cognitive bandwidth. Faculty members felt that their lives were mirroring their students. They were advising students to keep regular engagement with research projects but were having difficulty taking their own advice because they were also managing childcare responsibilities as schools and childcare facilities were closed. Childcare seemed to disproportionately fall on female participants, even those with supportive partners:

> *I had to just focus on courses, literally at midnight, or three or four in the morning. Not work on my own research track. I know I've heard of folks saying that they during the pandemic, when they are able to take away their commute time, allowed them more time to do research. I did not find those people to be women, particularly not women who have small kids.* (Participant 11)

Words like "chaotic", "uncertain", "scary", and "stressful" came to participants' minds. The uncertainty surrounding the pandemic extended into all facets of faculty life. Participants described being concerned about their family's health and well-being as new variants emerged. Children were exposed to the virus and needed to quarantine. Female participants described being responsible for the schedule of the family while at the same time not knowing when schools and childcare facilities would reopen. One participant described: "You can't plan when you don't know what's coming". Like conductors in an orchestra, faculty members were managing their family's needs, students' needs, course redesigns, clinical education challenges, as well as research and committee work. Another participant described that "Trying to hold all of this new information in your head, to be able to use it effectively is just a crushing kind of weight because you invariably get it wrong" (Participant 3). For many, the experience was described as an emotional roller-coaster where they were never quite hitting the mark in any aspect of this balancing act. Their children (often much younger than the college-age students they were dealing with in their professional lives) were also facing fear and anxiety and had significant needs. The systems they relied on to be able to work were non-existent:

> *The learning pods which [are] supposed to protect us actually infiltrated with COVID. One of the families did end up getting COVID and the son brought it into our home. And he was asymptomatic. Then my husband got COVID . . . That same week, our dog died. It was just unreal. I remember being on my Zoom call for my PhD class, and the Massachusetts contact tracing is trying to call me and my son couldn't go to school. It was just difficult.* (Participant 2)

There were days when faculty members felt that despite the hard work and exhaustion, they had accomplished nothing and felt like they were always failing someone (family, students, work colleagues) in an effort to prioritize, "That was like one of the lowest

periods I can think of" (Participant 6). As social distancing measures were eased, faculty members then devoted time to converting classes again, this time into hybrid formats, and prioritizing students' emotional needs which escalated as the pandemic dragged on. Caring for students was described as "all-encompassing". The ongoing pandemic, combined with the uncertainty as new variants emerged, took a toll on both student and faculty mental health:

> *If I give attention to my kids, then something is going to fall off at work. And that was more significant during the pandemic, I felt because the needs were so much higher for everyone. And the conversations were longer, and who you needed to involve, and there was more regular need for support. So it was always who do I prioritize in this moment?* (Participant 1)

Participants were aware that their students were experiencing loss of the graduate school experience they were anticipating and perhaps the loss of a clinical experience:

> *Caring for our students during this time of change has occupied a lot of everybody's time, mine included because with every change that comes our way there's a lot of questions and lack of clarity and it becomes anxiety and fear and concern that they're not getting what they're paying for. And that's not just their only concern. Their major concern is, Am I going to be able to be a safe and competent health care provider by the end of all of this? Those are really intense fears and anxieties.* (Participant 8)

Faculty members were experiencing loss as well. Sometimes as profound as the loss of a family member due to COVID with a lack of opportunity to stop and grieve. Their children were experiencing a loss of classroom experiences or the opportunity to celebrate milestones. Faculty members who were doctoral students themselves took leaves of absences and lost their cohort or changed their dissertation focus due to lack of time or access to a patient population. Participants described reaching a breaking point:

> *I finally hit a wall. I was like, Alright, I'm not going to kill myself to live like this anymore. I tried to gain that high productivity at high outcomes for long enough. So, this fall semester, I've definitely been saying no a lot more. I've been outsourcing things a lot more . . . It's really interesting from a psychological perspective. I'm sure there's been studies done now on this about hitting a wal—specifically for women in academia and research.* (Participant 2)

Participants described needing to stop working at a frenzied pace, seeking mental health support, and prioritizing their well-being. In order to do this, they sought meaningful connections which had been missing during the peak of the pandemic.

RQ 4: How did a sense of connectedness or lack thereof contribute to faculty motivation to produce scholarship during the pandemic?

3.2.3. Theme 3: Meaningful Connection

One of the challenges of the pandemic for health sciences faculty members (and students) was that virtual interaction is contrary to the motivation to enter the health sciences:

> *There's a reason why it's a health science and why we go into it. We're people, people, you know? We like to be with people, we want to make people happy and feel better, and be healthier. And that's a very human interactive thing. And so you get a bunch of people that like to do human interactive things getting shoved into Zooms, and it's jarring!* (Participant 4)

Human interaction, a key to health sciences education, was also necessary for clinical research. Senior clinical researchers who were unable to collect patient data during the pandemic were able to turn their attention to writing. However, one participant expressed concern that the pandemic was leading junior researchers away from clinical research:

> *My fear is that the young, brilliant clinical research minds that are all say, maybe 5–8 years out and less, they will just pivot and say, "I'm not doing clinical research. I don't want to do patient research anymore" . . . Everyone wants to do health services research now because you can do that on the computer. The messy research where you're*

> *with patients and have to get people come in, I think that there is going to be a group of this generation that skipped that.* (Participant 3)

In addition to losing access to patients, faculty members also lost access to their collaborators. While there were some lonely scholarly pursuits, such as writing a dissertation, faculty members relied on colleagues' input to move a research project to the next phase and even chance encounters to generate ideas and potential collaborations. Faculty members lost access not only to research colleagues at the academic institution but at healthcare facilities as well highlighting that health sciences faculty members were working in two overburdened systems:

> *Collegiality took a huge hit last year. Because it had to be intentional. Either I had to reach out to get collegiality, or somebody had to offer it to me. It wasn't just sort of there. And I did not have any realization of how much I depended on it being just there.* (Participant 4)

The loss of collegiality and research support impacted faculty members disparately depending on rank and years of experience:

> *I feel very grateful because I already have a track record of success and so a blip in anything that I would do isn't going to derail my whole career. . . . If you are just starting out, it's really easy. Oh, you graduated in 2021? Oh, you get a bit of a bigger pass. But the hardest is for people who just sort of started and then got interrupted and they're trying to get the momentum going again . . . I think that group needs particular care as researchers.* (Participant 3)

Mentorship was greatly needed as faculty members emerged from the pandemic, but was described as slow to build back up, even as campus life returned to (somewhat) normal. Faculty members in terminal degree programs valued the mentorship and support they received because informal mentorship and collaboration in the academic institution had decreased. There were fewer chance encounters, decreased opportunities to collaborate, a lack of networking at conferences, and decreased motivation to attend virtual conferences as the pandemic progressed. Senior faculty members reflected on the difficulty to provide mentorship during the pandemic and how that may have affected junior faculty members more significantly because of the importance of mentors early in an academic career. Although not impossible during the pandemic, collaborations needed to be much more intentional. Junior faculty members were hesitant to reach out and add one more meeting request to mentors' schedules and this lack of support slowed their professional development. Time was seen as a precious commodity during the pandemic:

> *I feel like people are seeking or they have an expectation for meaningful connectedness and that people's time has become more important. They're more attuned to not wasting their time. I do feel like I have had some really nice, meaningful connections, meaningful conversations and that things are moving forward. There's some hope that something good is going to come out on the other side.* (Participant 3)

There was a focus on other positives as well. Participants were proud of their accomplishments, particularly keeping students on track to graduate. The events of the summer of 2020 had also spurred a focus on social justice and inclusivity and while their courses had undergone multiple revisions, some participants were looking ahead to better versions of their curricula. Participants were also acutely aware of the stress that their clinician colleagues were under and were grateful that they were able to work from home and care for their families. The majority of participants in this study were married or living with a partner and were caring for children or older adults in their lives. While participants spoke about the significant draw on their time and the balancing act required, they also acknowledged the privilege of having social support from family, "I am so fortunate to have a family social connection built into my home, and I often think about people who didn't have that, you know, people who were really isolated" (Participant 8).

4. Discussion

This study highlighted the unique challenges faced by health sciences faculty members charged with educating the next generation of health care providers and advancing the science of education and patient care during a pandemic. Consistent with studies of faculties' productivity in academic medicine [12,13], we found a decrease in scholarly productivity between March 2020 and April 2021 compared with the preceding year. A lack of time to engage in scholarship was a barrier for health sciences faculty members even before the pandemic [17]. It is not surprising that as time dedicated to teaching increased during the pandemic, scholarly output decreased. Staniscuaski et al. found that male faculty members' productivity was less affected by the pandemic than female academic productivity [31] which was the case in this study as well. Female scientists report having less time available to devote to research compared to their male counterparts during the pandemic [32]. Working from home is not the same when there are dependents at home who also require care. Women spend 8.5 more hours per week on domestic activities and are more likely to take time off work to provide childcare when there is a disruption of usual arrangements [33]. In this study, 100% of participants who took full responsibility for childcare while schools and daycare facilities were closed were female. Female participants described the challenges of caring for their children and meeting students' needs which increased exponentially during the pandemic and took priority over research. This finding is not surprising given that female faculty members are more likely to perform more service-related work, exert more emotional labor, and spend more time transitioning to online learning [34]. Gender, parenthood, and race have all been shown to impact the ability of faculty members to submit manuscripts and meet deadlines during the pandemic [31]. Due to a small sample of mostly White faculty members in this study, we were unable to observe for the effects of race, but the effects of gender were evident.

We also found changes to all three psychological needs that support internal motivation. People need to be motivated to act and ideally possess internal motivation, acting for interest and enjoyment. By acting on their interests, people grow their knowledge and skills and apply those skills [25]. This type of motivation is vital for faculty members who produce and disseminate knowledge. One of the needs which must be met to support intrinsic motivation is competence. Experiences of small successes can foster intrinsic motivation. However, decreased scholarship and scholarly collaborations during the pandemic, limited the small wins that faculty members gain through scholarship such as submitting an abstract or manuscript or presenting at a conference. Faculty members, especially junior faculty members, reported decreased mentored opportunities to master their research skills which likely impacted intrinsic motivation.

The other basic need which supports intrinsic motivation, and was lost during the pandemic, is a sense of autonomy and internal perceived locus of causality [27]. The argument can be made that there is always some degree of reward for faculty scholarship such as prestige and promotion, so scholarship is not entirely internally motivated. However, the pandemic further complicated the academic environment that fosters intrinsic vs. extrinsic motivation. Faculty members in this study described that, even prior to the pandemic, there was a degree of external regulation to producing scholarship as well as pressure and ego involvement, especially early in their careers. However, over time, faculty members appreciated that their scholarship advanced health care and health professions education and became more internally motivated. The pandemic then vastly altered the social and environmental factors that contribute to internal motivation. Faculty members were faced with a strong sense of external locus of control as there was a lack of autonomy and pressure to help students graduate on time and maintain quality of teaching while dealing with uncertainty in both their professional and personal lives.

Relatedness also supports intrinsic motivation [26] and there was a lack of relatedness and connection during the pandemic which included lost scholarship and networking opportunities. Despite advances in technology that allowed for virtual interactions, collaborative researchers needed to adjust to the elimination of in-person conferences. This reduction in net-

working was even more pronounced for women due to increased domestic responsibilities that could not be outsourced because of the pandemic leaving less time for career-advancing networking [32,35]. Recent studies in science-related fields are demonstrating an impact on women's scholarship due to decreasing collaboration with smaller teams and fewer female first and senior authorships [13,36], which we noted in this study. Those who continue to work remotely even after the pandemic cite increased productivity but also report decreased connectedness with co-workers [37]. With more evidence supporting the efficacy of remote learning, institutions of higher education face pressure to blend instructional design. The work environment may be greatly altered moving forward [38,39]. Research examining the successes and challenges of virtual work and learning post-pandemic will be vital. It will be important to determine the lasting impact of the pandemic on female faculty members, those from minoritized backgrounds, and researchers at the beginning of their careers. Program development directed towards mitigating these effects should be implemented and studied, as when individuals feel supported and engaged, intrinsic motivation is likely to be sustained [40].

Our results also highlighted the interplay between the pandemic, academic productivity, and career stage. Faculty rank has been shown to be associated with increased resilience during the pandemic [15]. Junior faculty members noted that while they were motivated to be productive and show tangible products, research mentorship was slow to start back up as the campus life returned to normal which slowed their professional development. Some faculty members described that, despite a lack of time and bandwidth, they pursued doctoral programs during the pandemic to gain access to formal research mentoring. Ultimately, senior faculty members may be quicker to recover from the effect of the pandemic whereas junior faculty members, without mentorship, may see longer-lasting effects. While there is evidence of an increase in journal submissions during the pandemic [41], our results showed a decrease in submissions with survey participants as first and senior authors, but an increase in submissions as co-author. Senior clinical researchers confirmed that with the inability to gather patient data, they did dedicate their time to writing. However, the concern is that the pandemic may deter junior researchers from pursuing clinical research which can have longer-lasting effects on patient care.

Despite the clear external locus of control during the pandemic, faculty members did have internal drivers as well, which contributed to their resilience. Faculty members felt that the values of the institution aligned with their own. Faculty members were committed to helping develop future health care providers and were aware of the importance of sharing their innovations. However, as the pandemic drew on, there was evidence of faculty members reaching a breaking point and needing to re-establishing boundaries between personal and professional lives. Faculty members were once again seeking autonomy, choice, and the opportunity for self-direction to build back their intrinsic motivation.

Limitations

Just as important as the response rate is that the study sample is representative of the population being studied [42]. This study focused on one graduate school in the northeast, making the results potentially less generalizable to other faculty groups. The results of this study should be interpreted as exploratory. As is reflective of faculty composition in health professions programs, most of the participants were White women. Women from minoritized backgrounds may have been affected by the pandemic differently than their White counterparts and should be a focus of future research in the health sciences. We attempted to capture the demands of caregiving which extend beyond childcare. An estimated 53 million adults in the United States are caregivers, and 61% of family caregivers are also working [43]. While a small number of participants cared for dependents besides children, most participants in this study cared for children younger than 18 years of age. However, older children also returned home as their college campuses closed. While older than 18, these children also had significant needs not captured in this study.

5. Conclusions

Consistent with studies in academic medicine, this study demonstrated a reduction in scholarly productivity disproportionately affecting women who were balancing work responsibilities in three stressed systems: health care, higher education, and their home lives. In this study, we also saw changes in faculty motivation and the psychological needs that support intrinsic motivation, including competence, autonomy, and connectedness. Mentorship and networking were greatly reduced during the pandemic. We may see the lasting effects of the pandemic on junior faculty members more than on senior faculty members already established in their research. Additionally, the effect on clinical research needs further investigation as junior researchers may have switched to health science research due to limited access to patients. We argue that academic environments must attend to the psychological needs which foster intrinsic motivation. Ultimately, intrinsic motivation and self-determination can lead to increased resilience [20–22] which will be necessary to stimulate the process of adaptation to recover from the pandemic.

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Appendix A. Interview Protocol

1. What was it like to be a researcher in a health sciences program during the COVID-19 pandemic.
2. What stories can you share about the experience that were particularly memorable?
3. Tell me some stories about how you navigated this challenge. Follow-up questions:
    a. You said it was a challenge to . . . Can you say more about this challenge?
    b. You said that you had difficulty with . . . Can you elaborate?
4. How do you define scholarly productivity?
5. Can you talk about what, if anything, hindered your scholarly productivity during the pandemic?
6. Can you talk about what, if anything, facilitated your scholarly productivity during the pandemic?
7. Do you have anything else to share about being a researcher during the pandemic?

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Factors Affecting Undergraduate Medical Science Students' Motivation to Study during the COVID-19 Pandemic

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Abstract: In the current study, we investigated the motivational status and underlying factors of the motivational changes among Japanese medical science students brought by the COVID-19 pandemic. Two groups of second-year undergraduate medical science students (training to become medical technologists and/or medical science researchers) participated in this study in the summers of 2020 and 2021 by writing essays describing how the pandemic had affected their motivation to study. A content analysis of the motivation status and underlying factors (both motivating and demotivating factors) was conducted before statistical analysis was used to investigate possible differences between the sexes and the two groups. In total, 73 essays were included in the analysis. The students had increased motivation to study in both groups (89% and 62%, respectively); however, in Group 2021, 19% of the students (all women) had decreased motivation. Among the underlying reasons behind the increased motivation, students showed a desire to help/save others, contribute to the development of medical science, increase knowledge, and disseminate correct information. The demotivating factors were largely linked to online learning and the negative emotions associated with lockdown. Our findings suggest that, for Japanese medical science students, the COVID-19 pandemic has been an overall motivating experience for our students. However, the prolonged pandemic and lockdown measures could attenuate this and be particularly disruptive for women.

Keywords: COVID-19; medical science; student motivation; education; undergraduate

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1. Introduction

In Japan, the new academic year begins in April, with the blooming of the cherry blossoms symbolizing fresh starts and future promise. From spring 2020, however, in response to the SARS-CoV-2 2019 (COVID-19) pandemic, local and national officials enacted several tiers of social, educational, and commercial restrictions that forced universities and schools across Japan to rapidly adopt online modes of learning at great expense to the institutions and causing stress for teachers and students alike [1,2]. The somewhat rural location of our university allowed for the return of students to the campus in a limited capacity from October 2020. Since then, the university has employed a hybrid learning style, with a combination of online and in-person classes, while maintaining measures such as mask wearing and social distancing. However, the impact of this paradigm shift in education has been particularly disruptive for the students of our medical faculty (clinical medicine, nursing, and medical science) for whom an essential part of their education is hands-on practical training such as clinical experience and experiments.

The profoundly negative impact of the pandemic on medical education has been globally reported and is reflected in studies such as a report from Jordan that investigated

the effect of distance learning on medical education and showed high levels of dissatisfaction among the students [3]. In a study of second-year medical students from the US, Shahrvini et al. found that about half of the students felt unprepared for their clinical clerkships and for taking the United States Medical Licensing Examination [4]. Harries et al., in their large cross-sectional study of six medical school in the United States, for example, reported that 74.7% of the respondents to their survey felt that the pandemic had disrupted their medical education significantly [5]. A nationwide study of 49 medical schools in Indonesia reported on how the pandemic had not only had devastating effects on medical student education but also on mental health through fear of infection, lost educational/training opportunities, and increased financial burdens [6]. Similarly, at the height of the lockdown period in Japan, when the students were studying online only, we were unable to provide some vital aspects of medical science education, such as hands-on laboratory experiments, which cannot be adequately experienced through online-only instruction. Furthermore, student life changed drastically with social distancing and lockdown measures forcing the closure of all extra-curricular activities, such as sports and music clubs, and the events that make university life fun. Thus, given the limitations of online learning and this additive lack of social interactions, we were concerned about our students' motivation to study. However, while there is a growing body of literature on the impact of COVID-19 on medical education, there is a paucity of studies investigating education for medical scientists or laboratory technologists.

The effect of constant media (traditional and social) highlighting the role of medical technology in the diagnosis and treatment of COVID-19 (e.g., PCR testing, blood tests for admitted patients, etc.) may have increased the profile of medicine in the public mind. In a previous study, we found medical students to be highly instrumentally and vocationally motivated, meaning that their motivation to study was largely based on its perceived usefulness for their future success in their chosen profession [7]. Hypothesizing that a similar vocational drive undergirds medical science students' motivation to study, we wondered whether the pandemic might have some positive impacts on our students' perceptions of their chosen career and whether it might have a subsequent effect on their motivation or whether they felt the negative effects of online study, social isolation, and anxiety, as reported in most studies dealing with COVID-19 and education. Regarding medical education, motivation is, as Pelaccia and Viau (2016) stated "a major determinant of the quality of learning and success, the lack of which may well explain why teachers sometimes observe medical students who are discouraged, have lost interest or abandon their studies, with a feeling of powerlessness or resignation" [8]. For medical science students, who, like medical students, are pursuing a professional degree, it requires a consistently high level of motivation to complete their requisite licensing requirements; therefore, we were keen to monitor and understand the effects of the pandemic on our students' education.

To gain some insight into this, we gathered data from our medical science students in the summer of 2020, four months after the start of the lockdown, and in the summer of 2021, using an English essay-writing activity. The findings presented in this study are derived from a content analysis of the student essays, which explored the questions of (a) how the pandemic has affected medical science students' motivation for studying and (b) the underlying factors behind that motivational change. We then further sought to explore (c) whether learning motivation and motivating factors varied significantly by sex. Finally, we detail (d) whether the length of time since the start of the pandemic (4 months vs. 16 months) had any significant impact on the above. The preliminary findings from this study were presented at the 24th Japanese Society of Medical English Education (JASMEE) Academic Meeting in July 2021 and appear in the conference proceedings [9].

2. Materials and Methods

2.1. Study Design and Participants

This study was designed as a quantitative content analysis [10] involving the systematic coding, quantification, and analysis of factors relating to the participants' study motivation during the COVID-19 pandemic. The participants of this study were a convenience sample of second-year undergraduates studying on a four-year degree program in medical science at the University of Tsukuba, a national, research-focused university located in Tsukuba Science City, Japan. As second-year undergraduates, the students were 19 to 20 years of age at the time of the data collection, and all were Japanese nationals. The study involved two groups of 37 students (74 students total): Group 1, which matriculated before the pandemic in Spring 2019, and Group 2, which matriculated at the start of the lockdown period in Spring 2020. Of the 74 total respondents of the groups, 48 were women (64.8%). The medical science course prepares the students for careers as licensed medical technologists who will work in hospital diagnostic laboratories. From the third year, the program also offers the option to take a more research-focused course of study, taught in English, for those students who are interested in pursuing graduate studies in medical science and careers in research. The participating students were enrolled on a compulsory 10-week English-language certification course, which, due to the pandemic, was being taught online. Informed consent was received from each of the participating students, and explanations of the right to opt out at any time were given.

2.2. Data Collection

The data were collected through essay-writing assignments in the summers of 2020 (Group 2020) and 2021 (Group 2021) as part of the coursework for the mandatory English certification course. In 2020, the students in Group 2020 were just beginning the summer vacation following 1 term (15 weeks) of online classes whereas, in 2021, the students in Group 2021 had completed two terms of hybrid learning preceded by a term of purely online learning. In the assignment, the students were instructed to write an essay of at least 500 words describing how the COVID-19 pandemic made them feel as medical science students and how it had affected their motivation to study medical science. The students had to write their essays in Microsoft Word (Microsoft Corporation, Redmond, WA, USA) and had a two-week deadline to return their essays. The university's online course management system, Manaba (Asahi Net, Inc., Tokyo, Japan), was used to administer the essay-writing assignment. The essays formed part of the students' coursework and therefore added no extra burden to their time. In preparation for the content analysis, the essays were anonymized and given identification numbers, and a note was made to identify the sex of each participant.

2.3. Data Analyses

The essays were carefully examined by the lead researcher, who used content analysis techniques [10–13], firstly to assess student motivational status (increased/decreased motivation, no change, etc.) and secondly to identify any key statements that described the underlying factors that influenced motivational status. Patterns and similarities in the ideas expressed in these key statements across the essays were identified and categorized, and coding labels were assigned to each discrete motivational factor. The coding labels were further categorized as motivating and demotivating factors and were also identified as being specific to medical science or not. Assigning coding labels allowed for the quantification of the occurrences of these factors within the essays as a whole.

For verification, the anonymized essays were then independently coded by two other researchers. This process involved each researcher reading the essays and, using a spreadsheet that included a list of the coding labels and their explanations, noting first the motivational status and second all the appropriate codes for that student. A consensus between two or three of the researchers was used for verification of each student's motivational status and assigned codes. Krippendorff's alpha [14,15] was used to evaluate

the interrater reliability for the coding, and the calculations were performed in Microsoft Excel (Microsoft Corporation, Redmond, WA, USA), using the RealStatistics plug-in (Dr. Charles Zaiontz). The counts and frequencies (%) of each motivational status and code were calculated separately by sex for each group. The Chi-squared test, Fisher's exact test, and effect size (Cohen's d) were used to examine the differences between the code counts by sex and by group, and significance was defined as $p < 0.05$ and very strong significance as $p < 0.001$. Effect size was calculated by a power of 0.9, alpha error, and the sample size for each group. The categorization of the effect size was as standard: small, $d = 0.2$; medium, 0.3; and large, 0.8 [16]. SPSS version 27.0 (IBM Corporation, Tokyo, Japan) was used for these statistical analyses. The coding process was performed separately for both groups. Differences between the proportions of motivating factors and demotivating factors between each group and by sex were also examined. Furthermore, the proportions of the medical science-specific to the non-medical science-specific (i.e., general) coded statements were also compared between the two groups.

3. Results

3.1. Motivation Status

A total of 74 essays were returned. One essay from Group 2020 was excluded as it did not sufficiently address the question; thus, 73 essays were included in the analysis. The essays were read and separately coded by three researchers, and the Krippendorff's alpha scores indicated good interrater reliability for the motivation analysis (Group 2020 = 0.806, Group 2021 = 0.781) [10]. Regarding the effect of the COVID-19 pandemic on student motivation, Figure 1A–F shows the results of the analysis of the 73 essays, comparing the results by year (Figure 1A,C) and sex (Women, Figure 1B,E; Men, Figure 1C,F). In Group 2020, 31 of the 36 students gave clear responses about their motivational status; of those, a majority (89%) reported increased motivation and, while some reported no change (7%) or decreased then increased motivation (4%), none reported a decrease in their motivation to study (Figure 1A). The results were similar for both sexes, with 90% of women and 89% of men reporting increased motivation (Figure 1B,C).

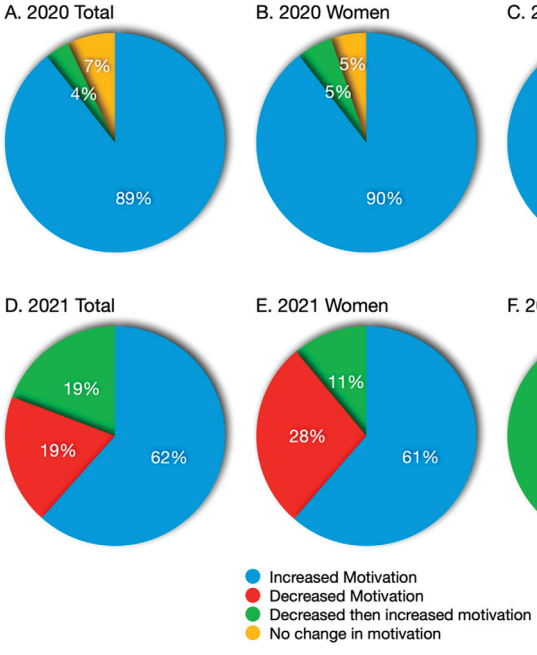

Figure 1. Changes in student motivation to study medical science during the COVID-19 pandemic.

In contrast, the number of students who reported increased motivation in Group 2021 reduced from 89% to 62% (Women, 61%; Men, 62%), as shown in Figure 1D. In Group 2021, 11% and 38% of the women and men, respectively, said that they experienced decreased then increased motivation (Figure 1E,F). In Group 2021, 28% of the women reported decreased motivation to study medical science, while in Group 2020 no students reported purely decreased motivation (Figure 1E).

3.2. Coding Analysis

The results of the coding analysis, which investigated the reasons (or factors) that underlie the students' changes in motivation are presented in full in Supplementary Tables S1 and S2 for Group 2020 and Supplementary Tables S3 and S4 for Group 2021. From the essays written by Group 2020, a consensus between the three researchers was reached for 154 statements that represented factors for motivation change. Of these 154 statements, 124 were distributed across 17 codes that represented motivating factors, and the remaining 30 statements were across 8 codes that represented demotivating factors. The codes for the motivating factors for Group 2020 (and the frequencies) were: *Save* (20), *Knowledge* (18), *Heroes* (17), *Truth* (13), *Mission* (12), *Contribute* (11), *Vaccine* (9), *Skills* (6), *Solution* (5), *Link* (4), *Research* (2), *Online Good* (2), *Vision* (1), *Success* (1), *Developing Countries* (1), *Challenges* (1), and *Career* (1). Those for the demotivating factors were: *Lonely* (4), *Discrimination* (3), *No Experiments* (3), *Online Bad* (3), *Government* (2), *Robbed* (2), *Screens* (2), and *Being Home* (1). For Group 2021, a consensus was found for a total of 119 statements, 81 of which were distributed across 18 codes representing motivating factors and 38 across 10 codes representing demotivating factors. The codes for the motivating factors for Group 2021 (and frequencies) were: *Save* (11), *Truth* (9), *Research* (9), *Value of Studies* (9), *Contribute* (7), *Communication* (6), *Protection* (5), *Link* (4), *Time* (3), *Media Good* (3), *Heroes* (3), *Innovation* (3), *In-person Classes* (2), *Shortage* (2), *Developing Countries* (2), *Online Good* (1), *Determined* (1), and *Vision* (1). Those for the demotivating factors were: *Online Bad* (10), *Robbed* (9), *Discrimination* (4), *Negative Emotions* (3), *Lack of Vision* (3), *Being Home* (3), *Lonely* (2), *No Experiments* (2), *Mask* (1), and *Media Bad* (1). To give a more detailed picture of the most frequently occurring factors, Tables 1 and 2 below show the motivating and demotivating factors with a higher frequency of responses ($\geq$9) for Group 2020 and Group 2021, respectively. Included in Tables 1 and 2 and Supplementary Tables S1–S4 are short explanations and example sentences from the students' essays for each coding label. The tables also include counts and proportions (%) representing how many times that code occurred within the students' essays in total and by sex. Statistical comparisons between the frequency of the factors according to sex (p values and effect size) are also shown. In the tables, the codes have been divided into motivating and demotivating factors and arranged in descending order of frequency.

In total, 38 distinct codes were identified, of which 26 represented motivating factors and 12 represented demotivating factors. Statistical analysis of the coding statements exploring differences by sex found the code *Contribute* to be approaching significance ($p = 0.073$), with a medium to large effect size ($d = 0.646$; Table 1), and stronger significance and larger effect size were found for *Innovation* ($p = 0.046$; $d = 0.673$; Supplementary Table S3), with men being more impressed by advances and innovations in medical technology than women.

Figure 2A–F shows the proportion of coded statements expressing motivating factors to those expressing demotivating factors. In Group 2020, the proportion of motivational factors was, overall, 4 times that of the demotivating statements (Figure 2A) and was approximately the same for both the women (82%/18%; Figure 2B) and the men (80%/20%; Figure 2C). However, the proportion of motivating factors decreased from 81% in Group 2020 to 68% in Group 2021 (Figure 2A,D). The proportion of demotivating factors for the men decreased only by 1% (Figure 2C,F) but that for the women doubled, from 18% to 36% (Figure 2B,E).

Table 1. Coding analysis of Group 2020, motivating and demotivating factors with ≥9 responses.

	Coding Label	Explanation	Example Sentence	Women (N = 24) N (%)	Men (N = 12) N (%)	Total (N = 36) N (%)	Comparison by Sex *p* (Effect Size *d*)
Motivating Factors	***Save*** †	Protect, help, benefit, save lives/people/the world (through medical science)	"I strongly felt that there is a need for medical science in society and that what I am learning will greatly help save lives".	12 (50)	8 (66.8)	20 (55.5)	0.343 (0.478)
	Knowledge †	Frustrated by lack of knowledge/want to increase knowledge/skills/deepen understanding, responsibility/opportunity to study	"A few days ago, I was asked about medical terms. For example, the PCR test and the coronavirus and so on. However, I couldn't answer these questions completely. I didn't have enough knowledge. I was so frustrated by my lack of knowledges despite studying medical science".	13 (54.1)	5 (41.6)	18 (50)	0.48 (0.41)
	Heroes †	Recognized the importance of/respect for/feel proud of medical scientists/health care workers, heroes	"I believe that medical scientists will be heroes which eradicate COVID19 to protect people all over the world".	12 (50)	5 (41.6)	17 (47.2)	0.732 (0.288)
	Truth †	Importance of having/collecting/ disseminating correct information/knowledge	"We can save the world by getting the right information out there. With this COVID19 pandemic, there was a lot of information about the COVID19 flying around. People were confused as to which was the correct information. By disseminating the right information, we can prevent the spread of infection".	9 (37.5)	4 (33.3)	13 (36.1)	0.553 (0.385)
	Mission †	Pandemic made me think about life/medicine/medical science/gave a sense of mission, responsibility	"COVID19 steals our daily life and this can't be ignored. Many people want the solution that protects themselves. Personally, in this situation, I feel that I have to solve this problem like the mission".	10 (41.6)	2 (16.6)	12 (33.3)	0.13 (0.595)
	Contribute †	Contribute to/play my part in/the development of medicine, medical science/improve COVID testing	"I think I should contribute to medical science as a medical science student in the future. Moreover, I especially want to contribute to making a new medicine in the future".	5 (20.8)	6 (50)	11 (30.5)	0.073 * (0.646)
	Vaccine †	No vaccine/cure has been found/want to create a vaccine/cure	"If I study medical science, I will be able to develop a cure or a vaccine as a Medical scientist".	6 (25)	3 (25)	9 (25)	0.61 (0.358)
Demotivating Factors	***Negative Emotions***	I feel anxious/sad/worried/ fearful/scared/danger/ helpless/stressed	"The spread of COVID19 has increased my psychological and physical stress".	8 (33.3)	2 (16.6)	10 (27.7)	0.35 (0.47)

† Indicates medical science-specific coding labels. * Indicates statistically significant *p*-values.

Table 2. Coding analysis of Group 2021, motivating and demotivating factors with ≥9 responses.

	Coding Label	Explanation	Example Sentence	Women (N = 25) N (%)	Men (N = 12) N (%)	Total (N = 37) N (%)	Comparison by Sex *p* (Effect Size *d*)
Motivating Factors	***Save*** †	Protect, help, benefit, save lives/people/the world (through medical science)	"Through the pandemic, I felt that the medical science I was studying could save lives".	8 (32)	3 (25)	11 (29.7)	0.487 (0.409)
	Truth †	Importance of having/collecting/ disseminating correct information/knowledge	"We are in the midst of a pandemic in the Internet age, a situation of unprecedented information overload, and it is important to be able to discern what is correct and what is fake".	6 (24)	3 (25)	9 (24.3)	0.624 (0.346)
	Research †	Became interested in medical science/virology/ infection biology/new research fields	"I started to take a new interest in research fields related to COVID-19. Until now, I was not very interested in the fields of virology and drug discovery, but I became interested in this situation".	5 (20)	4 (33.3)	9 (24.3)	0.311 (0.486)
	Value of Studies †	Saw the value/meaning/importance/ duty of medical science studies	"Through the pandemic, I felt that the medical science I was studying could save lives. As a result, I realized that the medical science was useful, and motivated me to study".	6 (24)	3 (25)	9 (24.3)	0.624 (0.346)
Demotivating Factors	***Online Bad***	Online Classes/lectures are boring/bad/ have more disadvantages than advantages	"I feel that the prevalence of COVID-19 has discouraged me from learning. This is because I have not been able to take advantage of the various opportunities to gain knowledge in the medical field and because the format of online lessons does not suit me".	6 (24)	4 (33.3)	10 (27)	0.412 (0.442)
	Robbed	Covid robbed me of my college life/events/experiences	"COVID-19 has robbed our precious college life".	7 (28)	2 (16.6)	9 (24.3)	0.376 (0.457)

† Indicates medical science-specific coding labels.

Of the 38 distinct coding labels identified from both groups (both motivating and demotivating factors), 23 were specific to the medical science/medical/healthcare profession. The vast majority (n = 21) of the medical science-specific codes were representative of motivating factors. Of the 15 coding labels that were not specific to medical science, 10 were demotivating factors that were largely related to the various stresses of the lockdown situation, such as *Online Bad* and *Lonely*. In Tables 1 and 2 (and Supplementary Tables S1–S4), these medical science-specific codes are indicated with a cross (†). Figure 3A,B shows the proportions of the medical science-specific to the non-specific coded statements (Groups 2020 and 2021 combined) for motivational factors (Figure 3A) and demotivational factors (Figure 3B), respectively.

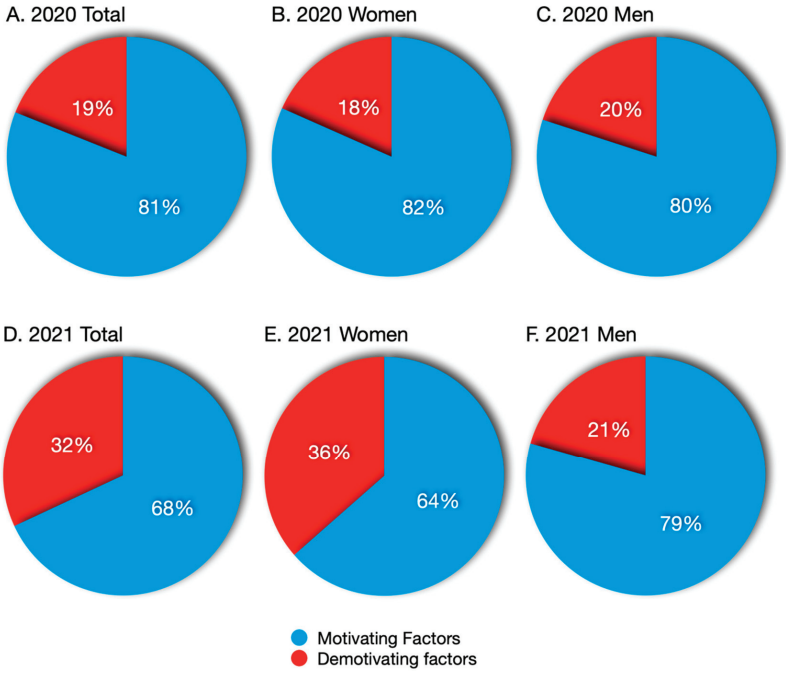

Figure 2. Proportion of coded statements expressing motivating factors to those expressing demotivating factors.

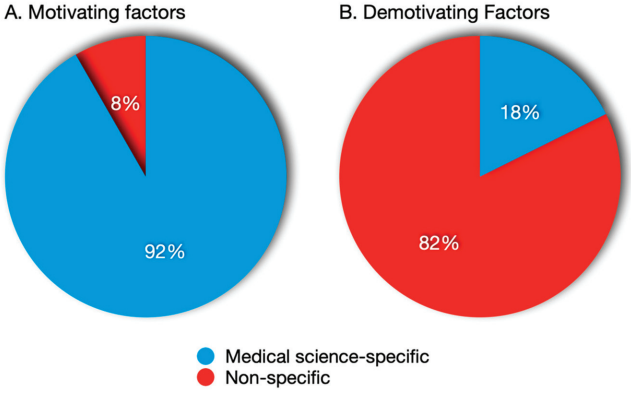

Figure 3. Proportions of medical science-specific to non-specific coded statements (Groups 2020 and 2021 combined) for motivational factors (**A**) and demotivational factors (**B**).

The proportion of medical science-specific factors was much greater among the motivational factors (92%; Figure 3A), while the non-specific factors dominated the proportion of demotivating factors (82%; Figure 3B). Figure 4 shows the proportions of coded statements from the students who were counted as stating decreased motivation.

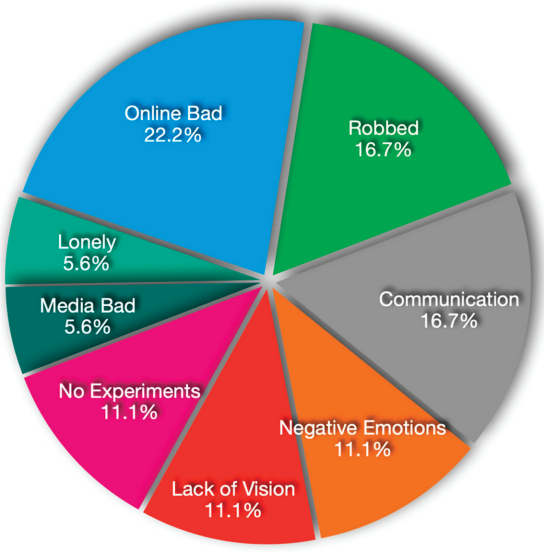

Figure 4. Proportions of coded statements from the students who reported decreased motivation. All students were women from Group 2021.

There were 16 overlapping (common) codes that were derived independently from both groups. Table 3 shows a statistical comparison (p values and effect size) of these common codes between the two groups and separately by sex. Comparing the two groups, the codes of significance were found for the motivating factors of Save ($p = 0.026$; $d = 0.507$), Heroes ($p \leq 0.001$; $d = 0.632$), and Research ($p = 0.028$; $d = 0.479$) and the demotivating factors of Negative Emotions ($p = 0.035$; $d = 0.493$), Online Bad ($p = 0.037$; $d = 0.490$), and Robbed ($p = 0.046$; $d = 0.479$). Among women, significance was found for the factors Heroes ($p = 0.004$) and Robbed ($p = 0.028$), while for men, significance was found for Save ($p = 0.041$) and Heroes ($p = 0.019$).

Table 3. Statistical comparison of common codes between Group 2020 and 2021.

Coding Label	Women *p*	Men *p*	Total *p*	Effect Size *d*
Save	0.242	0.041 *	0.026 *	0.507
Heroes	0.004 **	0.019 *	<0.001 **	0.632
Truth	0.305	0.5	0.315	0.345
Contribute	0.967	0.097	0.249	0.367
Link	0.187	0.109	0.967	0.001
Research	0.104	0.322	0.046*	0.479
Online Good	0.967	0.5	0.615	0.249
Vision	0.5	0.5	0.984	0.001
Developing Countries	0.967	0.5	0.588	0.259
Negative Emotions	0.073	0.239	0.035 *	0.493

Table 3. *Cont.*

Coding Label	Women *p*	Men *p*	Total *p*	Effect Size *d*
Lonely	0.65	0.109	0.43	0.309
Discrimination	0.32	0.5	0.719	0.208
No Experiments	0.967	0.5	0.674	0.227
Online Bad	0.055	0.32	0.037 *	0.490
Robbed	0.028*	0.65	0.046 *	0.479
Being Home	0.65	0.5	0.615	0.249

* Indicates statistically significant *p*-values, ** Indicates strongly statistically significant *p*-values.

4. Discussion

Overall, the findings of this study point to relatively high proportions of increased motivation to study among our medical science students. In Group 2020 (those who had experienced 4 months of online study), while 4% of the students said they had experienced decreased then increased motivation and 7% had no change, no students reported purely decreased motivation. In Group 2021, however, the proportion of students reporting decreased then increased motivation rose to 19% overall, and 19% of the students (all women) reported decreased motivation. As seen in some European studies of school students and undergraduates experiencing a similar lockdown period, motivation seems to have decreased due to many factors, including poor internet access, socioeconomic factors (loss of part-time work), perception of online studies as being less useful, and so on [2,17]. In contrast, as the greater proportion of students reported increased motivation in both groups (2020 and 2021), our results indicate that, overall, the pandemic has had a positive impact on the Japanese medical science students' motivation to study. This finding seemingly runs contrary to other studies on this topic, which largely deal with the overwhelmingly and unfathomably profound negative impact that the pandemic has had on student education; however, the results of our coding analysis perhaps give some insight into some of the reasons behind this anomaly.

Our coding analysis revealed that the underlying factors behind this increased motivation were largely connected to how the COVID-19 pandemic had brought to light the importance of their chosen profession as clinical laboratory technicians or medical science researchers. In their essays, the students expressed a desire to save, help, and protect people through medical science and to contribute to the innovation of new testing methods, vaccines, and drug development. The pandemic had suddenly thrown a spotlight on medical researchers, technologists, and front-line health care workers heroically working selflessly for others, which allowed the students to gain new respect for, and take pride in, their chosen profession and gave some of them a clear vision of their future. This psychological boost to perceived professional self-esteem has been shown to increase individual empowerment as well as satisfaction in occupational choices [18]. The increased media attention and, more importantly, social media attention raised a strong awareness of the importance of having, collecting, and disseminating correct and accurate information, especially with the threat of misinformation, as detailed in an increasing number of studies [19–21]. Some students even expressed feeling frustration at their own lack of knowledge when friends and family asked them medical science-related questions that they could not answer, which motivated them to study. Turana et al. touch upon this in their study, suggesting that medical students played a critical role during the pandemic by disseminating COVID-19-related information, especially to friends and family [6].

The most frequent code was that of *Save*, which was used to categorize the statements that described the desire to protect, help, and save lives through medical science (Group 2020 = 55%; Group 2021 = 29.7%) and was also frequent among both the men and the women. One student wrote about the desire to save others as follows: "If medical science

students study medical science hard and play an active role in the medical field, as a result, we can help save people from pandemics". This desire to help/save others is a common phenomenon, particularly among women, and Miller and colleagues (in their study of the goals of female science undergraduates) state that "when women plan a career that includes research, they tend to embed it within a helping profession and/or a desire to help others" [22]. Miller and colleagues describe this desire to help others as a "prosocial" attitude, and when categorizing the coding labels in our study from this perspective, it could be said that alongside *Save* the codes of *Contribute*, *Developing Countries*, *Mission*, *Vaccine*, and *Solution* could all be considered as prosocially leaning as they all touch upon a desire to help others. However, when segregated by sex, both the women and the men in our cohort of medical science students wrote statements affirming these motivational codes at an equal ratio. Indeed, the statistical analysis of the differences in the coding statements by sex found some statistical significance in only two codes: *Contribute* ($p = 0.073$; Table 1) and *Innovation* ($p = 0.046$; Table 2), both of which were more frequent among the men than the women.

As mentioned in the results, most (21 out of 26) of the coding labels that represented motivating factors were specific to the medical science profession, and these codes account for the majority (92%) of the coded motivational statements (Figure 3A). On the other hand, most of the coding labels that represented demotivating factors (10 out of 12) were not specific to medical science and were related to the pandemic-induced lockdown and studying online alone at home; these accounted for the majority (82%) of the coded demotivational statements (Figure 3A). Our findings demonstrate how far the COVID-19 pandemic has positively influenced our students' motivation to study medical science, while the experience of studying from home has been, overall, a demotivating experience.

Our findings of overall increased motivation among our cohort are in contrast with those of most other studies. For example, Meeter and colleagues' study of undergraduates at a Dutch research university found that student motivation decreased after the COVID-19 pandemic and that the decrease was mainly due to the limitations of online learning [23]. Their study revealed that decreased motivation was linked to the facilities for online education, i.e., not having a quiet place to study and bad internet connection, plus a lack of social interactions [23]. In this respect, however, our findings were similar; with many of the demotivating factors being connected to the limitations of online study, the lack of laboratory experiments, and the lack of social interactions. Importantly, the proportion of students who were coded for *Online Bad*, grew from 8.3% in Group 2020 to 27.7%, suggesting that, for this second cohort of students whose entire university experience has been disrupted by the pandemic, online learning has been particularly difficult. A number of recent studies have discussed in detail the application, advantages, and disadvantages of online modes of learning in relation to the COVID-19 pandemic [2,3,17,24–31], and while this is not the focus of the current study, it is an important observation that the demotivating factors we observed were largely attributable to online learning and, moreover, the broader picture of student life in lockdown. This finding is also observed in the statistical analysis presented in Table 3, where Group 2021 had a significant increase in the frequency of the codes *Online Bad* ($p = 0.037$) and *Robbed* ($p = 0.046$).

With regard to the motivation of students in a digital/online curriculum, Tan (2021) reported that a cohort of 282 Malaysian university students had an initially high motivation but a high dependence on social presence was closely tied to learning motivation, which dropped over time as a result of decreased social interaction due to online learning [32]. This would correlate well with our results, which indicate that *Online Bad*, *Lonely*, *Communication*, and *Robbed* (cumulatively, 62% of the total responses for those students who reported decreased motivation) were demotivating factors closely tied to lack of social contact, group experience dynamics, and missed opportunities to bond with peers. It is also important to note that these factors are not associated with medical science in particular. However, a study in a European medical school found that 198 students found that online methods which emphasized a game-centric interface and embedded learning through cases kept

motivation high even under pressure from asynchronous assignments [33]. In contrast, the online structure of content delivery in our system was perhaps insufficient for our students who experienced demotivation; it could be possible that the content delivery system itself is a key factor in preventing demotivation and Japan, which was well behind the West in leveraging online modes of learning before the pandemic [34]. Universities in Japan were, arguably, not fully equipped or prepared to provide the online content management and planning that fits well with a professional-license educational model. Indeed, some studies among Japanese medical students have pointed to the difficulties, drawbacks, and even mental distress caused by the shift to online leaning [34,35].

Our results trending towards increased motivation were similar to those of Armstrong-Mensah and colleagues, who, in their survey of graduate and undergraduate students of public health in the United States, found that 53.6% of the students reported being able to stay motivated while only 3.4% of the students reported difficulty in staying motivated to learn [31]. This similarity may be attributable to the fact that the participants of this study were from the field of public health, who, like our students, would have seen a clear link between their chosen profession and the pandemic situation. However, a study by Rahiem, involving social science education majors in Indonesia, also revealed that students were able to maintain positive attitudes towards learning despite being forced to study at home because of the pandemic [36]. Importantly, the data for these two studies were collected in 2020 when, perhaps, the novelty of studying online from home had not yet worn off. The findings of our analysis of the essays from Group 2021, in contrast, show a marked rise in the number of students who reported decreased motivation and a greater proportion of demotivating factors to motivating factors in their essays. This could indicate that the prolonging of COVID-19 countermeasures, online learning, and reduced social activities may have had a negative effect on the students' motivation to study.

The number of responses that were coded as demotivating factors, while not as numerous as the motivating factors, should not be ignored, especially considering that the proportion of demotivating factors grew from 19% in Group 2020 to 32% in Group 2021. Many students wrote about feeling negative emotions such as fear, stress, and anxiousness, some felt lonely, and many felt robbed of their college life. In a recent study involving undergraduate psychology students from Brazil, Godoy and colleagues found that most students spent 1 to 3 h (range 1 to >7) a day watching media or thinking about the coronavirus, and they observed strong correlations between a preoccupation with the coronavirus and fear [37]. Like our study, most of the students in this sample were women (20 women to 8 men). Godoy and colleagues point out that, among the Brazilian population, the COVID-19 pandemic aggravated anxiety and distress, particularly among women and young adults [37]. This is borne out in our study, too, with all the students professing decreased motivation being women.

As seen in Figure 4, the reasons behind the decreased motivation observed in our study appear to be due to the restrictions of a life in lockdown: online learning, lack of social interactions, missing communication with friends, being robbed of a range of experiences associated with college life, feelings of fear, anxiety, and loneliness, and losing sight of their future. Son and colleagues, in their study of the effects of COVID-19 on university student mental health in the United States, found that 71% of the students in their sample showed increased stress, anxiety, and depressive thoughts [34]. Among the primary stressors that they identified, decreased social interactions due to physical distancing was reported by 86% of the sample [34]. Walters et al. similarly point out that pre-clinical medical students were more likely to have burnout and stress related to social isolation and to have the need for mental health and support services [35].

As seen in Table 3, which details the statistical analysis of the overlapping codes comparing Groups 2020 and Group 2021, some codes were significantly different between the two groups, suggesting that some factors had shifted as the pandemic restrictions were drawn out month after month. While *Save* was the most frequent code in both groups, there was a significant decrease in its frequency among men in Group 2021 ($p = 0.041$),

implying that this strong desire to help people had dwindled somewhat, especially among men. The most striking difference, however, was observed in the code *Heroes* ($p \leq 0.001$), which showed a dramatic reduction in frequency among both men and women. There are some possible explanations for this; the initial media focus on medical scientists may have either lessened (perhaps following the creation of the vaccine) or become diluted over time. Furthermore, the media reports, especially those frequently shared on social media, have tended to be unrealistic, and polarization over hot-button issues (such as vaccination) may have had a counteracting effect on the self-image of medical professionals [36].

4.1. Implications

The COVID-19 pandemic has brought unique exposure to the field of medical science and the work of clinical laboratory technicians and medical science researchers. Suddenly, technical terms such as "PCR", "antibody", and "antigen" have become part of the common parlance. This spotlight on medical science has given our students a clear vision of their future selves; it has shown them the importance of their studies and their chosen profession and how they can contribute to society by helping others, even saving lives, through their work. Indeed, picking up on this motivation, a number of universities have used the pandemic as a way to promote educational programs for medical laboratory technicians [38,39]. We found that our students were able to take pride in and gain new respect for their profession and for themselves, as illustrated by this student's statement that:

> "Being a clinical laboratory technician is a job to be proud of. The COVID-19 pandemic has caused a lot of talk about health care workers putting their lives on the line for their work. Clinical laboratory technicians are also part of the medical profession. The clinical laboratory technician has been an inconspicuous occupation, but this time, it has attracted a lot of attention. But clinical laboratory technicians are responsible for intervening in the field of medicine, and I thought it was a job I could be proud of".

This increased future awareness in students pursuing a certification has, for the most part, overridden the disadvantages and difficulties of studying online and the restrictions imposed on them by the pandemic response. From the students' reports, it appears that overcoming the limitations of online learning may rely on developing a sense of professionalism, which the professors could encourage. Educators could leverage the pandemic as a teaching tool to motivate professional degree students even in classes limited by online interactions. Accepting that online learning will play a significant part in education going forward, hybrid classes, where in-person instruction can occur, may be therefore best utilized for intense practical/technical instruction, while the motivational and didactic education is delivered online to maintain the students' sense of their future utility in the workforce.

The findings of the current study and others [37] suggest that the pandemic has had a particularly negative effect on women. In light of the findings that indicate the negative impact of the pandemic on mental health [5,37,40–43], universities need to seek interventions to help their students through these times. Finding ways to build a sense of community, forge friendships, conduct group work assignments, and network would be helpful in alleviating this problem, particularly if the current situation is extended because of waves of new variants.

4.2. Limitations

There are limitations to the current study. First, the number of participants is small and from a single institution in Japan. A larger-scale study involving multiple institutions, whether international or domestic, would be useful to verify the generalizability of the findings. The finding of a trend towards decreased motivation is based only upon the data collected at two time points; future studies to investigate the same cohort multiple times across their undergraduate years could verify this trend. Furthermore, the data were

collected only from second-year undergraduate students; thus, it would be interesting to see how the COVID-19 pandemic impacted students across all four years of undergraduate study. Finally, other more objective data points, such as test scores or questionnaire surveys with established instruments, would be helpful in the triangulation of our data, which are based on subjective, self-reported essays. A limitation with our data collection method is that we cannot rule out the possibility of social desirability bias; i.e., there is a chance that the students did not want to appear too negative in their essays, especially to authority figures, and the students were aware that the essays would form a small part of the students' coursework evaluation. Furthermore, the students were writing the essays in a foreign language (English), which may have also had some biasing effect. However, the overall consistency of the responses, namely the patterns in motivation status and the underlying factors throughout both groups, strongly suggests that any bias may have had minimal implications for the legitimacy of the essays as valuable sources of data.

Another important point is that these results may not be applicable to the general student population as medical science students are pursuing a professional degree that requires a consistently high level of motivation to complete all the licensing requirements. Thus, our results may only be useful for comparison to other licensure-focused programs (e.g., medical, engineering, or technical) with regard to occupationally specific motivation factors. In light of this, the studies conducted in non-pandemic years may be divergent from the conclusions reached in this study as the visualization of a student's professional future may be different due to the public exposure of jobs that are important during such times.

5. Conclusions

In conclusion, through our analysis of the data gathered from two groups of undergraduate medical science students, we have been able to find that the COVID-19 pandemic has increased their motivation to study. This was particularly marked in the students who wrote their essays in 2020, just four months into the lockdown measures. Medical science students being able to see a vision of their future selves as important parts of the healthcare system seems to reaffirm a desire to save/help others and contribute to the well-being of society. However, in the students' essays from 2021, while we still saw most of the students reporting increased motivation, there was a greater proportion who reported decreased then increased motivation and some—all women—who reported purely decreased motivation. This decreased motivation stemmed from the stresses of online education and life in lockdown, which indicates that the pandemic and the measures could be having a negative effect in the long term.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/educsci12090628/s1, Table S1: Motivating factors, coding analysis of Group 2020 Video; Table S2. Demotivating factors, coding analysis of Group 2020; Table S3. Motivating factors, coding analysis of Group 2021; Table S4. Demotivating factors, coding analysis of Group 2021.

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Article

Emergency Remote Education and Its Impact on Higher Education: A Temporary or Permanent Shift in Instruction?

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Abstract: The COVID-19 pandemic has led to problems and upheaval throughout the higher-education sector, with university campuses ceasing face-to-face instruction and with assessments shifting to an online model for a few years. As a result, the pandemic prompted educators to teach online, utilizing online lectures, narrated power points, audio snippets, podcasts, instant messaging, and interactive videos, whereas traditional universities had primarily relied on in-person courses. Evaluations, which included assignments and multiple-choice questions, were conducted online, forcing lecturers to reconsider how deliverables were set up to prevent students from having easy access to the answers in a textbook or online. Learning from college students' experiences throughout this time period will assist higher-education stakeholders (administration, faculty, and students) in adapting future online course delivery selections for higher education. In this study, we investigated the experiences of students learning from a distance, as well as aspects of their learning. We provide recommendations for higher education. The COVID-19 pandemic has clearly resulted in the largest distance-learning experiment in history.

Keywords: emergency remote education (ERE); COVID-19; higher education; online learning; digitalization; SWOT

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1. Introduction

COVID-19 has clearly become one of the most significant disturbances that higher education has ever faced. As a direct result of the COVID-19 pandemic, "more than 1.6 billion students" were reportedly unable to participate in face-to-face learning [1]. Due to the COVID-19 epidemic, remote education has become the norm for students throughout the world, and it may continue to be a key aspect of higher education in the future. The term "emergency remote education" is used in the literature to characterize a sudden and unforeseen but necessary structural change from face-to-face classroom lectures to an online education format. This "emergency" online education that was thrust upon universities and colleges during the pandemic in the spring of 2020 differed from normal distance education, which follows a well-established methodology that is planned, designed, structured, and always intended to be carried out online [2]. Due to the fast-paced changes, emergency remote education (ERE) has demonstrated the need for faculty to participate in proactive self-learning to comprehend how to effectively teach courses online [3].

As a result of the COVID-19 pandemic, many college students—particularly undergraduate students—left their campuses and returned home in the spring of 2020 to live with their parents or other family members because on-campus housing was closed for several months. The relocation of students from their parents' homes to on-campus housing when starting college is frequently regarded as a transition toward independence and maturity.

Therefore, there is a risk of some developmental consequences if this common transition does not occur. In fact, it is anticipated that the development of students' maturity will be hampered by not having the chance to experience independence, as well as not being able to engage in different social activities that normally occur when students live away from their parents' homes and in a more independent setting [4]. Learning and social belonging may suffer as well; in fact, learning and engagement are aided by interactions with instructors and classmates both inside and outside of the classroom [5]. Participation in on-campus study groups and campus clubs has been found to be especially beneficial for students' growth because these expand and enhance learning and social belonging [6]. The following research questions were addressed in this study:

RQ1: How have the teaching and learning approaches been perceived by college students through the pandemic?

H1: Students were faced with online learning challenges during the pandemic.

RQ2: Will the abrupt change to emergency remote education have an impact on higher education in the future?

H2: Technological improvements are needed throughout universities.
H3: College students desire changes in the learning experience after the COVID-19 era.

2. Literature Review

The year 2020 will not be easily forgotten due to the advent of a new and unknown virus of animal origin, originally discovered in China, which causes an infectious respiratory disease, SARS-CoV-2—generally known as COVID-19 [7,8]. With globalization accelerating the spread of COVID-19, very few countries have remained excluded from this viral infection [2,7]. As of mid-February 2022, the confirmed cases of infection amounted to more than 413 million, with almost 6 million deaths [8]. To find pandemics of the same magnitude, in fact, it is necessary to go back over a century to the so-called 1918 pandemic (H_1N_1 virus) of influenza [9].

The Centers for Disease Control and Prevention in the United States [10] indicate that there are two categories of countermeasures that must be taken in the event of a pandemic: pharmacological ones (the use of vaccines and the administration of antivirals) and those aimed at limiting contact among people. Individuals, families, businesses, and institutions found themselves faced with the need to use digital services to continue to work, study, stay informed, and maintain their family and social relationships [11,12]. The tendency to "transfer" one's life online, which was already underway for some time, suddenly became routine for most citizens [13,14]. As a result of the COVID-19 pandemic, digital infrastructure has been confirmed as a strategic asset for most countries throughout the world. In fact, through internet connections, most organizations have been able to continue to operate, albeit with different methods and times compared to their usual practices [15]. Information systems have proved to be a key element in the current emergency situation of the COVID-19 pandemic as a vehicle not only for news, but also for indications of the correct behavior to undertake in limiting infections, with immediate repercussions on safety and health [16].

The aim of this research paper was to investigate the experiences of students learning through a distance/remote online format. Therefore, the setting of this study was the field of higher education. The COVID-19 pandemic has caused substantial challenges in daily educational activities, and we may even see continuing challenges due to the financial crisis and uncertainty that the world has recently faced. Currently, with the introduction of e-learning, academics are confronted with new hurdles and challenges relating to obtaining and utilizing information technology (I.T.) skills in order to teach and transfer course materials to all stakeholders [17].

2.1. The Main Characteristics of Remote Education

Traditional learning is concerned with the direct interaction of instructors with students, with typical face-to-face learning interactions that occur in a physical location, such as in a college campus classroom or laboratory. Remote learning, on the other hand, is defined as a way of studying in which students do not attend a school, college, or university. Rather, they study from where they live, usually being taught and given learning activities that are assigned over the internet [18,19]. The rapid development of technologies has made remote learning significantly easier [20,21]. Similarly, e-learning, according to Guri-Rosenblit [22], is the use of electronic media for various educational aims, ranging from supplementary activities in conventional classrooms to wholly substituting in-person contacts with online interactions. Palma and Garcia-Marques [23] defined e-learning as distance education through remote resources.

As Cojocariu et al. [24] (p. 1999) have stated, "most of the terms (online learning, open learning, web-based learning, computer-mediated learning, blended learning, m-learning, for example) have in common the ability to use a computer connected to a network, that offers the possibility to learn from anywhere, anytime, in any rhythm, with any means". Picciano [25] and Picciano et al. [26] presented a complete list of terms that describe the educational process in which a teacher and students are physically separated from each other, namely, "distance education", "distance teaching", "distance learning", "open learning", "distributed learning", "asynchronous learning", "telelearning", "e-learning", and "flexible learning". The authors pointed out that these terms have been used interchangeably with "distance learning". Remote education/learning, distance learning, and e-learning are frequently used interchangeably.

Remote learning activities, as with any teaching activity (including traditional learning), involve the reasoned and guided construction of knowledge through an interaction between instructors and students. Whatever the means through which teaching is exercised, the aims and principles do not change. Therefore, remote learning is proposed as a set of teaching methodologies and strategies aimed at creating a new learning environment that is capable of exploiting the potential of the web and multimedia [14,27,28]. Additionally, remote learning is a set of educational activities that can be carried out without the physical presence of instructors and students in the same place [29]. It is, therefore, a mediated teaching modality, focused on education between instructors and students and between students and other students. With remote learning, the ways of thinking and designing learning content, the ways of organizing and storing content, and the methods of choosing and using content, as well as the systems and platforms used to supply such content, change and differ from those of traditional learning [24,30,31].

The planning, preparation, and development of remote learning activities require a creative approach that considers the complexity of the learning process. Students must be enabled to learn independently, thus fully exploiting the potential of multimedia [32]. At the same time, however, the role of the instructor must continue to be central in the process of constantly verifying and facilitating the results achieved by students [26,33].

The ability of the instructor to understand the needs of the learner in a remote education environment is, in part, also related to concepts such as pedagogy and andragogy that are neither good/bad in themselves; however, they can be extremely useful techniques to consider within the context of a dynamic learning environment [34]. If considered along a spectrum that appreciates the unique learning needs of the student, however, differing levels of pedagogy and andragogy can be strategic methods for enhancing teaching effectiveness. Identifying the goals of the learner or diagnosing the learner's needs, for instance, can support the modeling of the learning environment to encourage greater levels of self-directedness [35].

Empowering the learner with opportunities to control elements of the learning process in a remote education setting can be an effective strategy in facilitating a more participative approach [36]. Knowles [34] argues that as learners mature, there is a greater sense of immediate application in one's life, which can lead to a need for greater levels of self-

direction. Models of self-direction may include a more multi-dimensional approach to learning and teaching as prior knowledge comes into consideration in an activity, along with a level of discovery built upon previous learning environments [37]. Various levels of self-direction can be determined through the learner's self-conception, along with the quality and quantity of prior learning experiences that can help the facilitator gauge what level of dependence or independence is appropriate to fit the learning activity [38]. The degree of andragogy, which is more highly associated with adult learning, is often a challenge for the facilitator in maximizing learning potential [39]. Overly restrictive learning environments can lead to resentment from the learner's perspective, whereas less overbearing learning structures can offer greater levels of empowerment, creativity, and self-direction if facilitated effectively. Guglielmino [40] further argues that self-directed learning readiness is related to a degree of learning capability that can be measured, to some degree, on a continuum for each person. Awareness of the level of dependence and independence in the learning environment, particularly in a remote education delivery model, can be challenging, with a heightened need for a highly skilled facilitator who can effectively support communication and dialogue that meets the individual learner's multi-dimensional needs.

In remote education, the educational activity is mediated by a computer and an internet connection, and the instructor becomes a sort of tutor who prepares the material and follows the activities carried out by the student step by step, activating and implementing evaluation practices [30,41]. The instructor's task is to create learning situations that students can access independently from their homes. The students can decide to work independently or to collaborate with their peers, but without the instructor's immediate feedback or assistance. Instructors decide if and when to intervene in this self-learning process to perform an evaluation. Additionally, they guide and create further educational opportunities to stimulate reflection and deepen the reasoning among students [22,42].

The evolution of e-learning in the history of teaching has seen three main generations of remote learning. The first generation dates back to the mid-nineteenth century and was based on the support of the postal service and the development of transport networks [43]. Essentially, it consisted of the use of paper didactic material, accompanied by instructions for self-study and verification tests to be returned to the sender (in this case, the instructor). The second generation was developed in the 1960s, with the introduction of color television [44,45]. The educational potential of color television was immediately evident at that time; that is, the positive impact and the strong fascination and attraction of the images on the TV screen. Its impact on mass society was then amplified with the invention of VCRs and videocassettes, which increased the domestic use of TV and videotapes as educational tools as well. The third generation, on the other hand, is linked to the spread of technology since the 1990s. The introduction of the personal computer marked an epochal turning point in the didactic–educational paradigm by strengthening the role of the user (in this case, the students) through the principles of interactivity and multimedia [46,47]. Two main phases have been proposed to characterize the use of personal computers: the "off-line" phase, based on the use of tools that do not require the support of networks and the internet (floppy disks, videodisks (DVDs), CD-ROMs), and the "on-line" phase, characterized by the use of the Internet and the World Wide Web [22,24,30,48,49]. With the advent of remote education, learning has become a dynamic social process that involves the active role of students: the network used is no longer just a tool for accessing information online but is characterized by social characteristics and interactions [50,51].

2.2. Emergency Remote Education and Potential Impact

As previously noted, the COVID-19 pandemic forced the closure of colleges and universities, starting in March 2020 and lasting for almost two consecutive years. Consequently, colleges and universities created contingency plans for delivering courses online for their students. These contingency plans are known as emergency remote education (ERE) [9,19,52]. ERE might entail modifying the curriculum that was previously taught face

to face in the form of blended learning or totally remote learning [53]. However, with the introduction of e-learning, academics have been confronted with new challenges related to obtaining and utilizing a broad number of IT skills for teaching purposes [54]. As a result, faculty must venture outside of traditional teaching modes, using online lectures, narrated power points, audio snippets, podcasts, instant messaging, interactive videos, Apps, social media, or simply by displaying calculations or other tasks through the screen.

Studies have examined the pandemic's impact on economic aspects, regular daily routines and functioning, academic functioning, and physical and mental health, as well as the lack of academic sporting activities [55–57]. The pandemic's negative effects on college students may vary according to students' socioeconomic status. When all learning is performed online, access to technology and related technical and social infrastructure disparities may have a greater influence. Dorn et al. [58] reported delays of six to twelve months for students of color, and of four to eight months for white students. Minority students reported distractions and family commitments as a hurdle before the epidemic [59], and the pandemic has continued to disproportionately burden minority students even further during the outbreak [58].

2.3. Advantages and Drawbacks of Remote Education

With the advent of digital technology, the conventional workplace transformed into a more interconnected one due to globalization. The pandemic has significantly altered the workplace even further. Because of the variety of options in terms of knowledge and resources brought about by globalization, the world has become more competitive [60]. Although remote education technologies can promote interactive learning, educators may find it difficult to keep students engaged while limiting distraction and technological misuse. Educators need to create content for digital platforms not only to meet the goal of content distribution, but also to develop students' creative and critical thinking skills [60].

The world is changing, and so must higher education. Societies are undergoing profound changes, and this necessitates the need for new educational models to nurture the skills that societies and the economy will require, both now and in the future. Education paves the way for advancing human rights and dignity, eliminating poverty, strengthening sustainability, and creating a better future for all based on social justice and equality, respect for cultural diversity, global cooperation, and shared responsibility. As Dr. Agarwal, the president of edX, stated, "I do hold to the view we have to rethink all aspects of education from the ground up and that a little tweak here or there is not going to be the answer", and this has been supported by Walters [61]. Statistics show that in 2021, 40 million new learners enrolled in at least one massive open online course (MOOC) compared to 60 million in 2020, according to Shah [62]. In addition, more than 40% of Fortune 500 organizations regularly and substantially use e-learning. The market is expected to increase by USD 72.41 billion between 2020 and 2024, in contrast with early projections that predicted this growth to be around USD 12 billion [63]. In contrast, Statista.com [64] has predicted the size of the online e-learning market will reach USD 167.5 billion in 2026 compared to USD 101 billion in 2019. Coursera, edX, and FutureLearn have continued to add a substantial amount of new non-university courses to their portfolios [62].

Classroom learning typically takes place in an instructor-directed educational context with face-to-face interaction in a live synchronous environment. Remote education can greatly increase the access to learning [65]. By eliminating geographical barriers and improving the convenience and effectiveness of individualized and collaborative learning, remote learning suffers from some disadvantages, such as lack of peer contact and social interaction, high initial costs required for preparing multimedia materials, and substantial costs of maintaining and updating the learning management systems and platforms, as well as the need for flexible digital support for tutorials [66–68].

Hence, remote learning has the advantages of providing students with greater time and spatial flexibility, it allows educators to reach a greater audience, and it provides a wider availability of courses and contents, as well as immediate feedback. However, it also

has disadvantages such as the occurrence of different technical and technological difficulties; the potential to lower students' ability and confidence levels and to make time management more difficult for the possibility of introducing greater distractions, frustration, anxiety, and confusion; as well as lack of physical and personal attention [69–75]. As a result, it is best to avoid merely copying traditional instruction and activities in a remote learning setting. On the other hand, flexibility and imagination are needed to maximize the advantages of remote learning while limiting its disadvantages [25,29,76].

2.4. Student Satisfaction

Student satisfaction has been identified as an important basis for comparison when trying to compare traditional teaching and remote learning. On the one hand, Fortune et al. [77] found lower overall satisfaction in online courses; however, Artz [78] found that adult student satisfaction was higher in online courses [79,80]. Although a third group of researchers, Allen et al. [81], found no difference in student satisfaction between conventional and online courses, and most researchers achieved the same result, others found that students do not find remote classes equivalent to traditional lessons and perceive online courses as easier [82–85]. According to Van Wart et al. [86], students find that remote learning is somewhat beneficial, even if it is perceived as lacking in social interaction and communication. For example, remote learning has led universities to be more innovative due to the availability of information technology. However, there is no statistically significant difference in learning preference between the various levels of education (Bachelor's, Master's, Ph.D., etc.).

In the service economy, satisfaction, quality, and performance turn out to be mutually related key factors. The higher the quality of the service (and/or the product), the more satisfied the customers are. Therefore, satisfaction is based on customer expectations and perceptions of the service or product quality. The same applies to student satisfaction in the education sector [87–90]. Education, particularly the higher-education sector, is a key driver of economic growth. The latter is becoming an increasingly competitive market, and student satisfaction has become an important component of quality assurance. Thomas and Galambos [91] argue that students are viewed as consumers of higher education. Current research findings reveal that satisfied students can attract new students by engaging in positive word of mouth to inform acquaintances and friends and can return to the university to take other courses [14,92].

O'Neill and Palmer [93] define university service quality as the difference between what a student expects to receive and their actual perception of their experience. In many countries, the evaluation of teaching by students is the primary tool used for the evaluation of instructors and their teaching, which is also used as a means of communication with students and in regard to public opinion. Rust et al. [94] conducted a survey on a number of universities over a two-year period to determine why students chose a particular university. The eight main reasons identified were: the right course, the availability of computers, the quality of library facilities, a good reputation for teaching, the availability of quiet areas, the availability of areas for study, the quality of public transport in the city, and the friendly attitude of faculty and staff towards students. Clearly, students' perceptions of university facilities significantly influence their decisions to enroll. Similarly, Sahin [95] established that personal relevance (linking course content with personal experience), followed by instructor support, active learning, and real-life problem solving are the main satisfactory elements for students. Analogously, Douglas et al. [96] and Bush-Gibson and Rinfret [97] found that factors associated with the quality of teaching, learning, and the sense of belonging of students were the key factors for student satisfaction. Even more recently, Billups [98] established that feeling like part of the university community, the effectiveness of the course, and the sense of belonging were the main factors affecting student satisfaction.

Therefore, student satisfaction can be considered the heart of any teaching method, and it indicates whether the learned information and knowledge meet the students' ex-

pectations. In this context, remote learning can improve student learning effectiveness, thereby increasing student efficiency. According to Oduma et al. [99], remote learning can help universities increase student satisfaction. Although face-to-face learning is perceived as more satisfying, many choose remote learning for convenience, time savings, and the ability to work when they want and not when they have to. In addition, remote education is cost effective and allows students to complete their course of study while they work. However, remote courses present a number of challenges: remote learners may never have visited the physical location on campus and may have difficulties establishing relationships with faculty and other students [14,52,100,101].

2.5. SWOT Analysis Framework

An organization's strengths, weaknesses, opportunities, and threats can be identified and analyzed using the Strengths, Weaknesses, Opportunities, and Threats (SWOT) framework (see Figure 1). The main objective of a SWOT analysis is to raise awareness of the variables that influence business decisions or the formulation of business strategies. In this study, we identified the strengths, weaknesses, opportunities, and threats that the university sector has faced during the COVID-19 pandemic, and still may be facing due to students not wanting to return to campus. The articles considered suitable for the literature review were divided into four categories, using open coding and a thematic approach by identifying themes. The coding consisted of noting the citation, year of publishing, title of the research article, location, name of publishing outlet, and theme. The information found regarding themes was later compared to the respondents' open responses.

	Helpful	Harmful
Internal	Strengths	Weaknesses
External	Opportunities	Threats

Figure 1. SWOT analysis framework.

2.6. SWOT—Strengths and Weaknesses

Universities and their faculty and staff worked quickly to place their courses online at the start of the pandemic. Some studies have shown that students noted flexibility as one of the top key strengths during ERE [102–104]. In addition, students reported that being able to re-watch recorded lectures on zoom/teams or concept videos recorded by the professor helped them to retain information better [105,106]. Students also reported not having to commute as a benefit, as they could attend to other responsibilities such as caregiving or part-time work [72,107,108]. Despite being recommended not to socialize in person, digital tools have greatly helped to enhance student socializing [109,110]. Students were able to meet and participate with other students in online social settings. Prior studies have shown that online instruction is as effective as traditional on-campus courses if designed properly [111–113]. During the pandemic and its aftermath, students and faculty have learned how to use digital tools more effectively, which will also make the industry more effective in the future [114].

The most glaring difficulties during the pandemic were access to technology, including technical difficulties with synchronous online sessions, and a lack of direct interaction with classmates and professors, all of which may have had an influence on motivation and student retention [115]. Chirikov et al. [116] also brought up the absence of peaceful study

rooms at home during confinement. Classroom environments are important places for students to have social experiences; however, due to the closing of campuses and on-campus housing and the related returns to their parents' houses during the COVID-19 pandemic, social isolation and a lack of interactivity have been considered major shortcomings of emergency remote education [117]. Finally, when universities and stores closed, many overseas students were left without a source of income, which was commonly derived from part-time work on campus or in the neighborhood.

The move to ERE was perceived as hasty by faculty in many instances; it was carried out efficiently but in a hurried way. Many faculty and students found adjusting to an online environment intimidating after transferring all classes and teaching materials online in a matter of days. To cope, the faculty did its best to brush up on concepts of universal design and learning with the help of its administrative staff. In regular times, one would have time to reflect, read, and discuss, but in these times, everything was conducted on the fly [104]. Not being able to have in-person interactions led to weaknesses for many faculty, including increased workloads, unfamiliarity with new technology, and a steep learning curve regarding how to best engage students in their learning process—all of which were found to be challenging as many faculty faced the "black screen" phenomenon during instructions [114,118–120]. Many universities have various types of learning labs, and it was considered difficult to replicate these labs online as there was no hands-on experience in this regard [121–126]. To move in-person labs online in the future, one would need to experiment and reflect in detail to ensure that students receive an optimal learning experience. There are many technologies in place, but it is also necessary for faculty skills to be updated for the online experience to be optimal.

Although remote learning tools can promote participatory learning, it can be challenging for instructors to maintain student interest while limiting the use of technology for distractions. In addition to achieving the goal of the dissemination of content, faculty need to create content for digital platforms in order to strengthen their implementation and creative thinking skills [127,128]. Coursera, edX, and FutureLearn continued to add a substantial amount of new non-university courses to their portfolios during the pandemic [62]. In a TedTalk, Dr. Agarwal discussed the status and future of education and stated, "What changed? The seats are in color. Whoop-de-do" [129]. Many universities, according to [130], lack the funding and academic capabilities necessary to switch to an online delivery system. They are simply adopting a short-term strategy that might not be viable in the long run. On the other side, the rapid conversion to ERE has given universities extraordinary motivation to upskill their faculty and staff and develop well-thought-out, professionally planned online courses, including the possibility of MOOCs. It also appears to have sparked a strong interest in the literature on teaching and learning.

2.7. SWOT—Opportunities and Threats

At some universities, students can complete all their coursework remotely while still interacting with their peers, attending lectures, participating in subject-specific conversations, or simply socializing due to the availability of advanced technology. However, it will be interesting to see how quickly universities which do not offer remote courses change their delivery methods and offer both. In many ways, COVID-19 changed how we view education and made us better prepared to adopt a 100% digital approach if needed. We have seen that a first-year student may have different needs compared to a third-year student or a graduate student. Teaching and learning do not benefit from a one-size-fits-all approach [131], and various subjects and levels in schools require different approaches [132]. ERE benefited many non-traditional students, especially those working while attending school and those with family responsibilities, because it allowed them to care for their families while setting their own study schedules. The pandemic forced universities to go online. Some say this move is long overdue due to the digital transformation that industries face [133]. It takes time and resources to develop a sustainable remote learning model; therefore, one should learn from the ERE and continue the work. A "best practice" paradigm

for remote teaching and learning will guide students' learning processes [131,134,135]. It will also be crucial to ensure academic honesty and standards by creating procedures that foster trust and confidence among students and faculty [79].

The advantages of remote learning present chances for advancing and renewing the delivery of teaching. The formation of a "pedagogy of care" has been identified as a key issue in the literature [79,133]. A greater understanding of students' specific needs may result in a more inclusive learning environment. The increased use of Zoom, Teams, Skype, WhatsApp, and WeChat, among others, in the classroom can aid in professional networking and collaboration as students prepare themselves for participation in the modern workforce [131,136,137]. Another possibility is that teaching materials may be shared among institutions as a "resource commons", allowing faculty to concentrate on teaching rather than the time-consuming effort of producing new resources [137]. Students and faculty can learn from one another as their familiarity with utilizing online technologies grows [138,139], and faculty can expand their professional skillsets [140]. In order to avoid feeling intimidated by added responsibility and spending all of their time preparing materials rather than teaching, faculty may need support in understanding how to effectively use remote teaching technologies and producing materials [141]. By hiring students as assistants to help instructors with remote teaching, universities may be able to provide students with financial aid. This also bridges the resource gap and gives students meaningful work experience. On the other hand, the focus on speedily deploying ERE may have distracted institutions.

Overall, the encounter with ERE during the COVID-19 pandemic has opened up an opportunity for inspiration [133,142,143], allowing universities to develop their remote teaching and learning strategies [131,143]. According to Soria et al. [144], one of the missing links was the unavailability of off-campus mental healthcare during times of crisis. To remain competitive in the current global market, companies frequently outsource their operations or build virtual teams; therefore, it is important to continue digitalization in higher education to better prepare students. New technologies are being used by businesses to increase efficiency, and employees collaborate at work using e-tools. Since it helps students learn how to collaborate online, e-collaboration is essential in today's classroom environment [139].

2.8. Summary

The pandemic has caused substantial problems in educational activities on a daily basis. The immediate consequence has been lockdowns and the forced closure of colleges and universities over the last two years [143]. However, colleges and universities created contingency plans, delivering courses online for their students. The abrupt implementation of ERE presented several obstacles for the main stakeholders in higher education: students, faculty, and the university. Although the impact on the various stakeholders was frequently comparable, the changeover to ERE affected each group slightly differently. As previously stated, the global pandemic created an unparalleled "distance-learning experiment" [145], and it is critical that this learning opportunity not be squandered. In order to consistently promote possibilities while addressing strengths, weaknesses, opportunities, and threats, a long-term strategy that provides flexibility in design, usage, support, and access is essential. The next section examines these concerns. In this study, we aimed to fill a gap in the existing literature by examining a group of students and their perceptions of ERE after two years of forced online education. This was a long period, and it was therefore interesting to see how students' perceptions of online instruction had changed. The goal of this study was to examine how students coped and how abrupt changes to ERE had an impact on higher education.

3. Method

The data for this study were collected through an anonymous questionnaire, which was distributed through Momentive, an AI-driven online market research firm, which

offered inclusive demographic information to prevent sample bias. Momentive was utilized in order to gather samples that are more diverse than those obtained from face-to-face interactions or other online and social media platforms [146]. Experts claim that the collection of data online, using entirely web-based systems and providing a more user-friendly interface, has grown increasingly popular in academia [147,148]. Criteria were established to survey college students who were enrolled in a college or university in the United States or Norway during the COVID-19 pandemic. A total of 447 usable surveys were analyzed, including information regarding gender, school level, major in college, and country. Incomplete surveys were discarded, along with those from participants who did not meet the criteria. SPSS was used in the analysis for descriptive statistics, with *t*-tests and ANOVA.

A quantitative analysis of survey data, as well as a thematic analysis of the open-ended questions, was performed. The survey consisted of both open-ended and closed questions. The questionnaire was distributed with the aim of learning about potential difficulties or positive outcomes that students faced, as well as their coping mechanisms. This allowed for a better understanding of college students' experiences during the pandemic, as well as their predictions regarding the future of higher education.

The open-ended questions were evaluated using thematic analysis and further incorporated into a SWOT. Thematic analysis is a technique for looking at data to comprehend participant perspectives in a meaningful way. The thematic analysis also reveals data patterns, assisting the researcher in fully comprehending the research findings. To effectively summarize portions of the data and assist in achieving the study's aims and purpose, it is helpful to group the codes into themes. Reflexive thematic analysis, coding reliability thematic analysis, and codebook thematic analysis are the three forms of theme analysis. Thematic analysis is typically performed on data generated from, for example, surveys, social media postings, interviews, and discussions, since it is particularly helpful when looking for subjective information, such as a participant's experiences, perspectives, and opinions. In summary, thematic analysis is a useful option for categorizing huge datasets (although enormous datasets are not required), especially if one is interested in subjective experiences. The information gathered from the SWOT analysis in the literature review was compared to the SWOT analysis in the discussion of our results.

The following Likert-scale values were assigned: 1 for "strongly disagree", 2 for "disagree", 3 for "neither agree nor disagree", 4 for "agree", and 5 for "strongly agree". Respondents were asked to indicate the level of agreement that best reflected their feelings about these statements. The following two questions were examined: (a) "How have the teaching and learning approaches been perceived by college students through the pandemic?" and (b) "Will the abrupt change to emergency remote education have an impact on higher education in the future?".

4. Results

The respondents ranged from freshman to graduate students majoring in IT, business disciplines such as hospitality and service management, and other majors. The respondents were studying in the USA and Norway. The descriptive statistics are shown in Table 1.

Table 1. Profile of the respondents (n = 447).

Characteristics	Category	Frequency	%
Gender	Male	283	63.3
	Female	164	36.7
Level in school	Lower classmen	291	65.1
	Upper classmen	156	34.9
Major	IT	298	66.7
	Business	69	15.4
	Other	80	17.9
Country	Norway	278	62.2
	US	169	37.8

4.1. Difference between Genders

Furthermore, the data were analyzed by applying *t*-tests and ANOVA. A significant difference was found between males and females regarding the aspects of campus life that students missed most during the pandemic. Male respondents agreed more with the statement "In-person labs/group work" than female respondents, t (447) = 3.587, $p = 0.001 < 0.05$. Related to "Study abroad" t (447) = 3.28, $p = 0.005 < 0.05$, female respondents rated this statement higher. This question corresponded to RQ2 (see Table 2).

Table 2. *T*-test results for Q5—What aspects of campus life have you, as a student, missed the most during COVID-19?

	Male (n = 283)		Female (n = 164)			
Category	Mean	SD	Mean	SD	MD	t
In-person labs/group work	3.5866	1.05627	3.2317	1.16491	0.3549	0.001
Study abroad	2.9717	1.07811	3.2805	1.14339	−0.3088	0.005

A significant difference was found between males and females regarding online learning challenges that students faced during the pandemic. Female respondents scored the following statements higher on all accounts compared to male respondents: "Coordinating group projects and keeping team members accountable" (t (447) = 3.518, $p = 0.016 < 0.05$); "Finding a quiet place to work" (t (447) = 3.085, $p = 0.001 < 0.05$); along with "Limitations of learning platforms/system glitches" (t (447) = 3.378, $p = 0.001 < 0.05$); followed by "Reliable Wi-Fi/internet access" (t (447) = 3.207, $p = 0.001 < 0.05$); "Accessing college resources (e.g., libraries, academic support)" (t (447) = 3.287, $p = 0.011 < 0.05$); and "Accessibility of course content/class engagement (due to special needs)" (t (447) = 3.00, $p = 0.000 < 0.05$). Finally, "Being in a different time zone than my fellow students" (t (447) = 2.524, $p = 0.000 < 0.05$) was rated significantly more highly by female participants. Despite the significant differences, both genders rated these categories fairly highly. This question corresponded to RQ1 (see Table 3).

Table 3. *T*-test results for Q6—Have you had any COVID-19 online learning challenges?

	Male (n = 283)		Female (n = 164)			
Category	Mean	SD	Mean	SD	MD	t
Coordinating group projects and keeping team members accountable	3.2686	1.09413	3.5183	0.97498	−0.2497	0.016
Finding a quiet place to work	2.5371	1.19152	3.0854	1.26976	−0.5483	0.001
Limitations of learning platforms/system glitches	3.0389	1.08270	3.3780	1.05249	−0.3391	0.001
Reliable Wi-Fi/internet access	2.6219	1.29722	3.2073	1.24573	−0.5854	0.001
Accessing college resources (e.g., libraries, academic support)	3.0071	1.15775	3.2866	1.02583	−0.2795	0.011
Accessibility of course content/class engagement (due to disability)	2.6396	1.08379	3.0000	1.09096	−0.360	0.000
Being in a different time zone than my fellow students	2.0883	1.19216	2.5244	1.29866	−0.436	0.000

A significant difference was found between males and females regarding the pandemic-era experiences that students wanted to retain post-COVID-19. Male respondents were more likely to agree with the statement, "Lectures made available online so you can go back and review material", than female respondents (t (447) = 4.166, $p = 0.005 < 0.05$). In regard to "Smaller class sizes" (t (447) = 3.500, $p = 0.036 < 0.05$), female respondents rated this statement more highly. This question corresponded to RQ2 (see Table 4).

Table 4. *T*-test results for Q8—Pandemic-era experiences that students wanted to retain post-COVID-19.

Category	Male (n = 283)		Female (n = 164)			
	Mean	SD	Mean	SD	MD	t
Lectures made available online so you can go back and review material	4.1661	0.98426	3.8902	0.98462	0.2759	0.045
Smaller class sizes	3.3039	0.95625	3.5000	0.94317	−0.1961	0.036

4.2. Differences between Students from Different School Levels

In terms of school level, a significant difference was found between upperclassmen and lowerclassmen regarding the aspects of campus life that students missed the most during the pandemic. In this case, lowerclassmen were first-year students. First-year respondents were more likely to agree with the statement "Friends and social life" than upperclassmen (t (447) = 3.962, $p = 0.002 < 0.05$), and this was also observed for "Sports/athletics" (t (447) = 3.364, $p = 0.024 < 0.05$). Upperclassmen, on the other hand, rated "In person resources" higher (t (447) = 3.519, $p = 0.014 < 0.05$). Furthermore, the category "I don´t miss anything" was scored more highly among upperclassmen (t (447) = 2.7372, $p = 0.001 < 0.05$). This question corresponded to RQ1 (see Table 5).

Table 5. *T*-test results for Q5—What aspects of campus life have you, as a student, missed the most during COVID-19?

Category	Lower Classmen (n = 291)		Upper Classmen (n = 156)			
	Mean	SD	Mean	SD	MD	t
Friends and social life	3.9622	0.96237	3.6218	1.15475	0.3404	0.002
Sports/athletics	3.3643	1.15578	3.0962	1.26888	0.2681	0.024
In person resources (e.g., career center and academic help)	3.2715	0.98882	3.5192	1.04401	−0.2477	0.014
I don't miss anything	2.2234	1.18973	2.7372	1.28571	−0.5138	0.001

A significant difference was found between upper and lowerclassmen regarding remote learning challenges that students faced during the pandemic. The upperclassmen scored the following statements higher on all accounts than the respondents from lower school levels: "Finding a quiet place to work" (t (447) = 3.1218, $p = 0.001 < 0.05$); "Limitations of learning platforms/system glitches" (t (447) = 3.4744, $p = 0.001 < 0.05$); "Reliable Wi-Fi/internet access" t (447) = 3.3269, $p = 0.001 < 0.05$; "Accessing college resources (e.g., libraries, academic support)" (t (447) = 3.4103, $p = 0.001 < 0.05$); "Navigating learning platforms" (t (447) = 3.3205, $p = 0.001 < 0.05$); and "Accessibility of course content/class engagement (due to special needs)" (t (447) = 3.0897, $p = 0.001 < 0.05$). Finally, "Being in a different time zone than my fellow students" (t (447) = 2.8718, $p = 0.001 < 0.05$) was rated significantly more highly by upperclassmen. This question corresponded to RQ1 (see Table 6).

A significant difference was found between upper and lowerclassmen regarding time-management problems that students faced during the pandemic. The upperclassmen rated the following statements more highly on all accounts than the lowerclassmen: "Increased hours of paid employment" (t (447) = 3.3.2821, $p = 0.001 < 0.05$); "Had new/additional caregiving responsibilities" (t (447) = 3.4231, $p = 0.001 < 0.05$); "Joined/participated in an online club or group" (t (447) = 2.8782, $p = 0.042 < 0.05$); and "Spent time using career

center services/on career development" (t (447) = 3.0192, $p = 0.001 < 0.05$). This question corresponded to RQ1 (see Table 7).

Table 6. *T*-test results for Q6—Have you had any COVID-19 online learning challenges?

Category	Lower Classmen (n = 291)		Upper Classmen (n = 156)			
	Mean	SD	Mean	SD	MD	t
Finding a quiet place to work	2.5326	1.18967	3.1218	1.26666	−0.5892	0.001
Limitations of learning platforms/ system glitches	2.9966	1.06187	3.4744	1.05616	−0.4778	0.001
Reliable Wi-Fi/ internet access	2.5739	1.27193	3.3269	1.23478	−0.7530	0.001
Accessing college resources (e.g., libraries, academic support)	2.9485	1.08314	3.4103	1.12377	−0.4618	0.001
Navigating learning platforms	2.8694	1.06518	3.3205	1.07155	−0.4511	0.001
Accessibility of course content/class engagement (due to disability)	2.6014	1.06958	3.0897	1.08581	−0.4883	0.001
Being in a different time zone than my fellow students	1.9141	1.09364	2.8718	1.28373	−0.9577	0.001

Table 7. *T*-test results for Q7—Time spent during COVID-19 in terms of academics, activities, and responsibilities?

Category	Lower Classmen (n = 291)		Upper Classmen (n = 156)			
	Mean	SD	Mean	SD	MD	t
Increased hours of paid employment	3.1787	0.81939	3.2821	1.03982	−0.1034	0.001
Had new/additional caregiving responsibilities	2.8729	1.18073	3.4231	1.07786	−0.5502	0.001
Joined/participated in an online club or group	2.6392	1.17607	2.8782	1.18780	−0.239	0.042
Spent time using career center services/on career development	2.4811	1.06778	3.0192	1.19931	−0.5381	0.001

A significant difference was found between upper and lowerclassmen regarding the pandemic-era experiences that students wanted to retain post-COVID-19. The lower classmen rated the following statements more highly on all accounts than the upper-class respondents: "Lectures made available online so you can go back and review material", (t (447) = 4.3402, $p = 0.001 < 0.05$); "The option of whether to attend courses in person or online" (t (447) = 4.2405, $p = 0.001 < 0.05$); "The ability to communicate privately with a professor (such as via chat) during a lecture)" (t (447) = 3.8694, $p = 0.018 < 0.05$); and "Online access to college support resources" (t (447) = 3.8969 $p = 0.022 < 0.05$). Finally, "More group projects" (t (447) = 3.1718 $p = 0.013 < 0.05$) was also rated more highly by the lowerclassmen. This question corresponded to RQ2 (see Table 8). Many students reported a positive opinion of online education, indicating that they preferred having additional flexibility and more digital material compared to their in-class courses.

Table 8. *T*-test results for Q8—Pandemic-era experiences that students wanted to retain post-COVID-19.

Category	Lower Classmen (n = 291)		Upper Classmen (n = 156)			
	Mean	SD	Mean	SD	MD	t
Lectures made available online so you can go back and review material	4.3402	0.86964	3.5513	1.00512	0.7889	0.001
The option of whether to attend courses in person or online	4.2405	0.85734	3.7372	1.06020	0.5033	0.001
The ability to communicate privately with a professor (such as via chat) during a lecture)	3.8694	1.00865	3.6282	1.04244	0.2412	0.018
Online access to college support resources	3.8969	0.92645	3.6795	0.99669	0.2174	0.022
More group projects	3.1718	1.17063	2.8782	1.20399	0.2936	0.013

4.3. Differences among Students with Different Majors

Moreover, as shown in Table 9, there was a significant difference ($p = 0.001 < 0.05$, SE 0.04943) between the majors when it came to their agreement with the statements "Friends and social life" ($p = 0.011 < 0.05$, SE 0.05685) and "Sports/athletics" ($p = 0.010 < 0.05$, SE 0.05247). IT students valued these statements the most highly in all three cases, followed

by business majors. For the last item, "I don´t miss anything", there was also a significant difference ($p = 0.001 < 0.05$, SE 0.05898), and business students, followed by the other majors, scored this item the most highly. It is no surprise that students missed their friends and were able to have a social life of some sort. For many months countries were under lockdown, which was difficult for many people. Not being able to go to the gym was also hard for many. For those students needing to attend a lab for their classes, the lockdown period was especially challenging for students and instructors. Some courses are not suited for online delivery, whereas others work perfectly. This question corresponded to RQ2.

Table 9. ANOVA results for Q5—What aspects of campus life have you as a student missed the most during COVID-19?

Category		N	Mean	SD	SE	F	Sig
Friends and social life	IT	298	3.9799	0.96727	0.05603		
	Business	69	3.6232	1.08603	0.13074		
	Other	80	3.5250	1.19042	0.13309		
	Total	447	3.8434	1.04499	0.04943	8.032	0.001
Sports/athletics	IT	298	3.3859	1.15852	0.06711		
	Business	69	3.1304	1.29380	0.15575		
	Other	80	2.9625	1.22675	0.13715		
	Total	447	3.2707	1.20187	0.05685	4.540	0.011
In-person labs/group work	IT	298	3.5470	1.06021	0.06142		
	Business	69	3.4493	1.21916	0.14677		
	Other	80	3.1250	1.14045	0.12751		
	Total	447	3.4564	1.10938	0.05247	4.639	0.010
I don't miss anything	IT	298	2.2215	1.17977	0.06834		
	Business	69	2.8261	1.34991	0.16251		
	Other	80	2.7125	1.26485	0.14141		
	Total	447	2.4027	1.24698	0.05898	9.979	0.001

Likewise, as shown in Table 10, there were significant differences among the data collected from business students, who rated five of the remote learning challenges items the most highly, with these being "Finding a quiet place to work" ($p = 0.001 < 0.05$, SE 0.05902), "Navigating learning platforms" ($p = 0.001 < 0.05$, SE 0.05122), "Accessing college resources (e.g., libraries, academic support)" ($p = 0.001 < 0.05$, SE 0.04943), and "Being in a different time zone than my fellow students" ($p = 0.001 < 0.05$, SE 0.05198). The other items, "Uncertainty around COVID-19" ($p = 0.029 < 0.05$, SE 0.04943), "Limitations of learning platforms/system glitches" ($p = 0.001 < 0.05$, SE 0.05289), "Reliable Wi-Fi/internet access", ($p = 0.001 < 0.05$, SE 0.06187), and "Navigating learning platforms" ($p = 0.004 < 0.05$, SE 0.05145) scored the highest among the other majors. Every university can learn from the pandemic experience. Learning platforms, online university resources, course content available online, and reliable Wi-Fi were on the top of the list for many who needed improvements. This question corresponded to RQ1.

Furthermore, as shown in Table 11, for additional online learning challenges, a significant difference ($p = 0.001 < 0.05$, SE 0.05555) was observed between the majors when it came to their agreement with the statement "Had new/additional caregiving responsibilities", "Decreased course load" ($p = 0.022 < 0.05$, SE 0.04444), and "Spent time using career center services/on career development" ($p = 0.001 < 0.05$, SE 0.05408). In all three cases, business students valued these statements the most highly, followed by the other majors. For the last item "Increased hours of paid employment", there was also a significant difference ($p = 0.020 < 0.05$, SE 0.05201), with other majors scoring this item the most highly, followed by business majors. This category of questions is interesting because business students have been reported to be the group who seek career counseling the most. In addition, business students reported having to cut back on the number of courses the most, as well as being faced with new and additional caregiving responsibilities. The group of other

students was the one increasing the number of working hours. A situation such as this can lead to students not being able to finish their study program on time, or perhaps having to postpone their planned education. This question corresponded to RQ2.

Table 10. ANOVA results for Q6—Have you had any COVID-19 online learning challenges?

Category		N	Mean	SD	SE	F	Sig
Uncertainty around COVID-19	IT	298	3.5705	0.98647	0.05714		
	Business	69	3.2464	1.25330	0.15088		
	Other	80	3.6750	1.02839	0.11498		
	Total	447	3.5391	1.04502	0.04943	3.558	0.029
Finding a quiet place to work	IT	298	2.5503	1.20569	0.06984		
	Business	69	3.1304	1.22370	0.14732		
	Other	80	3.1000	1.27884	0.14298		
	Total	447	2.7383	1.24776	0.05902	10.586	0.001
Limitations of learning platforms/system glitches	IT	298	3.0268	1.05694	0.06123		
	Business	69	3.5072	1.13271	0.13636		
	Other	80	3.3750	1.04790	0.11716		
	Total	447	3.1633	1.08297	0.05122	7.592	0.001
Reliable Wi-Fi/internet access	IT	298	2.5973	1.28404	0.07438		
	Business	69	3.2609	1.27939	0.15402		
	Other	80	3.3625	1.18261	0.13222		
	Total	447	2.8367	1.30803	0.06187	16.103	0.001
Accessing college resources (e.g., libraries, academic support)	IT	298	2.9732	1.09450	0.06340		
	Business	69	3.5362	1.07894	0.12989		
	Other	80	3.2500	1.14184	0.12766		
	Total	447	3.1096	1.11816	0.05289	8.123	0.001
Navigating learning platforms	IT	298	2.9060	1.08148	0.06265		
	Business	69	3.2609	1.06622	0.12836		
	Other	80	3.2750	1.06706	0.11930		
	Total	447	3.0268	1.08772	0.05145	5.631	0.004
Accessibility of course content/class engagement (due to disability)	IT	298	2.6309	1.08152	0.06265		
	Business	69	3.2174	1.04134	0.12536		
	Other	80	2.9125	1.10458	0.12350		
	Total	447	2.7718	1.09905	0.05198	9.095	0.001
Being in a different time zone than my fellow students	IT	298	1.9631	1.14679	0.06643		
	Business	69	2.8406	1.24408	0.14977		
	Other	80	2.8000	1.26691	0.14164		
	Total	447	2.2483	1.24871	0.05906	25.955	0.001

Table 11. ANOVA results for Q7—Time spent during COVID-19 in terms of academics, activities, and responsibilities.

Category		N	Mean	SD	SE	F	Sig
Increased hours of paid employment	IT	298	2.7987	1.08544	0.06288		
	Business	69	3.0145	1.06402	0.12809		
	Other	80	3.1625	1.14122	0.12759		
	Total	447	2.8971	1.09960	0.05201	3.970	0.020
Had new/additional caregiving responsibilities	IT	298	2.9060	1.18545	0.06867		
	Business	69	3.4783	1.09287	0.13157		
	Other	80	3.3000	1.08383	0.12118		
	Total	447	3.0649	1.17439	0.05555	8.909	0.001
Decrease course load	IT	298	2.8490	0.85714	0.04965		
	Business	69	3.1884	1.07478	0.12939		
	Other	80	2.8500	1.06854	0.11947		
	Total	447	2.9016	0.93950	0.04444	3.852	0.022
Spent time using career center services/on career development	IT	298	2.5034	1.08323	0.06275		
	Business	69	3.1449	1.16664	0.14045		
	Other	80	2.8750	1.20521	0.13475		
	Total	447	2.6689	1.14332	0.05408	10.865	0.001

For the post-pandemic era, IT majors rated the following statements the most highly: "Lectures made available online so you can go back and review material" ($p = 0.001 < 0.05$, SE 0.04693), "The option of whether to attend courses in person or online" ($p = 0.001 < 0.05$, SE 0.04552), "The ability to communicate privately with a professor (such as via chat) during a lecture" ($p = 0.004 < 0.05$, SE 0.04852), "Virtual events/virtual access to live events" ($p = 0.039 < 0.05$, SE 0.04883), "Online access to college support resources" ($p = 0.026 < 0.05$, SE 0.04522). As for the two last items, "More individual assignments ($p = 0.010 < 0.05$, SE 0.04868) and "Online organizations or clubs" ($p = 0.008 < 0.05$, SE 0.04603), business students rated these items the most highly. These results are not surprising. IT students are perhaps more tech savvy and may enjoy working and playing for multiple hours in front of the computer. One could easily see why IT students are more open to taking online courses, especially in Norway, where online methods were previously not frequently used in higher education. This question corresponded to RQ2 (see Table 12).

Table 12. ANOVA results for Q8—Pandemic-era experiences students that wanted to retain post-COVID-19.

Category		N	Mean	SD	SE	F	Sig
Lectures made available online so you can go back and review material	IT	298	4.3389	0.87765	0.05084		
	Business	69	3.5652	0.93113	0.11210		
	Other	80	3.4750	1.03085	0.11525		
	Total	447	4.0649	0.99226	0.04693	40.284	0.001
The option of whether to attend courses in person or online	IT	298	4.2416	0.86962	0.05038		
	Business	69	3.9565	1.03519	0.12462		
	Other	80	3.5000	1.00631	0.11251		
	Total	447	4.0649	0.96243	0.04552	20.964	0.001
The ability to communicate privately with a professor (such as via chat) during a lecture	IT	298	3.8859	0.99852	0.05784		
	Business	69	3.7246	1.01292	0.12194		
	Other	80	3.4625	1.07849	0.12058		
	Total	447	3.7852	1.02588	0.04852	5.628	0.004
Virtual events/virtual access to live events	IT	298	3.7148	1.04246	0.06039		
	Business	69	3.5942	0.94431	0.11368		
	Other	80	3.3875	1.03720	0.11596		
	Total	447	3.6376	1.03231	0.04883	3.274	0.039
Online access to college support resources	IT	298	3.8960	0.92437	0.05355		
	Business	69	3.7826	0.87228	0.10501		
	Other	80	3.5750	1.09977	0.12296		
	Total	447	3.8210	0.95608	0.04522	3.663	0.026
More individual assignments	IT	298	3.3523	1.02823	0.05956		
	Business	69	3.5507	0.94769	0.11409		
	Other	80	3.2875	1.09306	0.12221		
	Total	447	3.3714	1.02912	0.04868	4.639	0.010
Online organizations or clubs	IT	298	3.2517	0.91770	0.05316		
	Business	69	3.4928	0.96441	0.11610		
	Other	80	3.0000	1.12509	0.12579		
	Total	447	3.2438	0.97321	0.04603	4.860	0.008

In terms of future learning desires, an overwhelming 54.4% of the students indicated there were things that they liked about remote learning but that they still preferred in-class learning. However, 32.7% indicated they would prefer not to return to the old teaching and learning method. Finally, 12.98% indicated that they never wanted to take another Zoom/Teams class again. This question corresponded to RQ2 (see Figure 2).

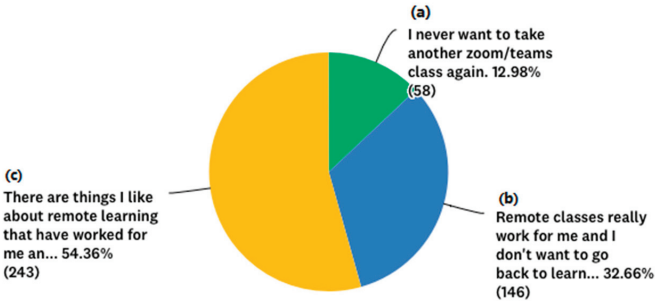

Figure 2. Q9—What are your post-pandemic learning desires? Note: Survey response alternatives: (**a**) "I never want to take another Zoom/Teams class again"; (**b**) "Remote classes really work for me and I don´t want to go back to learning in person"; and (**c**) "There are things I like about remote learning that have worked for me and my learning style, but I prefer in-class courses".

Furthermore, the participants were asked if they felt any discomfort about having their cameras on while on Zoom. Their responses were mixed, with 46% answering no, 15% answering yes, and 39% answering sometimes. Once students embrace the use of technology and better adapt to its use, their level of discomfort will decrease. Moreover, technology will become more advanced in future years.

4.4. Thematic Analysis

Thematic analysis is a method of examining data to gain a meaningful understanding of participant perspectives. Furthermore, thematic analysis exposes patterns in data, helping the researcher to comprehensively understand the research findings [147–152]. Thematic analysis was used to evaluate the open-ended questions and the results were further incorporated into a SWOT. The open-ended questions were categorized as follows: (1) studying and learning from a distance, (2) post-COVID-19 era, and (3) availability of technology. Furthermore, the open-ended replies were connected to the study questions to confirm that the responses matched the research questions.

In the first category, the respondents shared their experiences with distance learning. Those who voiced their opinions indicated that it was difficult and challenging and that they felt a lack of motivation and had mixed feelings. However, some respondents liked online learning. Regardless of their opinions, the pandemic created a special and abnormal situation that urged everyone to keep a safe distance and avoid contact with people as much as possible. The past pandemic years of 2020 and 2021 were atypical and very challenging for most people. In a normal, non-pandemic situation, more students would thrive in an online setting if their daily activities remained intact. These responses correspond to the first research question, "How have the teaching and learning approaches been perceived by college students through the pandemic?" (see Table 13).

In the second category, the respondents explained how they preferred their courses to be taught in the post-COVID-19 era. The written responses were overwhelmingly in favor of online courses. Some mentioned that online methods made it easier to learn, resources were available online, as well as online recordings, greater flexibility, and added convenience, and several courses were found to work well online. These responses correspond to the second research question, "Will the abrupt change to emergency remote education have an impact on higher education in the future?" (see Table 14).

Table 13. Responses related to studying and learning from a distance.

	Theme	Area	RQ	HO
1.	"It has been a bad time"	Difficult	1	1
2.	"Learning remotely is a challenging and not as engaging"	Challenging, less engaging	1	1
3.	"It´s hard to keep up"	Difficult	1	1
4.	"Terrible"	Difficult	1	1
5.	"It is a totally different experience on faculty and students. If people would be less selfish, get the vaccine, and take this seriously, we could be done with it by now"	Moral	1	1
6.	"There´s been good things but in person is best"	Good, prefer in-class	1	1
7.	"Hard time but got through it"	Difficult	1	1
8.	"That is was stressful and harder than it should have been"	Difficult	1	1
9.	"It is ok, but the problem comes with so many things left to figure out for oneself"	Difficult	1	1
10.	"As a student I have had the upmost amount of difficulty with everything virtual. If I'm paying for college, why am I, essentially, not attending college. Honestly, it's the biggest waste of time and money in America and in the world right know. I honestly believe that."	Difficult	1	1
11.	"Motivation is really hard to have when there are so many distractions during remote learning"	Motivation	1	1
12.	"I was already an online only student (living out of state). The biggest effect for me when covid shutdowns occurred was less class availability due to the addition of previously in-person students now attending online only courses"	Fever classes available	1	1
13.	"It was ridiculous to start out because no one was prepared for online"	No one prepared	1	1
14.	"I loved how relaxed online school was"	Like online	1	1
15.	"Online studying has been a plus"	Like online	1	1
16.	"It's hard to stay on top of things"	Difficult	1	1
17.	"I think online studies are the best, it is appealing to me"	Like online	1	1
18.	"I miss social interaction, fear is what is killing us and also the lack of love and sharing with others, social distancing is the worst"	Lack of social interaction	1	1
19.	"Sometimes it's good time and some time it's bad feeling"	Mixed feelings	1	1

Table 14. Responses related to the post-COVID-19 era.

	Theme	Area	RQ	HO
1.	"I don't want to go back to in person learning I just want there to be a new structure to online learning"	Like online	2	3
2.	"I really like taking courses from a distance"	Like online	2	3
3.	"I like distance education a lot. But it took some time to get into it. But now it´s more efficient and works better because it helps save time with not having to commute to school"	Like online, Commuting	2	3
4.	"It's quite convenient, but it is easier to understand the content when its physical"	Convenient,	2	3
5.	"I like online, provides more flexibility"	Convenient	2	3
6.	"Digital courses are good as long as the teaching resources are good"	Like online Online-resources	2	3
7.	"It is great to have courses online because it seems like many courses work well online. Also, when the instructor offer small group talks in-class is great if we don't understand something, I really like that"	Works well	2	3
8.	"I enjoy some subject online"	Like online	2	3
9.	"It's convenient having online courses"	Convenient	2	3
10.	"Online works fine"	Like online	2	3
11.	"Another thing that I personally have liked during the pandemic is that many teachers record their lectures and publish them on the course website on Canvas afterwards, also when we student could come back and attend the lectures on campus. I wish that the teachers continue doing that also after the pandemic"	Online recordings	2	3
12.	"I want courses to be online. Anyways I am finished after this semester"	Like online	2	3

In the third category, the respondents expressed their viewpoints regarding the availability of technology at their institutions. Several of the respondents felt that universities and colleges needed to upgrade their available technologies. The learning management system (LMS) offered by the universities to students as the online courses platform needed to be further modernized, with interactive tasks and Kahoot being integrated into the courses. In Norway, for example, the use of Kahoot was not allowed in "higher education". There was also a request to standardize the courses, and several felt that instructors also needed assistance with delivering courses online. These responses correspond to the first research question, "How have the teaching and learning approaches been received by students through the pandemic?" (see Table 15).

Table 15. Responses related to the availability of technology.

	Theme	Area	RQ	HO
1.	"All professors should have a course in streaming and the school should invest in mics and such"	Technology knowhow	2	2
2.	"Standardize the quality of online education"	Standardization	2	2
3.	"Good microphones and have good enough knowledge to share screen is important."	Technology knowhow	2	2
4.	"Smooth streaming services, quizzes, discord"		2	2
5.	"I like online. I believe the instructors should receive better equipment to teach digitally so the quality becomes better"	Technology upgrade	2	2
6.	"It's difficult to ask questions in class, so maybe students can send in questions anonymous, and instructors can answer them live etc."	Easier to speak up online	2	2
7.	"Short videos and interactive tasks"	Videos	2	2
8.	"Maybe have some interaction like Kahoot so we know how we are doing in the class. Or a way to check if we understand the topic 100%. It can be hard to know if one has picked up the information needed to do good in an online class"	Kahoot	2	2
9.	"Interactive platform and not 3rd part platforms"	MLS	2	2
10.	"Better webcams, newer computers (Quick tip: Apple is heavily over-priced in terms of price-to-performance). Studio/podcast microphones"	Technology upgrade	2	2
11.	"I would like to have better online programs to complete course work"	MLS	2	2
12.	"Refunds for students who paid fees for campus services that were impossible to access"	Tuition reduction	2	2

Based on the above analysis, one can see that universities must continue investing in new technologies to meet tomorrow's students' desires. Students have also grown up with various advanced technologies at home. Students also noted the need for standardization and re-tooling by instructors to better handle the delivery of digital services. The participants clearly liked taking courses online, despite the challenging worldwide situation. The flexibility and lower commuting times, as well as access to a new way of learning, were appealing. However, many also found emergency remote education (ERE) challenging. In conclusion, based on the open-ended questions, it was evident that the respondents embraced online courses but recognized the need for improvements in technology in relation to (a) the post-COVID-19 era, (b) studying and learning from a distance, and (c) the availability of technology (see Figure 3).

Figure 3. Word cloud summarizing the thematic approach.

5. Discussion

In the current study, we investigated the influence of the COVID-19 pandemic on the educational and personal experiences of current students in Norway and the United States during the lockdown. The findings indicated disparities in student experiences and in how administrators and officials perceived the issue. These were related to the course delivery, health, overall quality of life, and, most importantly, the future direction of higher education. The aim of this research paper was to investigate the experiences of students learning from a distance/in a remote online format during COVID-19. A SWOT was applied to identify strengths, weaknesses, opportunities, and threats in relation to higher education. The findings of the SWOT were clearly aligned with the findings from the literature. The SWOT analysis, summarized in Figure 4, indicated that there are opportunities to learn from the COVID-19 pandemic's abrupt shift to remote education. These results indicate that stakeholders may not want to return strictly to the old norm. The new generation of students has grown up with technology and, in many cases, is more tech-savvy than their instructors.

Strengths	**Weaknesses**
- Many courses are suited for online instructions. - Many students are tech savvy. - Many students want flexibility. - Online instruction delivers information in a way that might make learning easier. - More sharing of information. - Increased research among faculty.	- All labs might not be suitable to be taught online. - Faculty might not be ready for ERE. - Many classrooms might not be fitted with proper technology for a hybrid solution. - Logistic challenges. - International students. - Less interaction among students. - Technical glitches.
Opportunities	**Threats**
- New innovative opportunities. - Re-tooling of faculty members. - Flexibility in education. - Inclusive learning environment. - Advanced online education.	- MOOCS. - Increase in workload for faculty. - New investments for universities. - Changes to infrastructure. - Isolation.

Figure 4. SWOT matrix.

The aim of this research paper was to investigate university students' ERE learning experiences during the COVID-19 pandemic. The results of the study were meant to provide context for higher education institutions, as well as those who create distance learning curricula, in addition to providing recommendations to enable universities to better prepare for any other potential ERE situation. Incorporating cutting-edge teaching strategies and approaches into academic institutions' curricula should be a top priority [153,154]. The lockdown during the COVID-19 pandemic has revealed the reality of the status of higher education today. Progressive universities in the twenty-first century did not seem to be prepared to implement digital teaching and learning tools across the board. Existing online learning platforms did not provide universal solutions and numerous university instructors were not adequately prepared nor equipped to teach classes fully remotely, and absolutely not at the accelerated pace that the COVID-19 pandemic produced. Knowledge of online teaching was primarily limited to sending materials, PowerPoint slides, online exercises, and assignments to students via email, in addition to setting deadlines for submitting completed tasks electronically [154].

Regarding RQ1—"How have the teaching and learning approaches been perceived by college students through the pandemic?"—based on our results, one can clearly see that many of the respondent's welcomed online education in the future. Students did not expect everything to be fully online, but they preferred having the option of taking a certain number of their required courses online. Students today are more and more tech savvy; additionally, they want flexibility. Therefore, especially in the critical and difficult economic situation that the world is facing at the moment, offering flexibility to students by providing a wider choice of online courses can help to alleviate some of the economic burdens that many are facing. In Norway, transportation, housing, and food have doubled and tripled in price in a very short period. This means that people possess lower purchasing power and have less money to spend on non-essentials. Some of the students reported they had to increase the number of hours they worked during a week, and some had new caregiving responsibilities. Unfortunately, many will continue to face the same challenges due to other crises affecting the world.

Participants reported learning challenges during COVID-19; however, this was a time of uncertainty for all people, as the world was closed down and instructors had to put together online courses at a pace that none were used to. Many were lacking resources in the beginning, ranging from a suitable Wi-Fi connection to equipment that could handle such online activity. Despite the challenges, many increased their technical skills significantly for the better.

A wide range of institutions still need to upgrade their equipment on campus, and rooms need to be refitted to meet the needs of tomorrow's students. This will lead to new innovations and opportunities and a much more flexible education system. Not all students learn the same way; this will lead to a more inclusive learning environment, the potential for a greater level of personalization, and a much more advanced education system.

Regarding RQ2—"Will the abrupt change to emergency remote education have an impact on higher education in the future?"—universities may take the opportunity to learn from the recent years of lockdowns. Better equipment and re-tooling of its faculty members to feel more comfortable with the new teaching and learning environment are needed. Some universities are ahead of the game, especially those that have offered online education for over a decade, and which have continued to improve their delivery methods and platforms. Based on the survey results, 33% of respondents would prefer online courses in the future, whereas 54% reported there were things that they liked about online education that worked for them, but they preferred in-class courses, and only 13% reported that they never wanted to take another Zoom class again. In the next few years, it will be interesting to see whether universities will continue to improve their delivery methods and assessment practices, invest in technology, and refit their classrooms.

The institutions' initial unpreparedness to deal with the enormity of the COVID-19 epidemic was one of the primary problems identified across the studied literature. Univer-

sities will need to address the issues identified in the research if a long-term contactless teaching and learning paradigm is to be established. University services ranging from enrollment and career services to psychological services need to be offered online to ensure retention, as well as to make sure that students are motivated and not struggling, or feeling isolated or disadvantaged in any way due to a lack of access to hardware/software and/or Wi-Fi [104,155]. To combat these issues and ensure the success of online education, equity issues must be carefully examined and handled [102,141]. To avoid frustration and demotivation, universities need to continue to invest in online learning platforms (LMS), as well as opting to use online systems developed by publishing companies such as McGraw-Hill, Pearson, Wiley, etc., and allow other systems such as Discord to be used in class for communication purposes. Universities need to develop ways to check in with students, particularly first-year students [126,144,156,157], as well as students from minority groups and disadvantaged homes, as well as overseas students, who are most at risk of falling behind [144,157].

6. Limitations and Future Studies

Through this analysis, we clearly identified groups of students who were satisfied and embraced the shift toward remote learning and instruction. However, in-class teaching remained the preferred method of instruction. A more in-depth investigation of the impacts of remote learning and digital shortcomings is necessary, and as time passes, it will be interesting to see how education shifts. One can note that, in the workforce, many employees like working from home. Employers have discovered that employees have remained productive while working from home, if not becoming even more productive. In conditions further removed from COVID-19 and the present financial crisis and global uncertainty at a distance, in-depth interviews may be conducted as a follow-up to this study to find out whether the situation has changed.

7. Conclusions

Every year, the discussion comparing remote learning and traditional teaching seems to intensify. Traditional teaching occurs in old-fashioned classroom on campus, whereas remote learning can occur online, anywhere and at any time, at the student's convenience. In remote learning, the instructor is expected to be more of a facilitator of information and materials, similar to the role of a tutor, who must prepare the materials, plan activities, and constantly evaluate the activities carried out by students [158]. The instructor's main role in remote teaching is to create learning situations in which students can independently develop skill competencies [159]. Remote learning does not mean that contact with students is lost. Indeed, online instruction is of primary importance for developing and programming different virtual activities, among other online actions, such as tools to ensure constant contact with and between instructors and students [26].

A major difference between traditional learning and remote learning is the profound change in the space–time dimension of the learning process that one encounters in remote learning. It is, therefore, important to change the approach and go beyond traditional practices with distance or online learning. In remote learning, activities in direct connection that occur at exactly the same periods (synchronous activities), such as video lectures and videoconferences, must be constant and continuous, because these serve to maintain contact [158]. However, the need to make students feel supported and cared for must not become a suffocating presence. Additionally, since the concentration threshold of students when they are not in a classroom setting can easily drop [160], it is necessary and beneficial to diversify the tools that the instructor uses, thus not focusing only on videoconferencing and virtual lessons, but including written messages, videos, podcasts, announcements, and online discussions, among other activities, which are still very effective tools for stimulating the attention and interest of the class group, without having direct face-to-face contact with students [161,162]. For the aforementioned reasons, solely implementing the simple reproduction of traditional teaching activities in a remote learning environment should be

avoided. Flexibility and creativity, on the other hand, are essential in order to make the most of the potential of remote learning and, at the same time, to limit its disadvantages [14,101].

The COVID-19 pandemic has resulted in the largest remote learning experiment in history. The COVID-19 crisis swiftly brought attention to the use of online tools in higher education to transfer knowledge. There are obvious benefits to remote learning, as well as the potential for institutions of higher education to increase their competencies in digital delivery methods. Many classrooms still need to be refitted with appropriate and cost-effective technologies. Universities need to continue experimenting with the technologies available on the market, such as various message boards and chat functions, video and recording software, and increasingly real-time cloud-based applications, to make the experience as streamlined as possible. It is obvious that many students have embraced new technologies, and it is important that faculty expose students to new technologies to better prepare them for future careers. Facilitating self-direction in student learning offers a tremendous benefit if it is thoughtfully implemented, which can lead to a more self-sufficient workforce with varying levels of increased productivity and adaptation to change. Preparing learners and facilitators of learning for rapid change may be an essential approach for many institutions of higher education moving forward.

According to El-Azar and Nelson [163], the long-term disruption to the traditional way of teaching may be so severe that universities that consider traditional teaching as a "go-to technique" after COVID-19 may lose students to competing universities. Blended learning programs, which integrate asynchronous and synchronous communication strategies, experiential teaching, and both in-person and digital training, have great potential in higher education. The advantages of digital or e-learning include more personalization; the option to repeat lectures, if necessary; access to updated/upgraded information; cost savings; scalability (transferability to different settings); and lessened environmental effects [164]. However, as revealed by the outcomes of a study on faculty teaching remotely in the United States and Europe during COVID-19 [143], there is currently an emerging fear of the de-skilling and de-professionalization of faculty. Therefore, in order to avoid this, universities have to cautiously and strategically analyze the current situation and environment and take the necessary precautions and actions.

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Article

Unintended Pedagogical Consequences of Emergency Remote Teaching at a Rural-Based University in South Africa

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Abstract: In this empirical article, we argue that while emergency remote teaching (ERT) may have achieved its goal of saving the academic years during the COVID-19 pandemic, it also constructed unintended pedagogical consequences that were possibly overlooked at the time of advocating for it. We also contend that students and lecturers from rural-based universities (RBUs) in South Africa experienced different unintended pedagogical consequences compared to their counterparts who belong to urban-based universities (UBUs). Thus, the research question that the article raises is as follows: What were the unintended pedagogical consequences that students and lecturers based at RBUs experienced during the transition to ERT? Drawing on students' and lecturers' lived experiences of ERT, this article foregrounds unintended pedagogical consequences that arose at one RBU in South Africa during the transition from face-to-face teaching to ERT. Underpinned by the tenets of critical realism philosophy, as well as student integration theory, in-depth interviews with three lecturers and six students were conducted. The findings of the study indicate that home conditions, individual characteristics, pre-COVID-19 blended learning experiences, university training and support, teaching, learning, assessment practices, and policies altogether contributed to the construction of unintended pedagogical consequences of ERT presented in this article. These consequences include (1) the exclusion of low-income students from active teaching and learning, (2) equipping middle-class students with better chances of success than working-class students, (3) distressing female students and lecturers more than their male counterparts, and (4) unproductive assessment practices. This study may be beneficial to academics and policymakers from similar contexts in their plight to continue with remote teaching and assessment (RTA) after the pandemic.

Keywords: COVID-19 lockdown; critical realism; emergency remote teaching; higher education; rural-based university; unintended pedagogical consequences

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1. Introduction

South Africa is viewed as the most unequal country in the world, and this inequality is a large determinant of the country's high poverty rate [1]. The social inequalities in South Africa can be best understood by studying the apartheid policies [2] that produced them. The apartheid policies implemented in South Africa between 1948 and 1994 promoted white supremacy by fostering a culture of discrimination against the majority of non-white South Africans [3]. The Bantu Education Act (No. 47 of 1953) classified and separated education along racial lines (White, Indian, Coloured, and African education departments) [2] and the Extension of Universities Act (No. 45. of 1959) established higher education institutions for "non-whites" which were placed in deep rural areas [3]. This resulted in the establishment of separate universities for white and non-white students who attended urban-based universities (UBUs) and rural-based universities (RBUs), respectively. The realization of such policies rendered non-white students with inferior education and fewer learning opportunities as opposed to the white students who attended UBUs [2,3]. Subsequently, since the dawn of democracy in 1994, South African higher education revisited its policies

to address the past inequalities that were caused by the apartheid regime. The three resultant types of universities in South Africa are traditional universities, universities of technology, and comprehensive universities [4] that were established with the primary aim of expanding access for marginalized Black South Africans. This article describes a study conducted at a comprehensive RBU that was established in the year 2005 through the merger of two former Technikons with a traditional university [5]. Due to structural and cultural differences between the merged institutions that were all historically disadvantaged, it was difficult to establish a cohesive merged university that would be well-resourced [2,3].

Despite the modification of policies, numerous systematic segregation practices still exist, and because of their racial, ethnic, socioeconomic, or geographic backgrounds, many students are unable to participate fully in their own learning or make use of current educational resources. Some scholars believe that international standards are already attempting to impose a colonial education model in South Africa [2]. From the early 1990s onwards, many Black students who had performed well in their school-leaving examinations preferred to enroll in the better-resourced historically white UBUs that were now available to them [4]. While all universities recruit students from both urban and rural communities, rural middle-class students with better matric grades typically enroll in UBUs because they have better teaching and learning resources [4], even today. In the end, middle-class students are largely absent at historically Black RBUs [4]. Irrespective of their social class, students with higher matriculation grades have a greater chance of being awarded grants and scholarships. In contrast, students who perform poorly in their matriculation exams are typically the ones who enroll in RBUs. Numerous RBU students fall into this category, and some academics refer to them as underprepared students for university [4]. In contrast to their urban counterparts, RBUs are underfunded and under-resourced, making it difficult to recruit and retain highly experienced professors to teach in rural contexts.

This situation is not exclusive to South Africa. Research around the world suggests that young people who have the most access to and success in higher education are the children of middle-class, educated caregivers [4]. Since school-leaving examination performance and conditions in the home of origin are associated with the ability to access better schools, social class [4] is an increasingly important indicator in enrolment patterns across the globe [2,4]. This historical context of RBUs is provided to justify the argument that because of apartheid policies, UBUs have earned substantial advantages over their rural counterparts, and the inequities between them are extremely large in many respects, including human resources, teaching and learning facilities, the academic performance of students, financial status, research capacity, and the digital divide [6] among staff and students.

The transition from face-to-face pedagogy to technology-based ERT because of the COVID-19 pandemic occurred when the imbalances [7] described above persist between UBUs and RBUs. Long before the pandemic, RBUs grappled with inadequate teaching and learning facilities [2]. Subsequently, students' access to learning resources and academic support was limited during the transition to ERT at RBUs. Furthermore, some lecturers teaching at RBUs lacked the technological [5,8,9] and pedagogical expertise required to teach online and/or in blended learning environments [10]. Although ERT was deemed to be the most viable pedagogical solution during the time of the pandemic, its implementation was unplanned [5] and may not have been appropriate for everyone at the RBUs. In this article, we argue that, while ERT may have achieved its goal of saving the academic years during the COVID-19 pandemic, it also highlighted unintended pedagogical consequences that were possibly overlooked at the time of advocating for it. Although the unintended consequences discussed in this article may be experienced elsewhere, we argue that the extent of their materialization differs from context to context. A qualitative understanding of students' and lecturers' experiences of the transition to ERT was, therefore, necessary to understand the unplanned pedagogical consequences that arose during the transition, especially in the context of RBUs.

2. Emergency Remote Teaching at the Researched University

Emergency remote teaching is well documented in the literature globally since the eruption of the coronavirus pandemic (see, for instance, [7–9]). Scholars have reported on the results of empirical studies conducted in different contexts including higher education. However, only a few studies were conducted at the researched site [5,8,9] and other RBUs in South Africa. Given their segregated nature, some universities were able to adapt more seamlessly to the remote teaching and learning environment than others [5]. The transition to ERT at the studied university was not simple. In response to national initiatives, the studied university adopted a primarily online, technology-infused instructional model with a distinct delivery strategy to replace the contact model [5]. Although a blended learning strategy was adopted prior to the pandemic, technology integration in teaching and learning was minimal [8,9]. Early in April 2020, a technical task force was established to develop online policies and other related guidelines. The team consisted of academic and non-academic personnel with knowledge of online and Information and Communication Technology (ICT) instruction. This team was instrumental in driving the online learning initiative at the researched university. The team, comprised of Deans, Campus Rectors, and other relevant personnel, met regularly to assess the implementation of agreed-upon interventions, and monitor the progress [5].

Subsequently, in line with the ERT strategy of the university, a pilot study was conducted at the research site and the resultant framework influenced the future direction of the university (see [5]). The special training programs on using the university's learning management system (LMS), Blackboard Learn, and videoconferencing tools such as Microsoft Teams and Zoom, were held to prepare lecturers to teach and assess students in remote settings. The training was conducted simultaneously with the distribution of laptops to students and lecturers. Lecturers collected their resources from the university, but students collected them at designated sites that were communicated with them. Considering that social gathering restrictions were in place, only a limited number of laptops could be distributed on a given day. Subsequently, the university transitioned to ERT later than its counterparts. Unlike other universities, most students at the studied university are funded by the National Student Financial Aid Scheme (NSFAS). Learning from the NSFAS policy implies that their parents' combined income is less than three hundred and fifty thousand rand (SAR 350 000.00) per annum [11]. However, given that such training took place during a time of high uncertainty, frustration, and anxiety [12], its impact may have been less positive than it otherwise would have been. Whether lecturers achieved the learning outcomes of the online training programs or not, they were still mandated to teach and assess students remotely adopting the underlying principle of accommodating every student. While recognizing the benefits of ERT for students, instructors, and the university community, the aim of this article is to foreground the unintended pedagogical consequences of ERT by drawing on the students' and lecturers' reported experiences of teaching, learning, and assessment as they engaged with ERT in the context of an RBU. As stated earlier, the research site is representative of a group of universities in South Africa with roots in the apartheid educational structures that deliberately limited the quality of educational opportunities available to Black social groups [4]. Most of this group's institutions are located outside of South Africa's major cities [13]. In the South African higher education literature, there is a dearth of studies conducted in these institutions [14] due to the apartheid past. Therefore, this study significantly contributes to this knowledge gap in the field of technology adoption by an RBU during the time of the pandemic.

As the pandemic spread, students were forced to leave university campuses [13] and return to their homes [15] of origin. The closure of university campuses had implications for teaching and learning [8,16,17], particularly in remote settings. A history of inadequate resourcing [14] and ongoing funding challenges [18] have resulted in difficulties in the provision and use of technology [19]. During the pandemic, the university (research site), with the assistance of the Department of Higher Education and Training (DHET), provided laptop computers and data to almost all its students. Furthermore, lecturers were trained to

manage tuition in an online or blended learning environment and to administer formative and summative assessments online. However, given that students were forced to study at home [14,15], and that many of them come from rural areas, with some rural areas [13] in the Eastern Cape lacking electricity [2], it is important to study the participants' experiences of ERT to understand the unintended pedagogical consequences that may have occurred because of the transition to ERT. The purpose of this article, therefore, was to highlight the unintended pedagogical consequences of transitioning to ERT that arose at an RBU during the lockdown periods of the pandemic.

3. Materials and Methods

This article employed a case study research approach and purposive sampling [12] to recruit the participants. One of the authors works as a lecturer at the research site and, therefore, access to the participants was easy. One of the authors made an open invitation to seventeen lecturers in a selected department. Three lecturers agreed to participate in the study. The participating lecturers were then requested to invite their students to participate in the study as well. Lecturers communicated with 150 students from their classes. More than ten students promised to participate in the study. We set different dates for lecturers' interviews and focus group discussions for more than ten students. Six students were available for the focus group discussion, but individual interviews were conducted because of the decline in the anticipated number. Ultimately, the sample size for this study comprised three female lecturers and six second-year students (three males and three females). The students joined the university in January 2020. The three lecturers taught the same course to three different groups of students. Two students (one male and one female) were purposively selected from each of the three groups. The course lecturers identified students from their groups whom they believed would express their views freely, regardless of their socioeconomic background. Interview schedules were prepared for students and lecturers. Interview questions were aligned with the constructs of the Students Integration Theory. During the two-month period of May and June 2021, in-depth interviews were conducted with students and lecturers. The interviews were semi-structured to understand participants' experiences with ERT. The interview schedules were prepared for both student and lecturer interviews. The interview questions were structured around the concepts of the student integration theory and prompted participants to reflect on their personal experiences of teaching, learning, and assessment in general, social life as students and academics, and their home conditions during the pandemic. Interviews were semi-structured, implying that follow-up questions were made during interviews and new unplanned questions emerged during interviews. No discipline-related questions were asked. Since the case study approach was used [12], and there is a possibility of annual variation in student enrollments and shifts in lecturers' pedagogical and technological experiences, trying to extrapolate results directly to other populations is neither reasonable nor valid. Generalization was not the purpose of the sample selection or the overall study. The concepts deconstructed from student integration theory [20] were used also to analyze participants' interview data and are understood in this study as the main structures and mechanisms that influenced the lived experiences of both students and lecturers (see Figure 1 below). Gatekeepers' permission was sought and granted for the study. Anonymization was applied to all data.

Drawing on critical realism philosophy, the study adopted a critical realist lens to identify the structures and mechanisms that influenced students' and lecturers' lived experiences of ERT. According to Bhaskar's critical realism, three layers of reality exist: the empirical domain, the actual domain, and the real domain [4]. The empirical domain captures participants' experiences and observations and the actual domain is the layer of events from which these observations and experiences emerge. The real domain captures structures and mechanisms that are understood to exist independently of human action and thought [16]. This contrasts with events in the actual domain and experiences and observations in the empirical domain, which are understood to be relative [4].

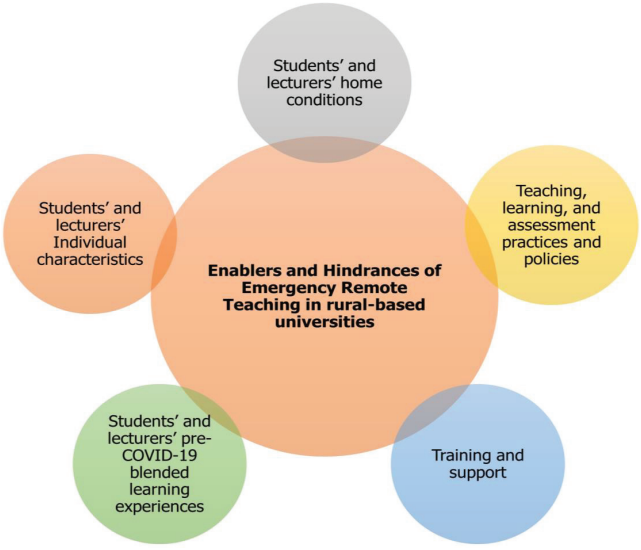

Figure 1. Enablers and hindrances of ERT at a rural-based university (Source: Authors).

Data were then subjected to a process of analysis involving abduction to identify the structures and mechanisms operating at the level of the real, in accordance with the tenets of critical realism [16] and student integration theory [20,21]. Abduction is the process of using theory to infer the existence of structures and mechanisms, as well as the interplay between them [4]. The concepts of student integration theory [20,21] were deconstructed as the explanatory theory in this abduction process, with the elements of the theory understood as structures and mechanisms located at the level of the real [4]. Critical realism acknowledges the existence of independent reality while also acknowledging the influence of human thoughts and actions on how we know and interpret that reality [4]. Critical realist researchers investigate the interaction of structures and mechanisms at the level of the real through the deductive process of abduction [4]. In moving from observations and experiences reported by participants to identify the enduring structures and mechanisms at the level of the real, critical realist researchers acknowledge their potential fallibility [4]. Any study based on critical realism must, therefore, check for fallibility using strategies such as member-checking and triangulation [4], and these processes were carried out during this study. The transcripts were sent back to the participants to verify the accuracy of the transcription conducted.

4. Results

The article sought to answer the following research question: What were the unintended pedagogical consequences that students and lecturers based at South African RBUs experienced during the transition to ERT? While many other concepts may exist, this study deconstructed concepts from student integration theory [20,21] to explain the findings. The results of this study are discussed according to the following five concepts, i.e., (1) Students' and lecturers' home conditions, (2) Students' and lecturers' individual characteristics, (3) Students' and lecturers' pre-COVID-19 blended learning experiences, (4) University training and support, and (5) Teaching, learning and assessment practices and policies. These concepts are understood as structures and mechanisms that triggered the emergence of participants' perspectives, (i.e., perceptions, practices, and experiences), from which the unintended consequences are drawn. It is important to note that these concepts are interlinked even though they were discussed separately. For instance, it is impractical to separate students' individual characteristics from their home conditions because of their interdependence. Figure 1 depicts these concepts.

4.1. Students' and Lecturers' Home Conditions

The interview data revealed that the student participants prioritized their choice of universities based on their family's affordability to pay for such university costs. Some student participants chose to attend RBUs on purpose because they could not afford tuition, housing, and other expenses at urban-based historically privileged universities. Some students enrolled at the studied university because it was closer to their homes. This was deemed necessary to save money on transportation to and from the university, as evidenced in the extract below from student participant 3:

> *I am the only child who passed grade 12 in my family. We all live here in the Eastern Cape at Ncise. I did not apply to other universities because they are far from home, and nobody is working at home. So, where would I get the money to travel when I wanted to see my child and my family? Accommodation is expensive. So, the NSFAS stipend would not be enough to provide for all my needs at other universities. At least now I can visit my family when I need to and support them financially with my NSFAS stipend when necessary.*

The extract above suggests that student participant 3 sometimes used her National Student Financial Aid Scheme (NSFAS) funds to support her family. This case may not have been unique to this participant, there could be many other students in a similar situation. This implies that NSFAS funds may, in some instances, be used to cover some unintended expenses, as student participant 3 has shown. The critical realist lens allows us to see that student participant 3's family background and her home's socioeconomic conditions influenced her decision to enroll in the studied university and to spend the funding in this manner.

In addition, some student participants indicated that they could not afford to buy extra data when the data provided by the university was depleted. Student participant 5 stated:

> *Data finishes before the month ends. Once that happens it becomes difficult to attend online classes. We can't even send emails or communicate with classmates on WhatsApp. It becomes worse when we must submit assignments or write online tests. We are forced to wait for the following month for the data to be reloaded*

Similarly, student participant 1 stated:

> *Sometimes we could not download notes, voice-over PowerPoint presentations, videos, and lecture recordings because data is not enough, it finishes before the month ends. We use the night data for downloads because it is more than the day data. But you can't use it to attend online lectures; I wish the university could increase the day data as well.*

To save data, students had to watch or download online videos or lecture recordings at night. This may have impacted their concentration levels during live lecture sessions during the day. Other challenges reported by student participants 2, 3, 4, and 6 included poor network connections, lack of electricity in some cases, and overcrowded households that made the environment detrimental to learning. Student participant 4 attested to the following statement:

> *There is no electricity at home, and we are many. Sometimes I helped my younger brothers with their homework because I am the only one with a computer at home. As a result, the battery and data do not last long. Even at res. (student residences) there is a lot of noise. Some students speak out loudly and some play loud music when they do not have classes. So, we do not hear properly sometimes during live online classes. Given a choice, I would prefer to attend face-to-face classes. Online classes are not good for me in many ways.*

The extract from student participant 4's interview data is the empirical evidence of the participant's reasons for his frustration with online classes and his preference for face-to-face classes. The critical realist lens allows us to see that students who come from low-income homes are likely to have experienced online teaching differently than students

who come from middle-class families. This finding indicates that laptops and data provided to university students to learn remotely may not have been sufficient to enable efficient ERT. More needs to be accomplished to extend battery life and network access for students who live in rural areas without electricity. The finding also proposes the need for the revision of students' allocation practices to residences. For instance, the students who registered for common qualifications and are accommodated together are likely to attend at the same time and work together fittingly. This arrangement could not only improve the efficiency of online classes but also improve the sense of belonging and related social aspects of students' life.

Student participants 1, 2, and 3 indicated that they spent much time doing household chores and ended up not having enough time for their studies. For instance, student participant 2 asserted:

> *Studying from home was not easy for me. I had to use abnormal working hours to finish different activities. I had to strike the balance between domestic work activities and academic activities by waking up early and sleeping late at night. My typical day would start with making breakfast and cleaning, cooking during the day, and preparing supper. These were the activities I would not be doing if I were on campus. Sometimes I would be too tired that I could not complete the academic work in the way that I would if I were not at home.*

Female participants reported this constraint more than their male counterparts. Only one male student participant, participant 5, indicated having missed afternoon classes because of household chores. He asserted:

> *Domestic work did not affect me that much. It was only Monday and Wednesday classes that were affected. They ended late at 16:30 pm and I had a responsibility of looking after cattle when I was at home. So, I had to leave at home around 16:00 pm more especially during Winter to look for cattle in the veld. Other than that, no other household chores affected my studies.*

The critical realist lens allows us to see that the social construction of gender roles by the rural communities where the student participants lived resulted in differing experiences of ERT among male and female participants.

Similarly, the home conditions of lecturer participants also contributed to the experiences that emerged in the adoption of ERT. One lecturer indicated that she has a study room that every family member respects. So, she makes time to prepare and record video lectures to share with students with ease. Lecturer participant 2 asserted,

> *It really helped to make my husband and children understand and respect my privacy as a lecturer during ERT. For instance, I would tell my children not to disturb me once I was in the study room. I would then record my lecture videos peacefully. Even when I conducted live lecture sessions, my children would not disturb me. I don't know if I were to stay with my parents or in-laws at home; maybe I would be narrating a different story now. But my husband also respected my preparation and live lecture times.*

On the contrary, the other two lecturer participants, participants 1 and 3, reported having been struggling to secure a quiet space at home to record lecture videos and/or offer live lecture sessions. As a result, preferred to go to their offices to record videos or conduct online sessions. Lecturer participant 1 stated:

> *The challenging part of ERT was that all my children were at home. I had to assist them in searching for information online to complete their assignments while I also had a task of preparing for my lectures. Balancing the responsibilities of being a mother and a lecturer was challenging. You could not run away from the household chores such as preparing food and cleaning, more especially when you have young children, you know! And hiring an assistant was risky at that time. The only viable solution was to use my office at work to record and conduct online sessions or use the quiet times at night to record videos while children were asleep.*

It could be observed from the finding presented above that lecturer participants' home conditions influenced the way they experienced ERT. The findings imply that the home conditions did not only influence the student participants, but they also exposed lecturer participants to similar challenges.

4.2. Students' and Lecturers' Individual Characteristics

When reviewing the set of transcripts of both the student and lecturer participants, a variation in the levels of technological skills and abilities was noted. Student participants attributed their level of skills and abilities directly to their basic education experiences. This may be evidenced by what student participant 6 shared: *"I was fortunate to be introduced to computer applications subject in my matric. The computer literacy skills that I had were improved as the result of online learning"*. The critical realist analysis of this finding suggests that student participant 6 was likely to come from a middle-class home and attended one of the better-resourced schools that is likely to be a private school.

On the contrary, many student participants indicated that they had no prior experience using computers. For instance, student participant 1 stated:

> *It was very difficult for me to learn how to use a computer on my own without any previous experience. I had to spend much data watching YouTube videos on how to perform certain tasks using a computer and I was not good in searching for the relevant videos. I could not submit assignments on time because I was slow in typing and sometimes, I did not know how to perform certain tasks.*

The extract from the student participant above suggests that the perception of the adequacy of the data provided by the university to students could also be subject to the computer literacy skills of students. Computer-literate students could have spent the data differently; obviously not watching the same YouTube videos that the computer-illiterate student participants claimed to have watched. This finding confirms that students from low-income homes experienced ERT differently than students from middle-class homes.

Some students perceived online lectures as uninteresting compared to traditional face-to-face classes. They reported online teaching lacked debates, discussions, and demonstrations as learning strategies. Student participant 6, for instance, stated:

> *I found online teaching to be limiting the development of students' social skills. Some of us are talkative and understand the subjects better when we debate topics among ourselves as students. We need to improve our presentation skills because we need them in the workplace. For a lecture to be enjoyable, it needs to combine teaching methods that allow students to participate in learning; sometimes in teaching our peers and learn from one another. Online tests require us to answer multiple-choice questions most of the time. We are not given enough chance to explain our answers. This encourages us to memorize answers and I am not good in doing that. I prefer to express myself. But I do understand that some of us are not good at typing . . .*

The above extract suggests that online teaching may have been inadequate in engaging all students effectively in learning. The move to ERT seems to have supported students who preferred rote learning approaches and deterred students who adopted deep approaches to learning. Likewise, students who were computer-literate were better off than students who were computer-illiterate. Students providing similar extracts to the one presented above are likely to be students who had developed active learning skills in their prior schooling. Similarly, students who studied through rote learning in high school are likely to have enjoyed the assessment practices adopted in online tests unless they were stimulated otherwise.

Lecturer participants agreed that online summative tests were developed mainly using objective question types such as multiple-choice questions, true or false questions, fill-in-the-blank, and matching columns. Lecturer participant 1 asserted:

> *In ideal situations, a lecturer would want students to express themselves openly in online assessments by asking them open-ended questions. But given that some students*

> *were computer illiterate, that would mean that most of them would not finish writing assessments on time. They would spend much of the time trying to type their answers, which might lead to anxiety and poor performance, not because they don't understand the subject content, but since they are not competent in the new assessment platform. So, I limited the number of open-ended questions I posed in summative assessments.*

The above extract suggests that the design of assessment tasks by some lecturers might have fallen short in assessing higher-order thinking and critical thinking skills, depending on the lecturers' perceptions of what it means to assess computer-illiterate students online and lecturers' competencies in formulating good assessment questions. This is another aspect that could be addressed through pedagogical training [15] of lecturers as assessors in online environments.

The general observation by both lecturer and student participants was that students' participation was restricted during online classes even if they were encouraged to speak. Lecturer participants attested that because of students' unwillingness to speak it was difficult to engage them meaningfully in class discussions. Student participant 3 stated: "*I could not speak during live lectures because I am a shy person*". In contrast, student participant 5 stated that he participated better in live online lectures because he was shy. He said: "*. . . the fact that lecturers and classmates cannot see me when talking makes me confident to speak during online classes because I am a shy person*". The language of instruction was reported as a barrier by many student participants. They were not confident in speaking English. Student participant 5, for instance, stated:

> *I struggle to speak in public whether I speak face to face or in online environments. Ndiyathintitha (a phrase in IsiXhosa that means, I stutter). I become worse when I speak English. I can't speak English vocally; I prefer to write it. I am worried that I can make mistakes in my speech. I think about the class recording that will be shared with me having made the grammar mistakes. Yhoo! That does not sit well with me. So that is why I can't speak when the session is recorded. I don't want to embarrass myself.*

The above extract suggests that some students could have preferred to participate only when the virtual sessions were not recorded. Failure to record live sessions, though, disadvantaged students who could not attend live lectures because of network glitches and other reasons. This finding also suggests that some student participants could have deliberately excluded themselves in class discussions because they could not express themselves confidently in English, although they were encouraged to code-switch.

4.3. Students' and Lecturers' Pre-COVID-19 Blended Learning Experiences

The interviewed lecturer participants indicated that they did not use blended learning in their classrooms prior to COVID-19, except for one lecturer participant who indicated to have a fair knowledge of the learning management system and used it a few years before the pandemic. Lecturer participant 3 asserted:

> *I started using Blackboard in 2015 after attending a training that the university organized. I used it mainly to share learning materials with students and to conduct formative and summative assessments. I conducted summative assessments in a controlled lab environment to avoid plagiarism. During the pandemic I didn't struggle much, instead, I was one of the e-learning champions who assisted in training colleagues in their departments to use the Blackboard for emergency remote teaching. I never used video conferencing software before the pandemic . . . I don't think the time for the training we had at the beginning of 2020 was enough. I was fortunate that I already started using blended learning way before the pandemic, but for someone who had no prior experience, I don't think they would have grasped all the ideas presented in the training in that short space of time.*

The extract from lecturer participant 3 confirms that lecturers' prior knowledge of LMSs influenced the ways they transitioned and adapted to ERT. Lecturers who had no prior knowledge of blended learning were likely to struggle to adapt to the new ERT environment.

Sharing the same sentiments, lecturer participant 1 asserted:

> *Even though the training sessions prepared me to understand how Microsoft Teams, Blackboard, and Moodle work, I found it difficult to understand practical ways of involving students in discussions during live lectures. Also, I could not use enough discussion questions in assessments because most students were slow typists and could not finish writing timed assessments on time.*

The extracts from lecturer participants' interview data confirm that the training was not enough to prepare inexperienced lecturers to manage online classes effectively at the beginning of ERT. As a result, after the training, the common approach that some lecturers adopted was to upload eBooks, handouts, voice-over PowerPoint presentations, self-made videos, lecture recordings, and YouTube videos to the university's LMSs [15]. Students had to download the uploaded learning materials and read or listen to them offline to save data. Subsequently, students could not engage meaningfully with learning materials as they would in a traditional face-to-face class [15].

Student participant 4 attested:

> *All university students were trained in using Blackboard and Moodle, but the time was not enough. I used Blackboard for the first time in 2020. When I started to understand it, the university shifted to Moodle. The time the university spent training us was not enough, but I managed to understand both apps by educating myself and watching YouTube videos.*

The extracts from both students and lecturer participants above suggest that the training that was provided at the beginning of 2020 that attempted to prepare both students and lecturers technologically to use the university's LMSs was not enough [15].

When prompted to comment on the underlying reasons for the preferred invisibility by students during live lectures, student participants mentioned saving data as the main reason for deactivating live videos. They also indicated that they were not comfortable subjecting their home conditions to the public. Student participant 5 reported:

> *Lecturers share live lecture recordings with all students after the class. In most cases, the videos are not edited. This means that my home conditions may be exposed. As I am being recorded, whoever watches the recording will see me and the home environment during the time of the recording . . . There are certain things about my home condition that I would not like the public to see . . .*

The practice of maintaining anonymity in live lectures made it difficult for lecturers to see students who were listening attentively during lectures even though they were allowed to deactivate their videos. Sometimes students would sit in one place and share one computer to save data. This practice discouraged lecturers because they would think that few students had attended the lecture whereas there might have been more students attending than what the videoconferencing system showed. The opposite was true in some cases; lecturers would teach a few students thinking that those who had not logged on were sharing computers with friends. This implies that students' attendance was difficult to monitor and control during ERT because of the reasons stated above.

4.4. Training and Support for Both Students and Lecturers

The student participants acknowledged that the university had support structures in place to provide a smooth transition to ERT during the pandemic; however, they believe that it was not enough to support them both academically and socially during ERT, as student participant 6 attested:

> *. . . Sometimes the phone numbers that we were given for academic support were not picked up and at other times as students, we did not have airtime to phone them. Where email addresses were given, there was a challenge of delayed responses. Maybe that could be because of the large number of students requesting the same services or because of the network challenges... Access to an online library was also difficult because it needs data,*

> *network connection, and electricity. The location of my home in a rural area made it difficult to access learning materials from the library.*

Due to insufficient data and increased network challenges, some students struggled to collaborate with their peers and to communicate with their lecturers while they were studying from home. Subsequently, some students felt isolated and depressed and ended up deregistering from some courses that they believed were problematic. Student participant 1 attested to this claim by saying:

> *I don't want to lie. I was tempted to cancel the registration of some of my modules as some of my friends did. I had no hope that I would manage to study so many modules independently because I am used to studying in groups with my friends. Thank God, I did not cancel them because I managed to pass all of them through the support that I received from the Writing Centre of the university and the WhatsApp support group that my classmates created.*

It could be seen from the analysis of participants' interview data that the availability of network connections and data was critical in all participants' lived experiences of ERT. Their availability correlated to better experiences of ERT while their unavailability related to worst experiences. The socioeconomic conditions of students' homes strongly emerged as structures at the level of the real that influenced students' home conditions and the availability of data.

4.5. Teaching, Learning, and Assessment Practices and Policies

As evidenced in the studied university's website, the university revised its teaching, learning, and assessment policies to accommodate ERT. When ERT was adopted, the policies encouraged the adoption of any educational technologies that could assist lecturers in their teaching endeavors. However, summative assessments were restricted to the university's approved learning management systems (LMS), Blackboard, and Moodle. Lecturer participant 3 stated:

> *Blackboard was the LMS that the university used since 2009, but when the university shifted to ERT the version of Blackboard that the university used became overloaded and difficult to maintain, triggering the move to its cloud-based platform that became much more expensive. Subsequently, the university adopted a new LMS, Moodle, that was much cheaper than Blackboard. However, the shift to Moodle necessitated another training to equip both lecturers and students. Then again, the training provided was not enough to prepare lecturers to engage students meaningfully in learning and assessing higher-order thinking and critical thinking.*

The problem with online exams was that the integrity of assessments could not be verified. Students may have shared their login passwords with acquaintances who may have been asked to write on behalf of enrolled students, or students may have written individual exams in groups, according to lecturer participants. Respondus Lockdown Browser and Respondus Monitor were used as proctoring tools by the institution to prevent cheating during online assessments. Due to network issues and restricted bandwidth, the quality of Respondus Monitor clips was occasionally poor, making it difficult for lecturers to ascertain whether students had cheated or not. In such circumstances, lecturers have the discretion to allow students to repeat online examinations in a controlled setting in the lecturer's presence if they were suspected of cheating in the prior online assessment. Although the accuracy of Respondus in avoiding cheating cannot be guaranteed, it has been considered to assist in lowering students' probabilities of cheating, thereby contributing to enhancing the integrity of online exams.

5. Discussion

The findings of this study were explained in the previous section using the five concepts of students' integration theory. The concepts are (1) Home conditions of students and lecturers, (2) Individual characteristics of students and lecturers, (3) Pre-COVID-19 blended

learning experiences of students and lecturers, (4) University training and support, and (5) Teaching, learning, and assessment practices and policies. These concepts are interpreted as structures and mechanisms that triggered the emergence of participants' perceptions, practices, and experiences, from which the unintended pedagogical consequences of ERT are observed. The key findings that could be drawn from the results explained above are summarized as follows: (1) low-income students are excluded from active teaching and learning, (2) middle-class students have better chances of success than working-class students, (3) during ERT, female students and lecturers were more distressed than their male counterparts, and (4) unproductive assessment practices emerged during ERT. We will now discuss the findings of the study.

South Africa's multidimensional divide [3,6] that exists between UBUs and RBUs [19] may be reflective of a social connection prompted by apartheid's substantial political influence on the structure, organization, and location of universities [2,3]. Although racial discrimination may still exist among South Africans, the most significant divide among Black South Africans is the difference between the poor and the wealthy, the lower class, and the middle class. This divide results in imbalanced access to opportunities and basic infrastructure [2,6]. Social class influences how we live and experience life in general. For instance, the funding formula of the National Student Financial Aid Scheme (NSFAS) excludes some South African university students based on the social status of their parents. This group of students is commonly referred to as "the missing middle" because of the structuring of the funding policy that makes them neither poor to receive assistance from the government nor wealthy enough to fund themselves [11]. This type of policy-based discrimination is not limited to higher education; it emerges in other policies as well. Reducing discrimination would necessitate a call for the emancipation of the marginalized through the improved provision and access to digital infrastructure, particularly in the service of education, because education was used as a means of control to promote white supremacy at the expense of the non-white population [3]. Access to resources alone may not be sufficient to bridge the divide [6]. Extensive training of lecturers and students [15] would thus be essential to use technology effectively for teaching and learning in the context of RBUs. The critical realist analysis of student participants' empirical data confirms that students who register in RBUs are low-income students who deliberately choose to study in RBUs because they cannot afford to study in other universities [3,4]. This finding coincides with [22]'s assertion that low-income students cannot afford to study at expensive universities. Many students in RBUs in South Africa are thus working-class students [2,3]. The student body is generally diverse [20] in all institutional types. Students possess different attributes such as learning styles, attitudes, perspectives, values, and goals [20]. In addition, students' personal, religious, and cultural values underpin their behaviors. Student participant 1, for instance, asserted: *" . . . as a child born and bred in a Christian family of moral values, I cannot cheat in tests and examinations . . . even if my classmates cheat."* The extract shows how the student participant drew on family values to abide by the university's academic integrity policy during online summative assessments. It would be inappropriate, though, to assume that all students who come from a Christian background would respond to cheating in the same way. Generally, an individual's habitus can thus be understood to reflect their demographic characteristics as well as cultural and social capital [23]. Students' personal characteristics influence the way they behave, perceive and experience university life and ultimately the way they integrate with the university culture [21,24]. Students whose personal values are aligned with the available university structures [4,24], whether political or religious, are likely to feel more connected to the university compared to students who do not find their associates [21]. The way students perceive and experience integration with the university is directly linked to how they perform in their studies.

During the pandemic, students were forced to study at home. This meant that what would have been conducted at the university had to be performed at home because of the pandemic. This change caused an increased workload for both teachers and students [18,25–27].

Students' home conditions were completely different [20,25]. Many students could not access the internet [9] when they were at home because of the unavailability of a network connection [28] and electricity [15], and sometimes the unaffordability of data [25] after what was offered by the university was depleted. The findings suggest that the early depletion of data could be attributed to the computer illiteracy of the student and the inefficient pedagogical approaches of lecturers. The computer-illiterate student could spend a large portion of the data watching "how to . . . " videos on YouTube because they are computer-illiterate. Alternatively, lecturers could use unproductive live lecture methods that require long time attendance to address issues that could possibly be addressed in less time.

The critical realist lens allows us to connect the unaffordability of data to the socioeconomic status of students' homes. Students who come from low-income homes are likely to experience this limitation more than students who come from middle-class homes. Social class can thus be seen to play a role in shaping students' experiences of ERT. Early depletion of data coupled with the unaffordability of data would mean that the student is excluded from the teaching and learning process. In such cases, students use night data to download lecture recordings. The disadvantage of relying on downloaded lecture recordings is that students do not have the opportunity to engage in the discussion. They passively observe what took place during the class and learn from that. Perhaps if they were part of the discussion, they could have experienced the class differently. ERT could be seen to benefit students who can afford to buy data while disadvantaging those who cannot afford to. The subsequent unintended pedagogical consequence of ERT in this case is the lack of adequate epistemological access by low-income students. This implies that the underlying principle of not leaving any student behind was not adequately observed, since middle-class students could be seen to benefit from class attendance more than working-class students. ERT thus intensified the digital and educational divide between low-income and middle-class students. It has been acknowledged that the lower levels of technology exposure among students coupled with the lower financial position of the institution pose substantial impediments to bridging the digital divide [2]. In this article, we argue that critical reflection on the digital divide and attempts to address it should take a contextual rather than a technology-centric perspective. Providing laptops and internet access alone is insufficient to bridge the digital divide [29]. This provision is essential, but it should be accompanied by skill development, a shift in mentality, and an acknowledgment of the magnitude of the problem [2].

Working-class students who stay on campus are likely to have more chances of accessing resources, such as the library and computer labs, compared to students who stay off campus [30]. In addition, students who stay on campus are more likely to know senior students who studied the same courses, and subsequently have better chances of peer support and integration into the university culture [21]. Moreover, they are likely to be involved in extramural activities, in so doing expanding their social network. Students are social beings [4,31], so the sense of belonging is critical to their well-being. During the pandemic, students returned to the university campuses only after the lockdown restrictions were relaxed. During the hard lockdown, social media played a major role in linking peers from different geographical areas and the availability of data and network were crucial.

ERT was thus rated lower than traditional lectures in relation to students' engagement in class activities [9,22]. Students who study at home report less positive university experiences, lower levels of engagement in academic studies, student social life, and extracurricular activities, and fewer opportunities to develop social and cultural capital and learning through informal interaction [20,23]. Academic and social integration during the pandemic was essential to determine whether students continued pursuing their goals in the university or gave up the academic years [21]. Restrictions on gathering and traveling prevented physical collaboration between students, lecturers, and research and conference attendance resulting in social loneliness [32]. This resulted in students and lecturers feeling alienated and suffering from mental health issues, such as depression and anxiety, arising from increased stress [26], workloads [32], and isolation [28]. Ultimately, lecturers took

sick leave and students ran the risk of dropping out [26]. It is for this reason that the university's counseling facilities were critical to assist students and academics emotionally. However, some students, especially first-year students, were not aware of the existence of such facilities, while others preferred not to use them because of the stigma associated with them. In many respects, COVID-19 exacerbated inequality [7,26] in varying levels of family support for students during the pandemic [33]. Again, the critical realist lens allows us to associate the differentiated family support of students with their family's socioeconomic standing where middle-class families were seen to support students more significantly than working-class families.

Different lecturers' pedagogical approaches influenced the way students experienced ERT [7,10,30,31,34]. Lecturers began to use media or teaching methods that they were familiar with and perceived as useful and appropriate [32,34]. Some lecturers had no idea how to transform their existing teaching resources into online learning spaces [5,8,9]. Subsequently, such lecturers taught in online classes in the same way they would teach in traditional lectures [26]. The lecturer would spend almost ninety minutes of teaching trying to engage students in discussions that most of the time were not successful because students could not participate in them. This pedagogical approach consumed a lot of data. On the contrary, many students expressed dissatisfaction with the lack of engaging, collaborative, and interactive class discussions [22] in the context of UBUs.

The results of the study have explained some of the reasons for students not participating in live lectures. One of the reasons was a lack of confidence in the language of instruction. The opposite is true in UBUs. Most students showed their willingness to participate in class discussions. Prior schooling experiences emerge as a causal mechanism for students to experience live classes differently. Universities are not the same and, as a result, strategies that are supportive at one university might not be appropriate for another. One university might be privileged and have easy access to technology and motivated lecturers; other universities might have to address students that were barely reachable since they did not have proper means to access the internet while staying at home [32].

Regarding assessments, some students stated that online assessments were much easier than traditional venue-based assessments. This finding is also directly linked to the pedagogical expertise of lecturers. Some lecturers found it challenging to assess students authentically online [28]. For instance, while they could be aware of assessment practices such as open-book examinations [26], they might not have been equipped to set questions for that kind of assessment. The underlying principle of setting open-book assessments is that students should not be able to find direct answers online if good questions are asked. Lecturers need training [15] in designing and developing good assessment questions. Alternatively, some lecturers would use discussion forums to minimize the amount of data consumed during live sessions. Again, only a few students participated in online discussion forums.

The overall finding thus was that some lecturers lacked pedagogical knowledge and experience in teaching online [26,28]. This implies that pedagogical training is essential [26] if lecturers must teach and assess effectively in online environments. Lack of adequate engagement in learning and limited authentic assessment practices that encourage deep approaches to learning would mean that epistemological access to students' learning is questionable during the era of ERT.

The findings and discussion provided above show how the personal attributes of students and lecturers enabled and constrained their academic and social integration into the university during the pandemic [20]. Lecturers who used blended learning before the pandemic transitioned to ERT differently than lecturers who used blended learning for the first time [30] during the pandemic. In addition, the way lecturers managed their classes could have been experienced differently by students depending on students' prior experiences [20] of blended learning. For instance, the technologically experienced lecturer reported using discussion forums to engage students and tried innovative ways to minimize data consumption, whereas the less technologically competent lecturer was not so effective in engaging students and saving data.

We could see through the critical realist lens that the socioeconomic conditions of students emerged as the conditioning structures for the experiences and observations that emerged for both students and lecturers. For instance, poor attendance of virtual classes by students was seen to have been triggered by infrastructural and socioeconomic constraints, such as the unavailability of network connection, the unavailability of electricity [31], and the unavailability of data [26]. The cultural constraint associated with the social construction of gender roles in students' homes, such as looking after cattle by male students and doing household chores [13,30] by female students, also surfaced in the study. The discrimination of females compared to their male counterparts in many aspects of social life is prominent in African countries and is well-recorded in the literature. Therefore, the higher education systems should not by any means perpetuate past inequalities. These technological and social structures are enduring and are likely to constrain future adoption of remote teaching beyond the pandemic if students continue to study from home. The critical analysis lens has allowed us to go beyond observations and experiences reported by student and lecturer participants to understand the underlying structures from which the events emerged. For instance, the recording of live online sessions was reported to have caused some students to stop participating in discussions. This might be because they were not confident in speaking the language of instruction or because they were not given the freedom to speak in their home language in cases where both lecturers and students understood students' home language. Lack of confidence to speak in public could be attributed to students' prior schooling and personal attributes that were discussed earlier in the article. Such events, observations, and experiences are linked to the structures at the level of the real, such as the family's socioeconomic conditions.

The findings of this study resonate with the findings recorded on Chinese middle school students. Rural students reported lower levels of achieving learning outcomes in e-learning courses than their urban peers. Although the study was not conducted in a university setting, it confirms the existence of the digital outcome divide between rural and urban students. Universities recruit their students from these schools. This confirms the correlation between high schools and universities. The primary causes of the digital outcome divide are differences between rural and urban students in habitus, (i.e., intrinsic motivation), forms of capital, including cultural, (i.e., e-learning self-efficacy), and social capital, (i.e., parental and teacher support) [20]. Thirdly, it was confirmed that these structures could be interpreted as the causal mechanisms for the digital outcome divide between urban and rural students, and that e-learning self-efficacy, intrinsic motivation, and parental support were the most influential structures in the rural-urban digital achievement gap in the e-learning context [22]. The digital outcome divide is understood as the difference in achieving learning outcomes because of the influence of other forms of the social divide [22]. The working-class students missed out on opportunities to engage meaningfully with learning materials because, for a variety of reasons, they were unable to attend all live sessions [35]. As a result, their epistemological access may be rated lower than their counterparts [19]. Inadequate assessment practices in the online environment by some lecturers, though, may fall short of identifying this gap in epistemological access. Additionally, the digital divide [3,29,36,37] that existed prior to the pandemic was exacerbated by the shift to ERT [25]. While some working-class students used their bursary funds to support their families, middle-class students purchased more advanced educational technologies. Furthermore, insufficient lecturer training [15] could have resulted in lower quality standards of teaching and assessment than could have been possible in traditional face-to-face classes. Another troubling finding was that the legitimacy of online assessments could not be guaranteed because assessments were not monitored [38]. It might be possible that students in some courses assisted one another in completing online summative assessments. The availability of proctoring software does not eliminate academic dishonesty completely. Recent research conducted in South Africa [38] confirmed that several factors contributed to academic dishonesty among students during the pandemic. Among these factors was (1) the availability of online content with ease. (2) Students felt overloaded and anxious.

(3) Lack of invigilation. (4) Ineffective time management. (5) Lecturers recycle questions and allocate excessive time for assessments. (6) The academic inexperience of students. (7) Having difficulty with technology [38]. These are some of the unintended pedagogical consequences that participants' interviews revealed. Future research should be designed and developed to address these issues. The study confirms that lecturers require more training [15] not only to be technologically competent, but also to be pedagogically competent in the online environment to manage these challenges. Furthermore, universities, especially RBUs, should have plans in place to accommodate students who are unable to engage with online materials due to home circumstances, as discussed in the study.

6. Limitations

ERT brought many opportunities for students and lecturers in all types of higher education institutions, including RBUs. However, they are not discussed in this study; they were excluded from the purpose of the study, which was to highlight the unintended pedagogical consequences of ERT. The unintended pedagogical consequences discussed in this article are neither exhaustive nor exclusive to the institution under study; they are experienced globally, including at historically privileged institutions. For instance, a study conducted at a historically advantaged university in South Africa confirmed that most students who participated in the study experienced more disadvantages than benefits. A total of 2744 complaints ranged from distractions to inequitable living and working environments and a total of 1584 benefits ranged from adaptability to self-directed learning [22]. Our study was significant to contribute to the dearth of knowledge produced by rural universities in South Africa [14]. Its qualitative nature prevents the generalization of its findings. Its findings are only applicable to comparable situations. Another limitation is the employed framework. It did not elaborate on the participants' technological experiences and psychological states during the transition. Future research could be conducted to gain a comprehensive understanding of these concepts.

7. Conclusions

The digital divide in South Africa is diverse, requiring the liberation of marginalized communities through improved access to digital infrastructure, primarily in basic and higher education [2]. To use technology effectively for teaching and learning at RBUs, lecturers and students would, therefore, require extensive training [15]. Students coming from low-income homes should not be perceived as defective stakeholders that need to be fixed. The social and cultural structures beyond their control support middle-class students and marginalize students from low-income homes. Higher education policies and practices should not discriminate against any students; instead, they should be designed to emancipate them. Universities, academics, and support staff were "underprepared" to perform their duties effectively during the pandemic. The challenges RBUs experience are influenced largely by the higher education policies that require drastic restructuring to emancipate rural communities. The key findings drawn from participants' interview data presented above are that (1) Students' and lecturers' home conditions inclined the way students and lecturers perceived, practiced, and experienced ERT, (2) students' and lecturers' individual attributes influenced how students and lecturers perceived, practiced, and experienced ERT, (3) students' and lecturers' blended learning experiences before the pandemic determined the way lecturers perceived, practiced, and experienced ERT, (4) the training and support that the university provided to students and lecturers were connected to the way students and lecturers perceived, practiced, and experienced ERT, and (5) the teaching, learning, assessment practices, and policies of the university affected students' and lecturers' perceptions, practices, and experiences of ERT.

Although ERT was meant to save the academic years during the pandemic and accommodate every student, the way it was implemented may not have been completely productive in RBUs. As a result, it constructed unintended pedagogical consequences, such as, (1) the exclusion of low-income students in the process of active teaching and learning,

(2) equipping middle-class students with better chances of success than working-class students, (3) distressing female students and lecturers more than their male counterparts, and (4) unproductive assessment practices that may have fallen short to assess students' learning comprehensively.

8. Recommendations

To confront these challenges, (1) university policies should concentrate on responding to the concerns of the digital divide [22,36], (2) lecturers should be given more autonomy to be innovative in their teaching and assessment practices, (3) flexible methods of assessment should be encouraged, (4) less technological pedagogical models that may be better suited to areas lacking a reliable internet connection should be explored because technology is not always a viable solution in all contexts, (5) infrastructure that supports hybrid blended learning should be acquired to accommodate students who prefer to learn online and through on-contact lectures simultaneously, (6) most importantly, instructional designers who train lecturers should be well conversant in the latest technologies and pedagogical approaches that are appropriate for the teaching and learning environments of the university. Ultimately, lecturers should be well-equipped both pedagogically and technologically, and (7) hybrid modes of teaching and assessment should be considered to take advantage of the best practices of online and contact education, blending them seamlessly to accommodate both students with and students without the necessary resources to engage meaningfully online.

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Face-to-Face or Online Learning in Applied Statistics in Health Sciences? Failed Experiment or Opportunity after COVID-19?

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Abstract: The rapid spread of the COVID-19 worldwide led to the migration of the traditional education system based on the face-to-face classroom into an improvised online system, among many other preventive measures. Thus, all teaching methods had to be adapted to this new modality. This work is aimed at studying the viability of the online teaching of the subject of Applied Statistics in Health Sciences in higher education based on the teaching experience lived during COVID-19. In addition to this, possible technological difficulties and COVID-19-derived problems were investigated. A retrospective observational cross-sectional study was performed to analyze the students' satisfaction according to the teaching methodologies in both face-to-face and online modalities. An exploratory and inferential analysis revealed that online teaching is feasible for the subject under study, although face-to-face learning still continues to significantly revert in favor of the quality of teaching. Therefore, further research is required to develop new online teaching methods given the feasibility of the proposal found in this research. Most of the students reported not having technological learning difficulties, whether related to their connectivity or technological resources, which did not have a significative impact on their teaching perception. Despite the psychological sequalae of COVID-19, this did not affect the students' teaching satisfaction.

Keywords: teaching methodologies; face-to-face teaching; online teaching; COVID-19; learning difficulties; statistics teaching; remote evaluation

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1. Introduction

Statistics is a field of knowledge which mainly comprises the collection, analysis, and interpretation of data. All evidence-based research needs to use its tools to obtain rigorous results on the raised research questions. Thus, Statistics is the basis of the scientific method and, consequently, it is the reason for being included in the study plans comprising all science degrees, whether exact, social, or health sciences in higher education. In particular, Statistics plays a crucial role in research planning and decision-making in the health sciences [1]. Among many other applications, it includes understanding the risk factors for communities, tracking and monitoring diseases, witnessing the impact of policy changes, and assessing the quality and safety of health care according to the National Library of Medicine [2]. This work focuses on the subject of Applied Statistics in Health Sciences which is part of the Nursing degree curriculum, as established in [3]. This subject takes place in the second semester of the first course of the nursing degree according to the study plan.

Following Greenberg [4], distance learning is defined as "a planned teaching/learning experience that uses a wide spectrum of technologies to reach learners at a distance and

is designed to encourage learner interaction and certification of learning". In this work, distance learning will be indifferently named virtual learning, online learning, or e-learning. Nowadays, there is a growing interest in distance education due to the numerous advantages that it offers. Among others, they highlight the fact that university education can be acceded at one's convenience at your own pace via the internet and the World Wide Web [5] and the possibility of offering educational opportunities to many people who would otherwise be excluded from the traditional higher education system [6]. Nevertheless, the so-named theory of online learning has been both celebrated and condemned in educational practice and research [7]. Motivated to clarify this issue, the main research question set out in this paper is whether it is feasible the online teaching of the subject of Applied Statistics in Health Sciences based on students' perception. Critics of online learning theory stated that too strict adherence to any theoretical viewpoint often filters our perceptions and thus blind us to important lessons of reality [8]. Thus, the present research aims to answer the previous research question by comparing teaching methodologies in the traditional face-to-face and emerging online modalities based on the teaching experience lived during the COVID-19 pandemic.

COVID-19 was declared a global public health emergency on 30 January 2020 and was later declared as a pandemic on 11 March 2020 by the World Health Organization [9]. Consequently, the Spanish population was confined to their homes without the possibility of leaving them except for exceptional reasons of force majeure [10]. This situation was extended until May, when the so-called "de-escalation" began which, although it allowed a progressive slow return to normality, it prevented the return to classrooms for the rest of the academic year. Among other precautions, the transition from face-to-face conservative teaching learning methods to remote instruction through online and hybrid learning was a major leap that the education sector took [11].

1.1. Learning Difficulties

In addition to the challenge of a rapid migration to the online learning system, other conditioning factors for student satisfaction must be considered for a fair comparison of the learning methods. Some pre-COVID-19 studies were aimed at analyzing the influence of the teacher on student satisfaction [12,13] or their personal preferences regarding the subject itself [14,15]. They could be classified as ''subjective" covariates influencing the student opinion, which are not the focus of this research. Others instead adopted a more economical approach, analyzing the interaction between student satisfaction and the information technology (IT) infrastructure that they had for monitoring online classes [16]. Since students did not have time to make a planned supply of IT infrastructures after the sudden outbreak of the pandemic, the secondary objectives of this research are to analyze the association between both technological resources and internet connectivity and student satisfaction. On the other hand, many works were dedicated to investigating the impact of COVID-19 on the psychological wellbeing (see [17,18]). Some of them were focused on higher education [19] and particularly on the nursing degree [20]. Therefore, it was also investigated whether the degree of the psychological impact of the pandemic affected in any way the students' perception.

1.2. Literature Review

Although there is a vast literature devoted to virtual learning which has experienced a substantial increase after the COVID-19 pandemic, few studies have focused on analyzing the virtual learning of the subject of Statistics. Most of these studies were performed before the outbreak of COVID-19 and were devoted to analyzing virtual learning environments (VLEs) mainly using a software as a complement to teaching [21–26] or as an enabling technology for Official Statistics [27]. The only existing work, as far as the authors' knowledge, focused on the impact of COVID-19 on the teaching of Statistics in higher education was conducted by Vega-Hernández et al. [28]. Nevertheless, it was stated from the teachers' point of view so that it is more oriented to their fast technological adaptation to learning and

their concern about virtual assessment fraud rather than the degree of student satisfaction. Leaving aside the field of Statistics, there are many teaching experiences reported after the outbreak of COVID-19 from other areas of higher education. It is noteworthy that there is no consensus regarding the efficiency of online teaching. Ramos-Pla et al. hold that online learning strategies in education faculties were successful, and some of them should be incorporated in face-to-face learning [29]. On the other hand, the authors analyzing online learning in engineering, technology, business management, and communication disciplines maintain that there is a pessimistic perception towards the transition to the completely online setting despite finding a significant student engagement in learning [11].

1.3. Objectives of the Study

Under this framework, the main objective of this work is to analyze the viability of online teaching in the subject of Applied Statistic in Health Sciences through the teaching experience lived during COVID-19. Particularly, we focused on: (i) comparing face-to-face and online teaching methodologies from the students' perspective; (ii) identifying the technological difficulties of e-learning; (iii) analyzing the psychological impact of COVID-19 on e-learning; and (iv) determining the students' satisfaction regarding distance evaluation.

2. Materials and Methods

2.1. Sampling and Instrumentation

A retrospective observational cross-sectional study was performed to analyze the viability of online learning in the subject of Applied Statistics in Health Sciences. The data were collected from 128 nursing students from the Faculty of Physiotherapy and Nursing of the University of Castilla-La Mancha (Toledo, Spain). The data were gathered in 2020 when the COVID-19 pandemic settled in Spain, causing a general confinement and forcing online teaching in the middle of the semester (see Figure 1). In particular, responses were collected from the 1st to 15th of June 2020 after having finished the final evaluation test of the ordinary call. The temporal sequence of the contents divided into units for the second semester of the academic course of 2019/2020 are also depicted in Figure 1. It is important to mention that all the units are independent without involving some of them more difficulty than others so that a fair comparison of teaching methodologies is possible. The inclusion criteria were: (1) to be enrolled in the subject of Applied Statistics in Health Science in the academic course of 2019/2020 (2) to have taken the subject in both modalities, face-to-face and online modalities, and (3) being willing to participate in the study and signed an informed consent form. The exclusion criteria were (1) not having attended classes regularly (at least once a week) and (2) not having attended classes in any of the modalities, face-to-face or online one.

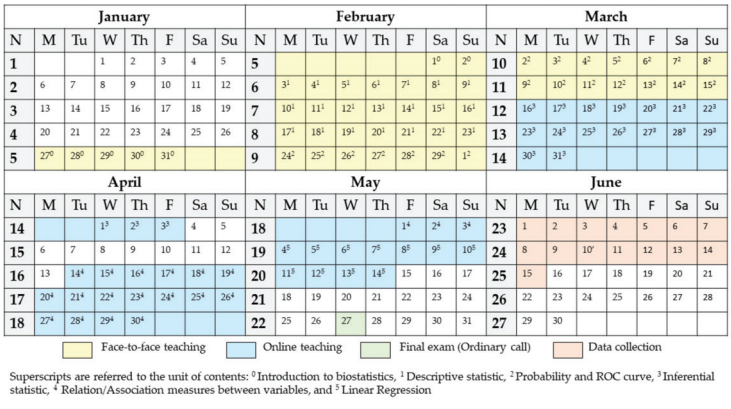

Figure 1. Second semester of 2019/2020 calendar and temporalization of teaching modalities.

The data were collected through a self-administered anonymous online questionnaire. The used instrument was self-developed since, as far as the authors' knowledge, there is not a validated instrument in the literature to compare the face-to-face and virtual teaching methodologies and, at the same time, to collect some aspects of the extraordinary circumstances of COVID-19 at the time of the administration of the questionnaire. Table 1 collects the structure of the questionnaire, the questions, and the way in which the responses were operationalized. The questions asked in the questionnaire were divided into five blocks: (1) socio-demographic features, (2) evaluation of learning methodologies (face-to-face and virtual modality) and assessment of the subject, (3) learning difficulties due to information and communication technologies (ICTs), (4) the psychological impact of COVID-19, and (5) the assessment of the online evaluation. In block 2, all the methodologies were scored through a five-point Likert-type scale, which corresponded to a 1 = very poor, 2 = poor, 3 = normal, 4 = good, and 5 = excellent degree of satisfaction. A score of 0 was used for no answer/do not know responses. The remaining questions were qualitative response questions. Two constructs were measured through a Liker-type scale: 1. student satisfaction in face-to-face teaching and 2. student satisfaction in online teaching. Both scales are divided into two dimensions according to (a) the satisfaction relative to teaching methodologies (items 1–4, see Table 1) and (b) the satisfaction relative to the general aspects of the subject (items 5–7, see Table 1). A reliability analysis was conducted to analyze the internal consistency of both scales. The student satisfaction scales reported a Cronbach's alpha of 0.824 and 0.906 for the face-to-face and online teaching, respectively. Subscales (a) and (b) obtained a Cronbach's alpha of 0.738 and 0.710 for the face-to-face teaching scale, while they were 0.858 and 0.798 in the case of the online teaching scale. Since the values of this coefficient higher than 0.7 are considered acceptable [30], we can trust the psychometric properties of the scale used.

Table 1. Outline of the questionnaire.

Block 1. Socio-Demographic Features	
1.	Age
2.	Gender *(male, female)*
3.	Grade *(1, 2, 3, 4)*
4.	Residence before COVID-19 *(university residence, shared apartment, alone in an apartment, parents' residence, others).*
5.	Residence during COVID-19 *(university residence, shared apartment, alone in an apartment, parents' residence, others).*
Block 2. Evaluation of learning methodologies and assessment of the subject	
1.	Satisfaction degree *(1–5)* [1] about the face-to-face teaching: 1. magistral lessons, 2. practical classes, 3. computer classes, 4. tutorials, 5. follow-up, 6. timing, 7. overall.
2.	Satisfaction degree *(1–5)* [1] about the online teaching: 1. magistral lessons, 2. practical classes, 3. computer classes, 4. tutorials, 5. follow-up, 6. timing, 7. overall.
Block 3. Learning difficulties due to ICTs	
1.	Sufficient technological resources *(yes, no).*
2.	Sufficient internet connection *(yes, no).*
3.	Type of internet connection *(optical fiber, ADSL, mobile connection).*
Block 4. Psychological impact of the COVID-19	
1.	Psychological affectation *(nothing, something, severe).*
Block 5. Assessment of the online evaluation	
1.	Satisfied with the online evaluation *(yes, no).*

[1] five-point Likert-type scale: 1 = very poor, 2 = poor, 3 = normal, 4 = good and 5 = excellent degree of satisfaction.

2.2. Demograpich Features

Table 2 shows the socio-demographic variables of the sample. The final sample was integrated by 128 respondents comprising 75.7% of the students enrolled in the 2019/2020 academic year, which implies a high percentage of the response. The vast majority of the students were taking the course for the first time (90.6%). The average age was 19.5 years and 79% of the sample were female. One of the most important features of the present work is to analyze the interaction between the factors related to new technologies and others derived from COVID-19 and distance learning. In this regard, 75.8% of the students revealed to have sufficient technological resources to follow up on classes and 74.2% exhibited to have a sufficient internet connection for the same purpose. Approximately two in three students reported being somewhat psychologically affected by the COVID-19 pandemic, while 22.7% of them considered to be severely affected, and 8.6% were not affected at all. It is noteworthy that significative differences were found in the frequency distribution regarding the place of residence before and during the COVID-19 pandemic. In particular, living in their parental residence experienced an increase of 56.2% during the COVID-19 pandemic.

Table 2. Description of socio-demographic variables of the sample [1].

Variables	Statistics
Age Mean (*SD*)	19.5 (±2.7)
Gender	
Male	26 (20.3%)
Female	102 (79.3%)
Grade	
1	116 (90.6%)
2	8 (6.3%)
3	2 (1.6%)
4	2 (1.6%)
Sufficient technological resources	
Yes	97 (75.8%)
No	31 (24.2%)
Sufficient internet connection	
Yes	95 (74.2%)
No	33 (25.8%)
Type of internet connection	
Optical fiber	79 (61.7%)
ADSL	42 (32.8%)
Mobile connection	7 (5.5%)
Psychological affectation	
Nothing	11 (8.6%)
Something	88 (68.8%)
Severe	29 (22.7%)
Residence before COVID-19	
University residence	23 (18%)
Shared apartment	58 (45.3%)
Alone, in an apartment	2 (1.6%)
Parents' residence	43 (33.6%)
Others	2 (1.6%)
Residence during COVID-19	
University residence	0 (0%)
Shared apartment	4 (3.1%)
Alone, in an apartment	4 (3.1%)
Parents' residence	115 (89.8%)
Others	5 (3.9%)

[1] Categorical variables are reported by n (%), whereas numerical variables are reported by $\overline{x}$ $(\pm SD)$

2.3. Statistical Analysis

A descriptive and inferential analysis was performed to address the objectives of the present research. The Wilcoxon signed-rank test was used to determine the existence (or absence) of significant differences between the face-to-face and online median level of satisfaction. In order to find the possible associations between the methodology scores and the learning difficulties, whether technological or derived from the COVID-19 pandemic, Cramer's V test was applied for each pair of categorical variables. The significance level was set to 0.05 for all the statistical hypothesis tests. The IBM SPSS Statistics v. 28 software (Statistical Package for Social Science) was selected to perform the data processing and analysis. Wilcox_effsize function belonging to the rstatix R package was used to measure the effect size when there are significant differences between both modalities of teaching methodologies.

2.4. Description of the Learning Methodologies and Other Aspects of the Subject's Assessment

Four learning methods were used in this course to achieve the learning outcomes: magistral lessons, practical classes, computer practices, and tutorials. All these methodologies were migrated to the online modality when the lockdown started by using the ICTs similarly to the first virtual experiences [31]. The virtual platform used for online asynchronous learning was Moodle [32] to provide learning materials and general announcements. Microsoft Teams [33] was selected to deliver the course in real-time (the synchronous method), ensuring interactions between the students and their learning facilitators or instructors continued [34]. These were the virtual supports given by the institution. The teaching methodologies used in both versions, face-to-face and online, will be briefly described below.

2.4.1. Magistral Lessons

This is the most traditional teaching method in which the teacher conducts an expository lesson supported by some teaching material being, in the case of this course, a presentation with slides. In these classes, it is a mainly exposed theoretical content with some illustrative examples given the applied nature of the subject. The participation and interaction with students are not allowed except to ask questions. In the face-to-face modality, these classes were performed in a traditional classroom equipped with a projector to present the slides, whereas sharing the presentation from teacher's screen was the method used in the online version. In addition to this latter, the teacher was seen by students live by image and voice.

2.4.2. Practical Classes

This kind of methodology comprises two phases: (i) students are asked to solve themselves a set of study-case problems prior to class, and (ii) only those exercises in which they faced a greater difficulty or doubts are corrected and explained in class. The first phase of this methodology is independent of the teaching modality. In face-to-face classes, study-case problems are projected in class and some arguments are clarified using a traditional physical backboard, whereas they are supported in a virtual board in the online modality. This latter comprises the difficulties of writing mathematical notation and, if feasible, it is very time consuming to write.

2.4.3. Computer Classes

This is probably the methodology that experienced more severe changes when moving to the online modality. In these classes, a set of real data-based problems are stated that students must solve using the statistical software IBM SPSS Statistics v.28. In traditional face-to-face classes, the proposed problems are solved in situ and projected in class at the same time as the students reproduce the steps on their personal laptops or using classroom computers. We thought that it was unlikely that students would be able to properly follow such a class online, since they would need one computer to follow the teacher's explanation

and another one to reproduce the exercises (we thought that it was not feasible to properly visualize both on the same screen). Thus, in the online modality, practice manuals were provided in which the problem resolution was detailed step-by-step (using screenshots). This methodology changed, therefore, from being synchronous to asynchronous, this being a substantial change. In order to reinforce the asynchronous modality, the teacher was connected during the classes so that he/she could assist with any arisen doubt.

2.4.4. Tutorials

These are not regulated classes, but are agreed upon request by the students. They are particular sessions in which one or more students meet with the teacher to expose any arisen doubts or to reinforce the unclear parts of the subject. They took place in person in the professor's office in the face-to-face modality, whereas the meetings were virtual in the online modality. In both cases, the methodology consisted in a personal interview.

2.4.5. Other Aspects of the Subject's Assessment

In addition to know the degree of the students' satisfaction regarding the teaching methodologies, the general perception of the subject, the timing of the contents, and the follow-up of the subject are fundamental aspects for obtaining a good learning performance. Thus, the students were also asked by their perception of these three general subject aspects in both modalities, face-to-face and online.

3. Results

3.1. Face-to-Face vs. E-Learning

In order to establish fair comparisons between the teaching methods, only students who took the subject for the first time were considered hereafter. The satisfaction degree that students showed in relation to the different teaching methodologies is depicted in Figure 2. All methodologies (except to tutorials) exhibited different medians, being better valuated the methodologies in the face-to-face version. The largest discrepancies were shown in the practical lessons in which 25% of the students expressed a poor or very poor satisfaction using e-learning. It is also remarkable that the boxplots remain unchanged in face-to-face and distance tutorials, with 50% of the responses representing a good or excellent satisfaction. The outliers depicted in the graph were considered in the analysis since they were valid values for being withing the range.

Table 3 collects the statistics calculated for all the methodologies in the traditional classroom and online modalities. In addition to this, the results of the inferential analysis are shown through the *p*-values. Significant differences were found between the medians of the face-to-face and distance learning for all methodologies, except for tutorials and computer classes. In order to quantify the magnitude of the experimental effect, the effect size was calculated. According to [35], values lower 0.3 report a small effect, values between 0.3 and 0.5 reveal a moderate effect, while values above 0.5 exhibit a large effect. The obtained values were 0.62, 0.33, 0.39, 0.40, and 0.39 for the discrepancies found between face-to-face and online modalities of the theoretical, practical, follow-up, timing, and overall scores, respectively. Thus, all the categories reported a moderate effect except for the theoretical classes which exhibited a large effect. Regarding the averages, the best valuated face-to-face methodology was tutorials (4.04), followed by master classes (3.91). Nevertheless, although tutorials were also the best scored in e-learning (3.85), the next most appreciate one was computer classes (3.36). It may be related with the students' positive reception of the manuals elaborated for the resolution of the SPSS study cases step-by-step. The follow-up of the subject was better perceived in the face-to-face modality than in the online one. On the other hand, although the medians remained unchanged and the averages exhibited quite similar regarding timing in both modalities, significant differences were found. It could be due to the high variability of the scores found in the face-to-face modality (see Figure 2). It is noteworthy that the median general evaluation of the subject was "good" in the face-to-face modality, whereas it was "normal" in the online learning modality.

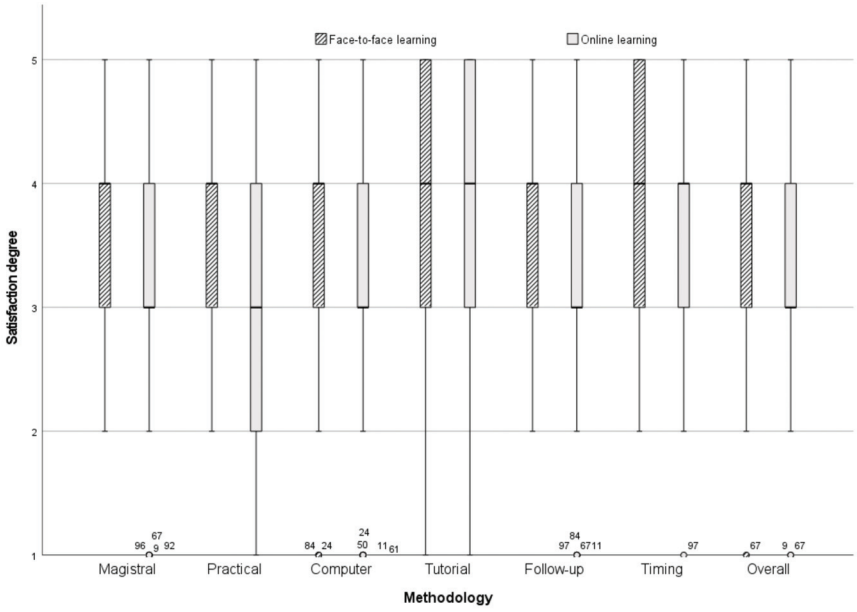

Figure 2. Satisfaction scores distribution for the different methodologies using face-to-face and distance learning.

Table 3. Scores of learning methodologies and assessment of the subject.

	Face-to-Face Learning		**Online Learning**		
Learning Methodologies and Valuation	**Mean (± SD [1])**	**Range**	**Mean (± SD)**	**Range**	***p* Value**
Master classes/theoretical ** [3]	3.19 (±0.72)	2–5	3.21 (±1.05)	1–5	<0.01
Practical classes/study-case resolution * [2]	3.46 (±0.83)	2–5	3.16 (±1.20)	1–5	0.03
Computer classes/SPSS software	3.63 (±0.96)	1–5	3.36 (±1.20)	1–5	0.08
Tutorials	4.04 (±0.97)	1–5	3.85 (±1.14)	1–5	0.13
Follow-up ** [3]	3.74 (±0.92)	2–5	3.40 (±1.05)	1–5	<0.01
Timing ** [3]	3.98 (±0.86)	2–5	3.63 (±1.03)	1–5	<0.01
Overall ** [3]	3.72 (±0.77)	1–5	3.42 (±0.99)	1–5	<0.01

[1] SD: standard deviation. [2,3] methodologies marked by * and ** correspond to those in which significant differences were found at 5% and 1%, respectively, between face-to-face and online modalities.

3.2. Technological Difficulties Found in E-Learning

In order to analyze the possible interactions between the low scores in the online modality and the difficulties encountered in the use of ICS, new variables named "differences" were created for the methodologies in which significant differences were found in the previous subsection. These new variables were defined as the scores' difference in the face-to-face modality minus the virtual one. Thus, positive differences corresponded to the responses underestimating e-learning. The associations between the scores' difference for each methodology and the sufficiency of the technological resources and internet connections were explored. The only pair which turned out to be significant was the scores' difference in practical classes and the sufficiency of the internet connection ($V = 0.39$, $p = 0.01$). In particular, students who disliked the online modality the most (difference +3) represent 8% of those that considered themselves as having an insufficient internet connection, whereas they are 4.7% of those with a good connection.

Since the internet connection turned out to be significant for the satisfaction degree of the practical classes, the relationship between the type of connection and the sufficiency of

the internet connection was investigated (Table 4). Nevertheless, no significant differences were found between the frequency's distribution of both variables ($V = 0.197$, $p = 0.113$).

Table 4. Table of contingency displaying the frequency distribution regarding type of connection and the sufficiency of internet connection.

Type of Connection/ Sufficient Internet Connection	Mobile Connection	ADSL	Optical Fiber	Total
No	3	11	11	25
Yes	4	26	57	87
Total	7	37	68	112

3.3. Psychological Difficulties Derived from COVID-19 in E-Learning

The existence of relationships between the scores' differences in both modalities for each methodology and the degree of the psychological impact of COVID-19 were explored. Even though 68.8% of the students stated that they were somewhat affected and 22.7% severely affected, as showed in Table 2, no significant differences were detected between the scores and the degree of psychological affectation.

3.4. Online Evaluation

Finally, the students were asked if they were satisfied with the system of online evaluation since the COVID-19 pandemic did not allow them to return to classes to take face-to-face exams. Most of them agreed with the evaluation system (68.8%), whereas 31.2% showed some disagreement.

4. Discussion

This research shows the results of a teaching experience in which face-to-face and online teaching methods coexist in the same academic course over the same student population. Due to the COVID-19 pandemic, teaching was forced to migrate to the online modality, thus offering the possibility of comparing both teaching methodologies. The main objective of this work was to investigate the feasibility of the online teaching of the subject of Applied Statistics in Health Sciences, which had not been considered until that moment. Online learning has been recognized as time saving and as a way of developing time management skills [11]. In addition to this, possible e-learning difficulties were explored relative to technological and COVID-19-derived problems.

It is noteworthy that all the methodologies (magistral lessons, practical classes, computer classes, and tutorials) exhibited a satisfaction degree median of normal or good in both modalities. Nevertheless, face-to-face methodologies were significantly higher scored than online ones (except to tutorials and computer classes). Based on previous results, it might be drawn that, although online teaching is viable in the subject of Applied Statistics in Health Sciences since a normal satisfaction is perceived, face-to-face learning significantly reverts in favor of the quality of teaching. This may be due to the fact that the teaching methodologies used in the online modality were somewhat improvised due to the sudden outbreak of the pandemic. In this vein, other authors state that careful planning is needed to lead to a true transformation which requires the modification of the learning strategies and the communication between the actors in the process and the evaluation strategies [29]. Consequently, since this teaching experience proved that online teaching is viable in Statistics, more sophisticated e-learning methodologies need to be performed to a correct digitalization in higher education after COVID-19.

Focusing on each teaching methodology separately, the worst rated online methodology was the practical classes. In this stream, Gamage et al. reported that learners are concerned about the missing or uncompleted practical component of their courses [11]. Then, in line with the conclusion drawn above, most of the efforts should be aimed at developing better practical teaching online methodologies. Tutorials were satisfactorily

performed in both modalities. This fact may be because communication with students is one of the most successful activities in teaching, having in mind that ICT facilitate communication, as Ramos-Pla et al. stated [29]. Therefore, this teaching experience was proposed to incorporate virtual tutorials as teaching methodology as a digitalization strategy after COVID-19. In addition, no significant differences were found between the scores of the face-to-face and online computer classes; in fact, they were the best valuated online methodology after tutorials since the elaborated manuals were well received by the students. From the view of the teacher, traditional computer classroom foments distractions that may lead to a loss of student attention. However, the use of offline manuals offers the advantage of being consulted at any time and as many times as necessary. Thus, this teaching experience proposes the use of manuals to conduct the teaching when the methodology involves the use and management of software.

Another important issue to consider in the present work is the exceptional circumstances derived from COVID-19 in which this study took place. Thus, technological difficulties due to the rapid migration to the online system as well as those derived from the psychological sequalae of COVID-19 were investigated. Approximately two-thirds of students reported having both a sufficient internet connection and enough technological resources. Then, as expected, no significant differences were found between technological difficulties and the difference in the scores given to the face-to-face and online modalities. The only distinguished result was that students with a poor internet connection reported a poorer satisfaction with the practical classes than those with a sufficient connection. On the other hand, uneasiness, fear, stress, and sadness were some of the psychological damages which derived from the COVID-19 pandemic, as reported in the literature [36,37]. Nevertheless, although two in three students exhibited to be somewhat psychologically affected by the COVID-19, this fact was not found to be associated with their perceptions about the teaching methodologies. On the other hand, most of the students agreed with the online evaluation system since the COVID-19 pandemic did not allow for the return to the classroom for the rest of the academic year.

Other methodological aspects should also be considered as the limitations of this work. The first is that the used instrument was self-developed. At the time of administering the questionnaire, there was no validated instrument in the literature to perform this comparison of teaching methodologies and consider, at the same time, the factors associated with the COVID-19 pandemic. On the other hand, the teachers' feelings should be also considered since they were manifested to be overwhelmed by the situation, not knowing how to adjust to the new normal [11]. Therefore, other conditioning factors for the students' satisfaction requires further research to assess the quality of online teaching.

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Article

Student Acceptance of E-Learning during the COVID-19 Outbreak at Engineering Universities in Spain

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Abstract: This article analyses students' intention to use a particular e-learning technology (MS Teams) at university during the COVID-19 outbreak in Spain using the Unified Theory of Acceptance and Use of Technology (UTAUT). The model was refined through a qualitative analysis based on six focus group discussions with students from different engineering faculties in Madrid, Spain. A survey involving 346 undergraduate students was subsequently fed into the model. Structural Equation Modelling (SEM) and SMART PLS software were applied for data analysis. The results shed light on theoretical and practical implications. The model was validated by the data and displayed a high predictive ability. Social influence was found to have the greatest influence over students' acceptance, followed by the professor's role in shaping the perception of improvement. Facilitating conditions were found to be the least relevant factor, probably due to the particular context in which this study was conducted. A significant difference was found between the public and private institutions in terms of the importance of the perceived usefulness for the professor (this factor was more important for students' acceptance at the public university). In order to improve its acceptance and use under the current scenario, it is thus important for universities wishing to introduce e-learning to focus on creating a positive social environment around the e-learning platform, for example, by using social networks or relying on testimonies by professionals who could confirm the interest of such a platform in a future work environment. Understanding professors' perspective on the implementation of the platform is also of paramount importance. More research is also needed regarding context-related differences when analysing students' acceptance of e-learning.

Keywords: technology acceptance and use; SEM; higher education; COVID; e-learning

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1. Introduction

The COVID-19 crisis has transformed the world around us, and the university is no stranger to this transformation. It is clear that COVID-19 has resulted in a major disruption in the higher education system, whose consequences are still to be fully understood [1–4]. As a recent study from UNESCO points out, due to sudden and long-lasting school lockouts all over the world, the major impact of COVID-19 on teaching and learning in higher education is the increase in online education, and the hybrid mode of teaching has become the most popular form [4]. Indeed, universities worldwide have been pushed to experiment with e-learning due to the restrictions during the pandemic outbreak [5–9]. As the uncertainty regarding future global emergencies is high, distant education and e-learning could become even more strategic to avoid the discontinuation of a basic public service, such as education.

The issues associated with the successful implementation of e-learning in pre-pandemic times are well documented in academic literature [10–12]. The shift to e-learning implies a cultural transformation, and students, as well as teachers all over the world, have struggled throughout the e-learning adoption process [2,13–17]. Particularly, failures in e-learning adoption have been reported due to a lack of preparation of the institution and its constituents, specificities of the regional context, as well as difficulties in adapting to innovative

teaching and learning approaches [18–21]. Indeed, the implementation of e-learning technologies involves a shift of focus from the lecturer to the educational process and the student experience [22], which is considered a revolution by some authors [23]. Beyond ensuring access to public service during difficult times, e-learning has the potential to improve communication, collaboration, knowledge transfer, and training to enhance the value provided to both individuals and organisations [24]. This implies contributing to the shift from a passive model of information transmission to an active model where the individual is monitored, tracked, and analysed in order to develop the best training process for each particular person [25].

An important success factor for the implementation of an e-learning system is the incumbent actors' willingness to accept and actively engage in using this system [26–31]. Understanding these actors' perspectives in this regard is of the utmost importance for higher education institutions. This is still under research, particularly under the new pandemic scenario [21]. Indeed, different theoretical models have captured the factors typically affecting technology acceptance by incumbent actors, particularly students and professors [32–34]. However, it is not yet clear the way the particular conditions created during the COVID-19 crisis have affected how these actors perceive and are willing to accept e-learning [35–38]. Characterising incumbent actors' perceptions regarding e-learning during the pandemic is indeed the crux of the matter. This knowledge is essential to inform policymakers and higher institution managers on successful e-learning implementation in conditions similar to those created during the COVID-19 crisis. The objective of our study is to analyse the point of view of the students regarding e-learning adoption during the pandemic. In particular, this article presents a study on the acceptance and use of Microsoft Teams (hereinafter MS Teams) at universities in Madrid (Spain), using a sample of students from different engineering faculties belonging to two universities, one being a public establishment (Universidad Politécnica de Madrid, UPM) and the other a private one (CEU San Pablo). The Unified Theory of Acceptance and Use of Technology (UTAUT) model was used as a theoretical background for this research [32]. The particular research question addressed is formulated as follows: What are the main factors affecting students' acceptance and use of an e-learning platform during the COVID-19 lockouts in engineering universities in Madrid?

Our study provides a fresh look at the acceptance of technology within higher education. Although a number of recent studies have explored student technology acceptance of e-learning during the COVID-19 outbreak [9,35–42], to the best of our knowledge, up to the current moment, no former study has been conducted in this particular regional context. Additionally, the number of works which have used the UTAUT model to study e-learning acceptance in this context is still limited [43–61]. Finally, no study to date has provided a comparison between public and private institutions. The minder of this article is structured as follows. Section 2 explains the theoretical background of this research, whereas the context of the study and the methodology used are explained in Section 3. Section 4 presents the results of the study. After that, the results are discussed in Section 5. Finally, Section 6 present some conclusions and limitations of this research.

2. Literature Review

2.1. The UTAUT Framework and E-Learning Acceptance during COVID-19

There exist several models designed to evaluate the factors affecting technology acceptance. Various studies have been based on the Technology Acceptance Model (TAM), such as [33,34]. Among several models derived from TAM, the UTAUT model was chosen (see Figure 1), which was created by unifying eight previously existing models that [32] tested and validated for different types of situations (including both optional and compulsory use by users, and these including both students and company employees). The versatility of this model was key in determining its suitability for this study. The model was chosen because of its explanatory power and completeness in the acceptance and use

of IS studies [44]. Furthermore, the qualitative study conducted as part of this research (see Section 3.1) confirmed the significance of the factors considered in the UTAUT framework.

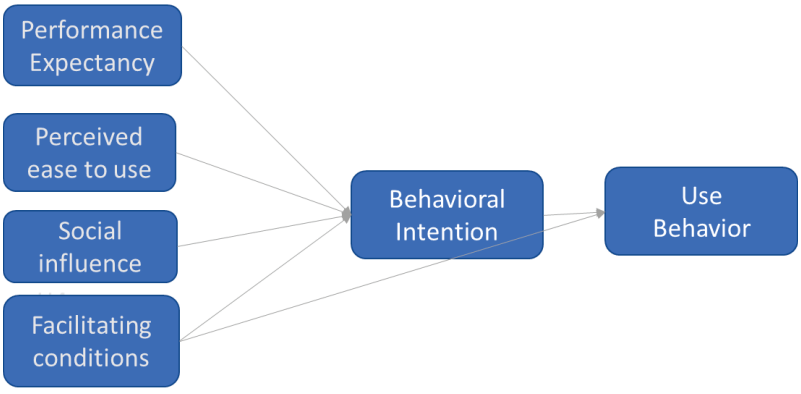


Figure 1. UTAUT model. Source: Venkatesh (2003).

The UTAUT model is composed of six constructs, each defined as follows:

Performance expectancy (PE): the degree to which an individual believes that using the system will help him or her to attain a better job performance.

Effort expectancy (EE): the degree of ease associated with the use of the system.

Social influence (SI): the degree to which an individual perceives that influential people believe he or she should use the new system.

Facilitating conditions (FC): the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system.

Behavioural intention (BI): the intention to use the system.

Use behaviour (UB): the actual user behaviour.

In the UTAUT model, four other variables are posited to moderate the impact of the four key constructs on usage intention (BI) and behaviour (UB): gender, age, experience, and voluntariness of use. For example, as depicted in Figure 1, the influence of performance expectancy on behavioural intention is moderated by gender and age; that of effort expectancy is moderated by gender, age, experience, etc.

Extant literature is still limited on the application of UTAUT to e-learning acceptance by students [44], particularly during the COVID-19 crisis. Experiences in the Middle East and East Asia [52,53,59,59–61], as well as in several African countries [50,51,55], are particularly represented in literature. Experiences in other parts of the world, such as Europe or America, are comparatively less represented [49,57]. Moreover, no previous studies have been conducted on the application of UTAUT to e-learning acceptance in the Spanish university context.

2.2. Hypothesis and Theoretical Framework

As it will be explained in the Methodology section, for the purposes of our study, this model was updated and fine-tuned with an additional construct (see Figure 2), which was introduced following the work of Escobar-Rodríguez et al. [34], and Hwang [62] This was deemed appropriate after conducting a preliminary qualitative analysis based on six focus-group discussions with students. The additional construct is defined as follows:

Perceived usefulness for the professor (PUP): defined as how the students believe the tool improves the usefulness to professors in terms of productivity, evaluation, and student follow-up.

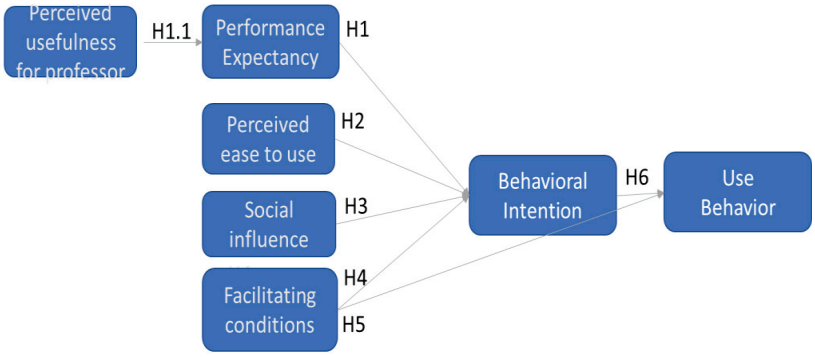


Figure 2. The theoretical model of the acceptance of MS Teams technology by university students. Source: own elaboration.

The theoretical model was used as the basis upon which a number of hypotheses to be tested were drawn up. These hypotheses are:

Hypothesis 1.1 (H.1.1). *Perceived Usefulness for the Professor has a significant effect on the Performance Expectancy of MS Teams.*

Hypothesis 1 (H.1). *Performance Expectancy has a significant effect on the Behavioural Intention to use MS Teams.*

Hypothesis 2 (H.2). *Effort Expectancy has a significant effect on the Behavioural Intention to use MS Teams.*

Hypothesis 3 (H.3). *Social Influence has a significant effect on the Behavioural Intention to use MS Teams***.**

Hypothesis 4 (H.4). *Facilitating Conditions have a significant effect on the Behavioural Intention to use MS Teams.*

Hypothesis 5 (H.5). *Facilitating Conditions have a significant effect on the Use Behaviour of MS Teams.*

Hypothesis 6 (H.6). *Behavioural Intention has a significant effect on the Use Behaviour of MS Teams.*

These hypotheses were elaborated based on the conclusions drawn in the extant literature on the application of UTAUT to e-learning acceptance, particularly during the COVID pandemic [35–38,43–61]. Indeed, most of the experiences represented in the literature validate the cause-effect relationships between the main constructs of the UTAUT model. Hypothesis H1.1 was drawn as a result of the qualitative study conducted as part of this research, which is described in Section 3.2.

3. Materials and Methods

3.1. Context

This study assessed the intention to use a collaborative e-learning IT tool in two engineering institutions in Madrid, one being a public university (Universidad Politécnica de Madrid-UPM) and the other a private one (CEU San Pablo). UPM is one of the oldest polytechnic universities in Spain. It was founded in its present organisational form in 1971, but its origins can be traced back to the beginning of the 19th century. It comprises 18 engineering faculties and offers degree programmes covering all areas of architecture and engineering. Meanwhile, CEU San Pablo was founded in 1933 and is one of the largest

and most traditional private universities in Spain. CEU San Pablo offers a wide range of subjects and 6 faculties, including an engineering faculty.

In order to address this study, a particular IT platform was chosen based on the expectation that users' responses would be more accurate when asked about a particular tool rather than generally about all tools in the sector. The tool chosen was MS Teams. MS Teams is a unified communication and collaboration platform that combines workplace chatrooms, video meetings, file storage (including collaborative editing), and application integration. Microsoft launched the service worldwide on 14 March 2017. By 19 November 2019, it reached 19 million users, and on 19 March 2020 (around the start of the COVID-19 pandemic), it reached 44 million users.

Within our sample, in some cases, MS Teams represented the only available option and was compulsory (at the private university), while in others, it was optional, with professors choosing which collaborative tool to use to deliver their online classes (among several available options, such as Moodle, BB Collaborate, etc.). In addition, although this article focuses on students, it is part of a broader investigation in which the acceptance and use by faculty (i.e., employees of a university) were also assessed, which will be discussed in subsequent works.

3.2. Qualitative Analysis

As explained in the previous section, the conceptual model employed in this study was a slightly modified UTAUT model, in which one construct was added to the six original constructs, as described in Section 2 above.

In order to fine-tune our model, a qualitative analysis was conducted. Six different student focus groups were organised considering the following criteria:

- Gender balance.;
- Inclusion of students belonging to different academic levels (undergraduate, graduate, and doctoral levels);
- Varied programme specialisations;
- Varied geographical locations within Madrid amongst the different university schools.

The focus group discussions were conducted between 18 February and 6 March 2020. A number of open questions were launched to the students regarding their experience with different e-learning tools available at UPM (Moodle, MS Teams, Virtual Labs, MOOCs, etc.), the role of the faculty members, and possible improvement opportunities. Several specific questions were posed regarding MS Teams.

Each focus group brought together around twenty students from different schools within UPM.

The focus groups involved students from different engineering schools belonging to UPM. Information coming from the focus group was transcribed and systematically analysed using content analysis techniques (Weber, 1990). Content analysis is a technique for analysing the content of a text; content might include words, symbols, pictures, or any other format that can be communicated. It has been extensively used in social sciences and particularly in education [63–65]. An important step in content analysis is codifying the text (or content) of a piece into various categories depending on certain criteria [66]. In this case, the codes were established a priori using the UTAUT categories. The codes were assigned to the text by three independent researchers; discrepancies were discussed until a consensus was reached.

Several cross-cutting themes were identified thanks to this analysis that were of use to fine-tune the conceptual model:

- The professor was acknowledged as a fundamental actor. The choice and efficacy of IT tools were deemed to be highly dependent on the kind of use made by the professor;
- The facilitating conditions and, particularly, having a help desk and a clear and available institutional repository of information were considered to constitute an important factor;

- The construct "Perceived usefulness for the professor" was deemed to be a key factor by the students. The role of professors in shaping the acceptance of the technology was thus incorporated as part of our model.

3.3. Data Collection

The survey involved a total of 346 undergraduate students from nine different engineering faculties belonging to the two analysed universities (50 students in the first year, 74 students in the second year, 137 students in the third year, 57 students in the fourth year and 28 in the fifth year). Indicators were designed to measure each variable (construct) in the model. These took the form of 34 questions that were posed to university students in an online survey. An online questionnaire was distributed by e-mail via the student associations present at the targeted university schools of engineering.

Responses were quantified using a 5-point Likert scale (where: 1 = totally disagree, 5 = totally agree), and in this manner, the indicators provided measurements for the variables in the model. The data collected were consolidated into tables containing all the responses. This data contained no personally identifiable information. Only non-identifying attributes were recorded: gender, the university and engineering school attended, and the academic level of the studies being pursued (undergraduate, graduate, or PhD). Our dataset was composed of the following groups:

- 249 responses from the public university (UPM) vs. 97 from the private university (CEU San Pablo);
- 165 responses from women vs. 181 from men;
- 160 responses from students of industrial engineering, 45 from architecture, 42 from industrial design, 31 from biomedical engineering, 26 from telecommunications engineering, 15 from mining engineering, 13 from aeronautic engineering, 12 from IT engineering, and 2 from road engineering.

3.4. Statistical Analysis

The model was quantitatively analysed using structural equation modelling (SEM), and SMART PLS software was applied for data analysis. SEM is a multivariate technique that enables evaluation and tests multivariate causal relationships. The technique has been increasingly used since the beginning of the last century in multiple scientific domains, including education [67].

The first step was to analyse the data sample's appropriateness for the chosen model. This involved testing the sample size as well as its qualities (missing values and normality). The second step was to perform an analysis of the measurement system, which meant validating the indicators (the survey questions). The specific statistical tests employed in these steps are detailed in the Results section. The third and final step was an analysis of the structural system, which assessed the validity of the relationships between the latent variables (or constructs) by testing the hypotheses (H1.1, H1, H2, H3, H4, H5 and H6).

4. Results

This section is composed of three parts. To begin with, an assessment of the volume and quality of the data in order to ensure it was sufficient and appropriate for carrying out the study. Secondly, an evaluation of the quality of our measurement system, in which each of the constructs in the model was decomposed into indicators, corresponded to the questions posed in the survey. Finally, an analysis of the quality of our model (structural analysis), the objective of which was to ensure there were no redundant elements (collinearity analysis) and to determine the predictive ability of the model, together with the relative weight of each of the constructs in the model. The predictive relevance of the model was analysed, and the weight of each of the constructs was determined, independently of the data, with the use of blindfolding techniques.

4.1. Data Analysis

This subsection deals with the evaluation of different aspects of the dataset, which consisted of a total of 346 samples. To begin with, the sample size was assessed in relation to the chosen model employing three different methods. The rule of [68] suggested a minimum viable sample size of between 40 and 60 (respectively equivalent to the highest number of formative indicators of a construct and the highest number of structural relationships, each multiplied by one order of magnitude). An estimate based on statistical power, developed by [69], indicated a minimum sample size of 97. (This method uses four parameters: the effect size, the power, alpha, and the number of predictors). The last method involved using the G Power programme, as recommended by [70], which yielded a value of 98. The threshold values thus obtained were, in all cases, amply surpassed by our dataset of 346 samples.

The second part assessed the qualities of the dataset. Missing values were evaluated using SmartPLS, which yielded a total of 290 missing values among a total of 34 indicators and 346 samples, which represented 2.4% of the dataset (290/(346 × 34)). This value being below the 5% threshold, the amount of missing data was thus considered quite acceptable. With regard to the distribution of the data, PLS does not impose any assumptions concerning its normality.

The theoretical model was set up in SmartPLS, as shown in Figure 3.

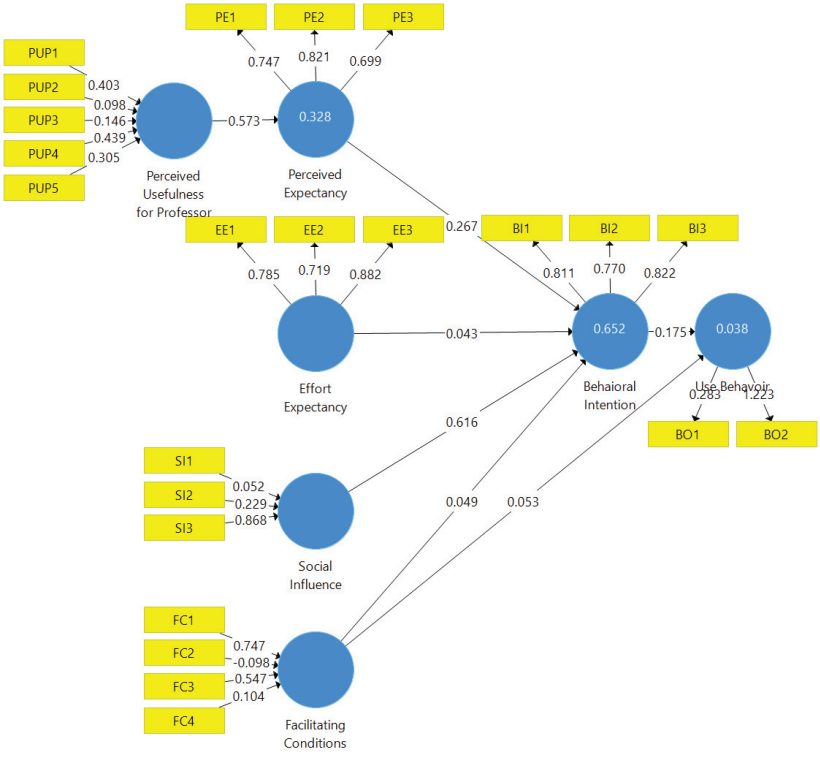


Figure 3. SmartPLS model. Load/weight values per indicator. Path coefficients between indicators. Within the R2 constructs. Source: own elaboration.

4.2. Analysis of the Measurement System

The objective of this analysis was to determine the extent to which the indicators for each construct or latent variable meet the required reliability and validity.

For the reflective indicators (outward arrows from the constructs), reliability was analysed using Cronbach's alpha, composite reliability [71], and consistent reliability [72]. The resulting values were above 0.7. Convergent validity, or the extent to which a set of indicators represents a single construct, was evaluated through load analysis, commonality analysis, and AVE. Finally, discriminant validity, or the extent to which an indicator is different from the rest, was assessed using cross-load analysis [51].

The analysis of these indicators is reflected in Table 1. Focusing on the results for UB's indicator B02, Cronbach's alpha was 0.514, below the lower limit of 0.6, but composite reliability (0.843) and consistent reliability (1.369) were both acceptable. The indicator BO1 was dropped for having a load of less than 0.7. The criteria of [73] were followed.

Table 1. Reflective measurement system. Source: own elaboration.

Construct	Indicators	Reliability			Convergent Validity			Discriminant Validity	
		Cronbach's Alpha	Composite Reliability	Consistent Reliability	Loads	Indicator Commonality	AVE	HTMT	HTMT Interval Excluding 1
		0.6–0.9	0.6–0.9	0.6–0.9	>0.7	>0.5	>0.5	<0.9	
BI	BI1 BI2 BI3	0.844	0.843	0.844	0.811 0.770 0.822	0.658 0.593 0.676	0.643	Yes	Yes
UB	BO1 BO2	0.514	0.843	1.369	0.283 1.223	0.080 1.495	0.788	Yes	Yes
EE	EE1 EE2 EE3	0.838	0.839	0.846	0.801 0.716 0.869	0.642 0.513 0.755	0.637	Yes	Yes
PE	PE1 PE2 PE3	0.799	0.801	0.805	0.747 0.821 0.699	0.558 0.674 0.489	0.574	Yes	Yes

The convergent validity of the reflective indicators was assessed, to begin with, by analysing loads. BO1 had a value below 0.7. The commonality of each indicator represents how much of the variance of the construct is due to the given indicator (with load values of 0.7, yielding 50% of construct variance). AVE describes how variations in the indicators are reflected in the construct. AVE values were above 0.5.

The discriminant validity was tested using the classical methods of cross-load analysis and the Fornell–Larcker criterion. Cross-loads were calculated using the correlations between the construct scores and the standardised data [53]. To comply, no item should load more heavily on another construct than on the one it is meant to measure [46]. The Fornell–Larcker criterion states that the amount of variance a construct receives from its indicators (measured by AVE) should be greater than the amount of variance it generates for other indicators. The results are presented in Table 2A,B. Cells in bold indicate links between the indicators and the constructs to which they belong (e.g., the intersections between BI and BI1, BI2, and BI3).

Ref. [74] demonstrated the lack of sensitivity of classical methods and devised the HTMT method. It represents the average correlation between HT (heterotrait-heteromethod) and MT (monotrait-heteromethod), and the values obtained should be below 0.9. The bootstrapping technique was then used to test whether the result was significantly different from 0.9. That is if the value 1 was included in the 90% confidence interval. The results for discriminant validity (HTMT) were as follows: EE effects in BI is 0.356; PE effects in BI is 0.588; PE effects in EE is 0.490; UB effects in BI is 0.188; UB effects in EE is 0.128; UB effects in PE is 0.124.

Table 2. (A). Measurement system for reflective indicators. Discriminant validity. Cross-load analysis. Source: own elaboration. (B) Measurement system for reflective indicators. Discriminant validity. Fornell–Larcker criterion. Source: own elaboration.

(A)	**BI**	**EE**	**FC**	**PE**	**PUP**	**SI**	**UB**
BI1	**0.811**	0.352	0.189	0.497	0.197	0.616	0.125
BI2	**0.770**	0.278	0.208	0.462	0.249	0.580	0.144
BI3	**0.822**	0.228	0.214	0.455	0.258	0.626	0.182
BO1	0.028	0.036	0.089	0.101	0.109	0.082	**0.283**
BO2	0.236	0.157	0.104	0.137	0.027	0.169	**1.223**
EE1	0.280	**0.785**	0.282	0.418	0.284	0.216	0.125
EE2	0.256	**0.719**	0.218	0.391	0.268	0.228	0.063
EE3	0.314	**0.882**	0.240	0.370	0.231	0.211	0.116
SI1	0.257	0.212	0.174	0.316	0.235	**0.338**	0.203
SI2	0.451	0.116	0.117	0.303	0.142	**0.595**	0.151
SI3	0.739	0.270	0.149	0.431	0.253	**0.975**	0.116
(B)	**BI**	**EE**	**FC**	**PE**	**PUP**	**SI**	**UB**
BI	**0.801**						
EE	0.356	**0.798**					
FC	0.254	0.308					
PE	0.588	0.490	0.339	**0.758**			
PUP	0.293	0.324	0.322	0.573			
SI	0.758	0.272	0.165	0.460	0.265		
UB	0.188	0.128	0.097	0.124	0.040	0.146	**0.888**

The following step was to evaluate the formative indicators (arrows from indicators towards constructs in Figure 3). It is important to note that the criteria applied to reflective constructors cannot be applied to constructive ones due to the inherent nature of how they are formed [75].

The formative constructs were tested through convergent validity analysis or redundancy analysis. This required a reflective indicator for every formative construct, which were included in the survey. Each formative construct was divided into two constructs. The first of these existed in the model, with the formative indicators, and it, in turn, communicate with a new global construct that had a single reflective indicator, which had already been considered in the survey. The path coefficient for this redundancy model will give us an idea of convergent validity. This is known as redundancy analysis [76]. A path coefficient value of around 0.7 or higher indicates convergent validity.

According to these criteria, the only formative indicators left were those for Social Influence (SI). The next step was to analyse the collinearity between them. VIF values < 3.3 indicate an absence of collinearity. Relevance and significance were then analysed. Given that the weights of the indicators decrease as they increase in number, the maximum possible weight value for each of the three SI indicators was $1/\sqrt{3} = 0.58$. The absolute importance of a formative indicator comes from its external load (loads come from simple regressions of the constructor with its indicators). Therefore, when the external weight of an indicator was not significant, the external load was analysed. If it was also below 0.5, its statistical significance was then analysed by applying the bootstrapping technique to more than 5000 samples. Doubts arose with respect to SI1, as it had the lowest external load, and its absolute contribution was 0.338 (below 0.5) and was not significant, but at the same time, it had no collinearity (VIF < 3.3) and was conceptually relevant [77]. See Table 3.

Table 3. Reflective measurement system. Convergent validity. Collinearity (VIF). Relevance and significance. Source: own elaboration.

Constructor	Indicator	External Weight	External Load	VIF	t-Value	*p*-Value	95% Confidence Interval	Significance ($p > 0.05$)
SI	SI1	0.052	0.338	1.103	0.795	0.427	[−0.077, 0.181]	**No**
	SI2	0.228	0.595	1.230	3.532	0.000	[0.097, 0.350]	**Yes**
	SI3	0.968	0.975	1.241	18.303	0.000	[0.772, 0.955]	**Yes**

The remaining steps involved analysing the significance of the different groups of users that existed in the measurement system. These distinguished between:

- Public and private university;
- Men and women;
- Different university schools.

Two types of non-parametric statistic tests were employed. The Mann-Whitney U test was employed when comparing two groups (see Table 4).

Table 4. Significance of the indicators for the group's University and Gender. Mann–Whitney U test. Source: own elaboration.

	Tests Statistics University						Tests Statistics Gender					
	Univ.	**N**	**Mean Range**	**Range Sum**	**Mann-Whitney U**	**Signif.**	**Gender**	**N**	**Mean Range**	**Range Sum**	**Mann-Whitney U**	**Signif.**
BO2	Public	249	168.44	41,941.00	10,816.000	**0.022**	Women	165	180.76	29,826.00	13,734.000	**0.050**
	Private	97	186.49	18,090.00			Men	181	166.88	30,205.00		
PE1	Public	249	172.27	42,896.00	11,771.000	0.705	Women	165	178.20	29,402.50	14,157.500	0.388
	Private	97	176.65	17,135.00			Men	181	169.22	30,628.50		
PE2	Public	249	172.20	42,878.50	11,753.500	0.685	Women	165	176.33	29,095.00	14,465.000	0.598
	Private	97	176.83	17,152.50			Men	181	170.92	30,936.00		
PE3	Public	249	169.50	42,205.50	11,080.500	0.219	Women	165	164.16	27,087.00	13,392.000	0.087
	Private	97	183.77	17,825.50			Men	181	182.01	32,944.00		
EE1	Public	249	174.24	43,386.00	11,892.000	0.810	Women	165	182.64	30,135.00	13,425.000	0.077
	Private	97	171.60	16,645.00			Men	181	165.17	29,896.00		
EE2	Public	249	175.47	43,691.50	11,586.500	0.531	Women	165	170.55	28,141.50	14,446.500	0.576
	Private	97	168.45	16,339.50			Men	181	176.19	31,889.50		
EE3	Public	249	177.57	44,214.50	11,063.500	0.166	Women	165	175.88	29,021.00	14,539.000	0.628
	Private	97	163.06	15,816.50			Men	181	171.33	31,010.00		
PUPG	Public	249	173.39	43,173.00	12,048.000	0.972	Women	165	167.47	27,633.00	13,938.000	0.272
	Private	97	173.79	16,858.00			Men	181	178.99	32,398.00		
FCG	Public	249	153.81	38,299.50	7174.500	**0.000**	Women	165	180.40	29,766.00	13,794.000	0.211
	Private	97	224.04	21,731.50			Men	181	167.21	30,265.00		
SI1	Public	249	159.42	39,695.00	8570.000	**0.000**	Women	165	188.82	31,154.50	12,405.500	**0.004**
	Private	97	209.65	20,336.00			Men	181	159.54	28,876.50		
SI2	Public	249	168.75	42,018.00	10,893.000	0.147	Women	165	187.97	31,015.00	12,545.000	**0.009**
	Private	97	185.70	18,013.00			Men	181	160.31	29,016.00		
SI3	Public	249	172.79	43,025.50	11,900.500	0.827	Women	165	176.75	29,164.50	14,395.500	0.549
	Private	97	175.31	17,005.50			Men	181	170.53	30,866.50		
BI1	Public	249	187.68	46,733.00	8545.000	**0.000**	Women	165	180.01	29,701.00	13,859.000	0.230
	Private	97	137.09	13,298.00			Men	181	167.57	30,330.00		
BI2	Public	249	177.26	44,137.00	11,141.000	0.248	Women	165	180.44	29,772.00	13,788.000	0.204
	Private	97	163.86	15,894.00			Men	181	167.18	30,259.00		
BI3	Public	249	167.57	1	10,599.000	0.070	Women	165	178.30	29,419.50	14,140.500	0.382
	Private	97	188.73	2			Men	181	169.12	30,611.50		

The different significance by universities (private/public) is B02, FCG, SI1 and BI3. On the other hand, BO2, SI1 and Si2 show different significance by gender.

The differences between the nine different engineering schools in the dataset were evaluated using the Kursaal-Wallis test for multigroup data (see Table 5).

Table 5. Kursaal-Wallis non-parametric test for the multigroup variable "School".

Ind.	Question	Asymptotic Significance	Significance
BO2	Please tell us again how often you have used Teams during the COVID-19 pandemic.	0.004	**Yes**
PE1	Teams enables me to improve my time management.	0.536	No
PE2	Teams helps me achieve the objectives of the course.	0.119	No
PE3	By using Teams, I improve my chances of getting a good grade in this course.	0.214	No
EE1	Teams is easy to use.	0.753	No
EE2	Teams can be used by anyone, with no need for specific training.	0.829	No
EE3	I adapted quickly to using Teams.	0.445	No
PUPG	Overall, I consider Teams a useful tool for the professor.	0.006	**Yes**
FCG	The resources provided by the university have enabled me to easily adapt to online classes.	0.000	**Yes**
SI1	The professor advocates the use of Teams for class work.	0.003	**Yes**
SI2	My classmates have encouraged and helped me to use Teams.	0.228	No
SI3	Teams is a tool that professionals in my sector recommend.	0.323	No
BI1	I intend to use Teams on a daily basis.	0.001	**Yes**
BI2	I plan to use Teams regularly.	0.279	No
BI3	I find Teams' functions useful and will continue to use them.	0.082	No

Significance variance by engineering school grouping, according to the Kursaal-Wallis non-parametric test for multigroup data, are BO2, PUPG, FCG, SI1 and BI1.

4.3. Analysis of the Structural System

As a means for testing the hypotheses, the capacity of the model to predict one or more constructs was evaluated through an analysis of the structural model [76].

The following steps were taken:

- Assessment of collinearity in the structural model;
- Assessment of the significance and relevance of the relationships within the structural model;
- Assessment of the level of R^2;
- Assessment of the effect size (f^2);
- Assessment of the predictive relevance (ρ^2);
- Assessment of the predictive significance (q^2).

Collinearity was evaluated considering a variance inflation factor (VIF), for which the value obtained was below the threshold of 3, thus meeting the criterion of acceptability. See Table 6.

Table 6. Structural measurement system. Collinearity analysis. VIF. Source: own elaboration.

	BI	EE	FC	PE	PUP	SI	UB
BI							1.069
EE	1.361						
FC	1.165						1.069
PE	1.622						
PUP				1.000			
SI	1.273						
UB							

Path coefficient values oscillate between −1 and 1, indicating stronger and more important relationships as they approach 1. The results yielded positive values in all cases, therefore supporting the model. Statistical significance depends on the standard error that results from applying the bootstrapping technique to a data sample. In this

analysis, the two-tailed and 5000-sample test was employed. The higher the empirical t-value is above the critical value, the greater the statistical significance. Thus, with an alpha of 5% = 0.05, the critical value would be 1.96, and the result will have significance. The *p*-value is often used because it is easier to remember, as it corresponds to the alpha value and reflects the probability of erroneously rejecting the null hypothesis when it is true. Thus, a *p*-value below the significance level (alpha) implies the significance of the path coefficient. However, if zero is found within the confidence interval, it indicates non-significance. If a path coefficient is statistically significant, it indicates the extent to which the exogenous construct is linked to the endogenous construct [77] (see Table 7).

Table 7. Structural measurement system. Significance and relevance of construct paths. Source: own elaboration.

Hypothesis	Path	Original Sample (O)	Sample Mean (M)	Bias	*p*-Value	2.5%	97.5%	Sig. $p < 0.05$?
H1	PE -> BI	0.212	0.211	0	0	0.128	0.302	Yes
H1.1	PUP -> PE	0.518	0.518	0	0	0.426	0.597	Yes
H2	EE -> BI	0.071	0.074	0.003	0.078	–0.01	0.147	No
H3	SI -> BI	0.602	0.603	0.001	0	0.516	0.675	Yes
H4	FC -> BI	–0.11	–0.109	0.001	0.001	–0.178	−0.044	Yes
H5	FC -> UB	0.044	0.043	−0.001	0.377	–0.058	0.141	No
H6	BI -> UB	0.218	0.218	0	0	0.103	0.325	Yes

Therefore, our model is shown in Figure 4.

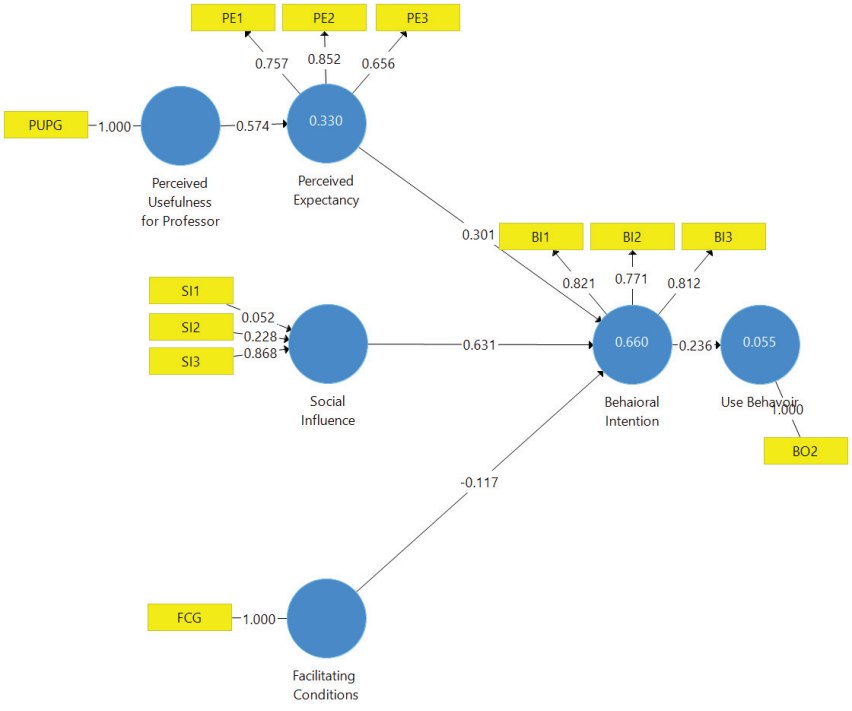


Figure 4. SmartPLS model with validated hypotheses. Source: own elaboration.

R-squared (R^2) is useful as an assessment of the predictive ability of the model. It is calculated as the squared correlation between the actual and predicted value of a spe-

cific endogenous construct. This takes into account the combined effect of all exogenous constructs affecting the endogenous variable. Going further, an adjusted R-squared (R^2 adj) that attempts to correct for the bias is more appropriate for complex models. R^2 adj= $1-(1-R2) \times (n-1)/(n-k-1)$, where n is the sample size and k is the number of exogenous variables affecting the endogenous construct being measured. The resulting values should be high enough to achieve a minimum explanatory power, which [78] state should be at least 0.1. [56] established that values of 0.67 and above were substantial, around 0.33 were moderate, and around 0.25 were weak in terms of explanatory power. [77] state that, in the field of marketing, values should be above 0.75, the explanatory power is substantial, around 0.5 and moderate, around 0.25. In the model, BI had a substantial predictive ability, PE moderate and UB weak. See Table 8.

Table 8. Structural measurement system. Predictive ability. Source: own elaboration.

	R-Squared	Adjusted R-Squared
BI	0.660	0.657
PE	0.330	0.328
UB	0.055	0.053

Next, the impact of the non-significant constructs was measured, in particular, EE effects in BI and FC effects in UB. For the effect size, f^2 was used, which measures the impact of omitting the effect of an exogenous construct on an endogenous construct, in terms of predictive ability (R^2). The contributions of FC and EE to the predictive ability of the model were very small.

The heuristic rule established by [69] states that:

- $0.02 \leq f^2 < 0.15$: small effect;
- $0.15 \leq f^2 < 0.35$: moderate effect;
- $f^2 \geq 0.35$: large effect.

Therefore, there was a large effect on SI effects in BI and PUP effects in PE, a small effect on PE effects in BI, and a negligible effect on PUP effects in BI, FC effects in BI, FC effects in UB, PE effects in UB, SI effects in UB (marked in red). See Table 9.

Table 9. Structural measurement system. Effect size (f2). Source: own elaboration.

	BI	FC	PE	PUP	SI	UB
BI						0.059
FC	**0.04**					
PE	**0.211**					
PUP			**0.493**			
SI	**0.917**					

The predictive relevance (ρ^2) provides an assessment of out-of-sample predictive ability. For this purpose, a blindfolding technique was used, which consisted of reusing the sampled data, eliminating the dth datum, and re-estimating the parameters with the remaining data. The predictive relevance was obtained by calculating the difference between the true data (which were produced when omitting the edth datum) and that which was predicted. The Handbook of Partial Least Squares Structural Equation Modelling (PLS-SEM) states that for "the relative measure of predictive relevance, values of 0.02, 0.15, and 0.35 indicate that, for a particular construct, an exogenous construct has small, medium, or large predictive relevance, respectively". Thus, the predictive relevance for BI was considerably high (0.406); for PE, moderate (0.187); and for UB, small (0.035).

Next, an analysis of the effect size was performed based on the predictive relevance, similar to what was previously done based on the R2 values.

Therefore, considering the value of the path coefficients, the significance of the path coefficients themselves, and the effect size on both BI and UB, the latent variables EE on BI and FC on UB were dropped from the model.

The following step was to analyse the heterogeneity of the dataset. To this end, the following category groups were analysed:

- University (Public/Private);
- Gender (Men/Women);
- Schools.

To end, the extent to which the groups differed was analysed, so as to determine if the differences among them were significant or not. The technique proposed by [74] was used, which involves applying bootstrapping to the dataset with 5000 samples. Parameters for each group were thus estimated, and a comparison among these determined if the differences were significant or not. This analysis was carried out using MGA multigroup analysis with SmartPLS. The results in Table 10 show that only PUP was significant when comparing university types. Also, R^2 was greater in the public sector than in the private one (0.714 vs. 0.493). See Figures 5A–D and 6, and Table 10.

Table 10. MGA multigroup analysis. Public/Private university. Men/Women. Bootstrapping. Significance. Source: own elaboration.

Public/Private University					**Men/Women**				
Differences between. Opposed Categories	**Path Coefficient**	**t-Value**	***p*-Value**	**Significance $p < 0.05$?**	**Differences between. Opposed Categories**	**Path Coefficient**	**t-Value**	***p*-Value**	**Significance $p < 0.05$?**
BI -> UB	0.076	0.614	0.54	No	BI -> UB	0.076	0.614	0.54	No
FC -> BI	−0.085	1.116	0.265	No	FC -> BI	−0.085	1.116	0.265	No
PE -> BI	0.059	0.527	0.598	No	PE -> BI	0.059	0.527	0.598	No
PUP -> PE	−0.107	1.153	0.25	No	PUP -> PE	−0.107	1.153	0.25	No
SI -> BI	−0.035	0.368	0.713	No	SI -> BI	−0.035	0.368	0.713	No

Grams for different university engineering schools. The brackets indicate the number of respondents from each school. Source: own elaboration.

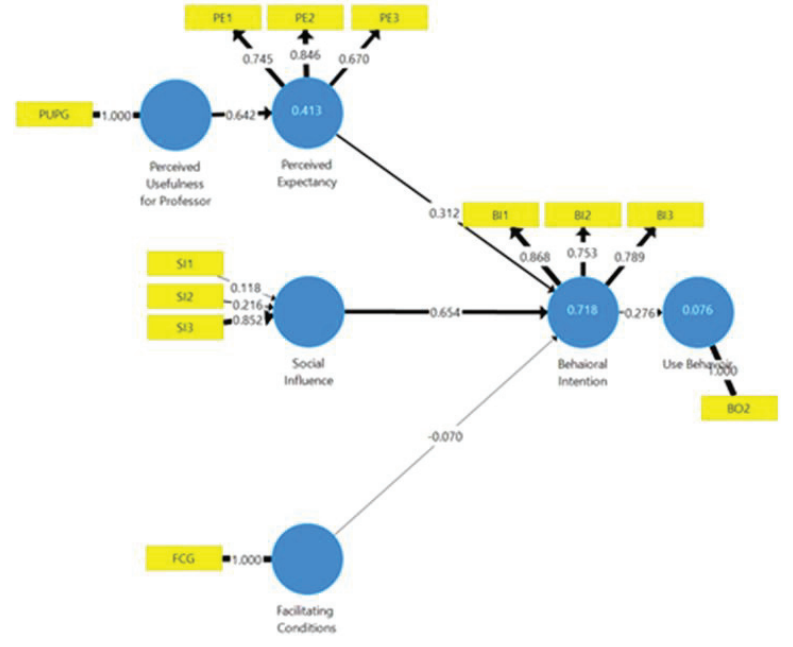
The school-based models did not have sufficient sample sizes to validate them, except in the case of Industrial Engineering (160 samples, above the minimum sample size of 97). Therefore, it was not possible to analyse the extent to which differences among schools were significant. In addition, the school-based models displayed rather atypical results due to the limited amount of data available (see Figure 6).

4.4. Summary of Results

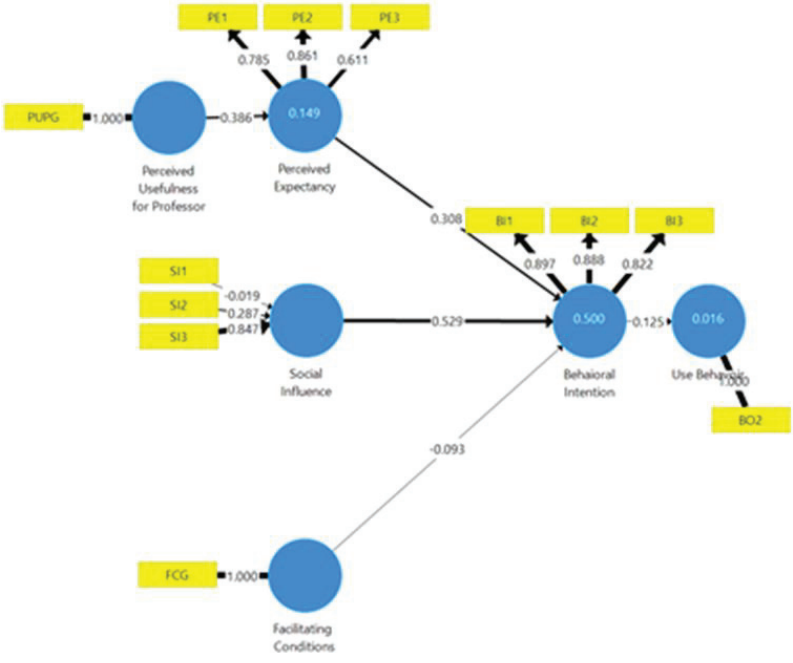
Table 11 presents a summary of significant differences by group for each indicator.

Table 11. Summary of significant differences by group for each indicator. Source: own elaboration.

Construct	**Indicator**	**Significant Difference**		
		Gender	**Univ (pub/priv)**	**School**
UB	BO2	**Yes**	**Yes**	**Yes**
FC	FCG	No	Yes	Yes
SI	SI1	**Yes**	**Yes**	**Yes**
SI	SI2	**Yes**	No	No
BI	BI1	No	No	**Yes**
PUP	PUPG	No	No	**Yes**

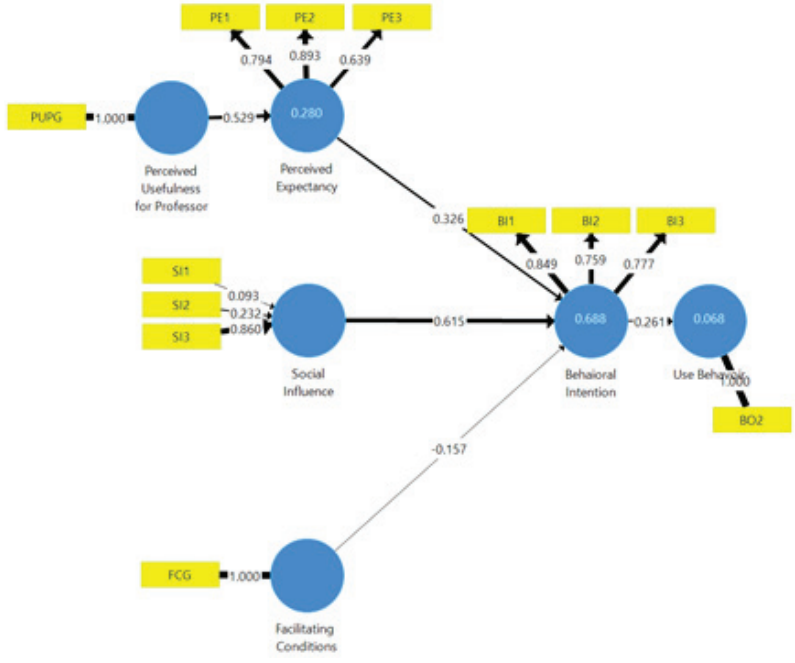


(**A**)



(**B**)

Figure 5. *Cont*.



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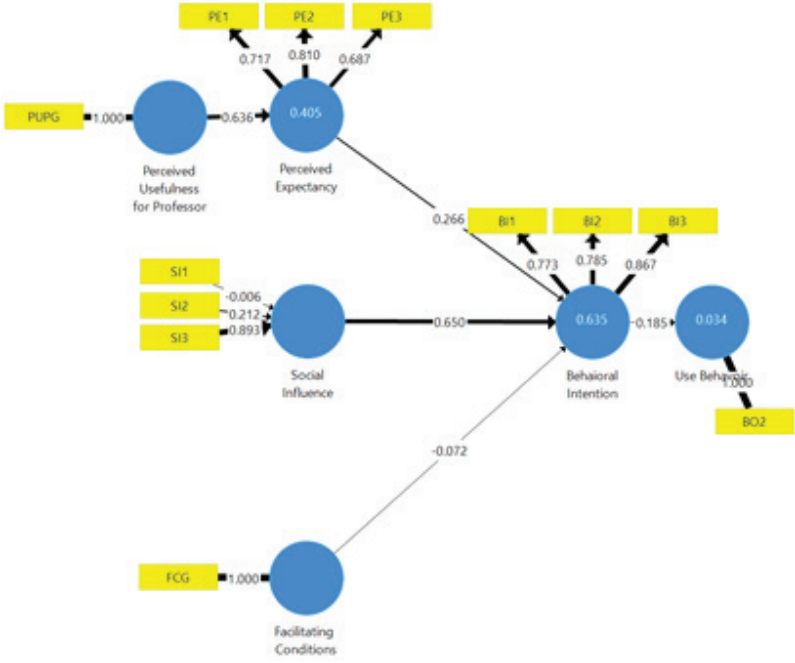

(**D**)

Figure 5. (**A**) SmartPLS model. MGA multigroup analysis. Public. Source: own elaboration. (**B**) SmartPLS model. MGA multigroup analysis. Private. Source: own elaboration. (**C**) SmartPLS model. MGA multigroup analysis. Men. Source: own elaboration. (**D**) SmartPLS model. MGA multigroup analysis. Women. Source: own elaboration.

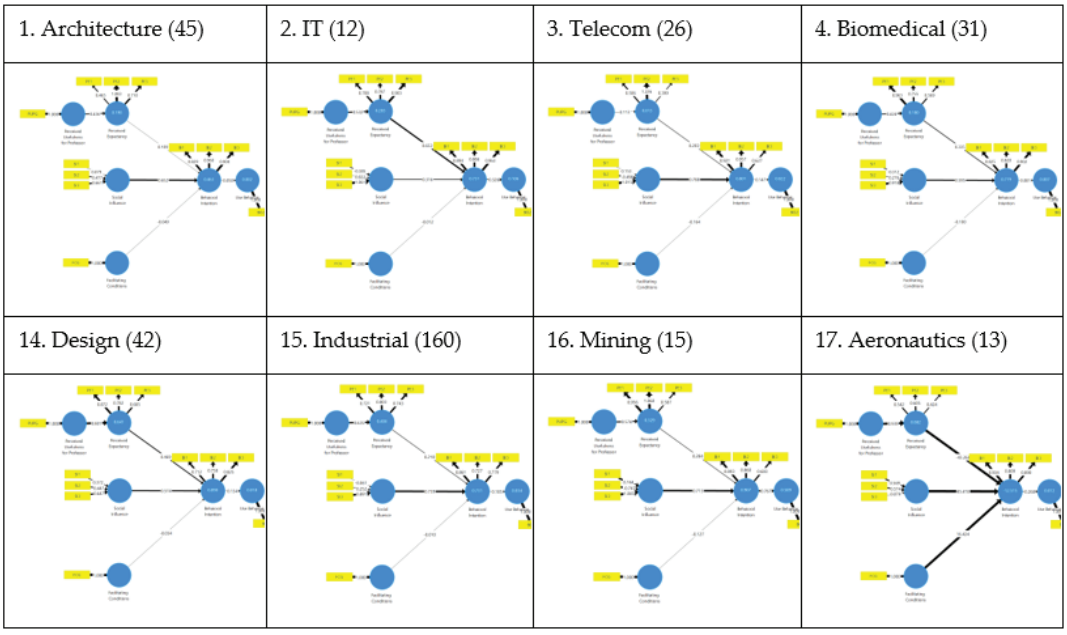

Figure 6. Path diagrams for different university engineering schools. The brackets indicate the number of respondents from each school. Not included is Road Engineering, with only 2 responses.

- The indicator BO2 (use of MS Teams) displayed significant differences among all groupings. This is due to the tool being mandatory at the private university.
- The indicator SI1 (the professor's social influence) displayed significant differences between genders and types of universities, and it reflected the important influence exerted by the professor on public students and women.
- The indicator SI2 (classmates' social influence) displayed a significant difference between genders, being a more important factor for women than men.

The structural system shows a very good predictive ability (see Table 12). R2 values should be high enough for the model to achieve a minimum level of explanatory power [58] recommend values above 0.10, whereas [56] considers R2 values of 0.67, 0.33, and 0.19 as substantial, moderate, and weak, respectively. The model had a very high coefficient of determination (R^2 = 0.660) for the intention to use MS Teams (BI), it being higher for public universities (R^2 = 0.718) and men (R^2 = 0.688). The value of 0.384 for BI indicates a high coefficient of determination. The model is, therefore, valid for BI.

Table 12. Summary of predictive ability and path indicators by groups. Source: own elaboration.

Data	R^2BI	R^2UB	R^2PE	Path				
				PE -> BI	SI -> BI	BI -> UB	FC -> BI	PUP -> PE
Global	0.660	0.055	0.330	0.301	0.631	0.236	−0.117	0.574
Private	0.500	0.016	0.149	0.308	0.529	0.125	−0.093	**0.386**
Public	0.718	0.076	0.413	0.312	0.654	0.276	−0.076	**0.642**
Women	0.635	0.034	0.405	0.266	0.650	0.185	−0.072	0.636
Men	0.688	0.068	0.280	0.326	0.615	0.261	−0.157	0.529

The elements that determine BI are especially SI (Social Influence) and PE (Perceived Expectancy) according to the values of the path coefficients.

The differences between path coefficients when comparing public and private universities suggest reasons for it being higher in the public sector, given that it is for PE that the non-parametric statistical data show a significant difference (see the numbers in blue in Table 12). It is, therefore, for PE that predictive ability shifts between public and private institutions.

5. Discussion

The most important factor determining the intention to use (BI) was Social Influence (SI). When analysing the SI indicators (SI1, SI2 and SI3), it is worth mentioning the enormous weight that opinions from social and professional networks had in determining the intention to use e-learning. Social networks and professional forums are, therefore, key tools for developing a positive attitude towards e-learning by students in the current situation. This should lead to a reflection on the permeability of professors and higher education institutions to tool choices coming from professional or social networks. This is, in general terms, consistent with results found in previous research dealing with the application of UTAUT to e-learning acceptance during COVID-19 in very different regional contexts [43,46,49,50,54,60]. However, it is possible to mention some exceptions, as a similar study focused on a developing country found that social influence did not affect students' acceptance of e-learning [52]. This seems to imply that the impact of social influence on e-learning acceptance in the pandemic context could be context-dependent.

The second most important factor affecting BI was the Performance Expectancy (PE), which in the model was determined by the new construct introduced: perceived usefulness for the professor (PUP). In other words, the professor's attitude towards the e-learning tool was the second most important element influencing the acceptance of TEAMS. Moreover, the results suggest that professors could have more influence over student acceptance of the e-learning platform at public universities than at private ones. Although more research is needed to confirm and explain this result, a possible explanation for this could be the differences in terms of governance between these two types of institutions. Indeed, governance at private universities in Spain usually follows a top-down approach, whereas public universities are less hierarchical [79]. Indeed, the use of TEAMS in the private institution was imposed on the professors, whereas it was optional at public universities. Moreover, private institutions are usually more student-centred (as the student is in part considered as a "customer"), while public institutions follow a more traditional, professor-focused approach.

It is surprising how little weight the facilitating conditions (FC) had on determining the use of the tool, as prior studies on the matter have mostly found that facilitating conditions have a direct impact on students' acceptance of e-learning during the pandemic [43,49–52,57]. In this case, the means provided by the university did not determine the students' attitudes towards e-learning. The same occurred with effort expectancy (EE). The effort involved in assimilating a new collaborative tool did not condition the learner's intention to use it. This suggests that, in this case, if network "influencers" establish that one tool is better than another in terms of prestige, improvement, and usefulness, it will not be the means provided by the university (support, manuals, networks, computers, etc.) that condition the students' use. It seems that a fast-learning curve was achieved through the internet and through students sharing experiences among themselves. This result could be linked to the particular regional and disciplinary context in which this study was conducted. Indeed, engineering students in a developed country such as Spain are likely to have significant prior e-learning experience as well as appropriate equipment at home, which would explain the reason why facilitating conditions provided by the university and effort expectancy were not as important in predicting e-learning acceptance as in other cases reported in the literature, coming mostly from developing countries.

6. Conclusions

The main conclusion of this research is that social Influence was the most important factor determining the acceptance of Ms Teams by the students, while the perceived usefulness of the professor occupied the second place. The facilitating conditions and effort expectancy did not affect acceptance, probably due to the particular pandemic context. A significant difference was found between the public and private institutions in terms of the importance of the perceived usefulness for the professor (this factor was more important for students' acceptance of MS Teams at the public university).

To sum up, for students, managing the change to a new e-learning tool under special circumstances lived during the COVID-19 pandemic requires, first of all, that the software package is positively considered in personal and professional circles and on social networks. This implies that universities wishing to introduce Ms Teams under the current scenario should focus on creating a positive social environment around the platform, for example, by using social networks or relying on testimonies by professionals who could confirm the interest of such a platform in a future work environment. Universities should also be very attentive to proposing to students with e-learning solutions that are used and valued in professional environments.

The second element is performance expectancy (the degree to which the student believes that using the system will help him or her to attain a better performance), where professors play a key role. It is, therefore, particularly important to seek the involvement of professors when implementing e-learning platforms. In that sense, more research is needed to better understand the professors' perspective and the factors that would facilitate their acceptance of e-learning technology.

An obvious limitation of this research is the fact that it has been conducted in two specific higher education institutions in a particular geographic setting. Furthermore, the findings of this study are limited to an exploration of MS Teams acceptance and may not be applicable to other e-learning platforms. Future research endeavours could include an exploration of the acceptance of e-learning in other geographic contexts using platforms other than MS Teams. More research is also needed regarding the context-dependency of the factors affecting e-learning acceptance during the COVID-19 outbreak.

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Essay

Education after the Pandemic: What We Have (Not) Learned about Learning

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Abstract: During the pandemic, educational technologies have become an essential tool to provide education at a distance. The paper outlines basic assumptions of research on the effects of the pandemic on education and points out methodological flaws when these effects are directly related to the pandemic or to effects of educational technology on learning. Studies cannot be easily aggregated and must consider the institutional, national and cultural conditions of how the educational system reacted to the pandemic. The article discusses how the experiences during the pandemic will shape the future discussion of education after the pandemic. With regard to the use of digital technology, the future seems widely open and will largely depend on the interpretation and re-construction of these experiences during the pandemic by the actors in the field. Two contradictory visions for the role of educational technology in *education after the pandemic* seem possible: a pre- vs. post-digital view that imply fundamentally different perspectives for the future of education. A pre-digital re-construction implies a return "back to normal", whereas a post-digital view tries to utilize the experiences of the pandemic for a consequential reform of education.

Keywords: educational technology; pandemic; future; social construction

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1. Introduction

There is a growing body of research on experiences and effects of the pandemic in education. In the following, we will categorize the different research approaches and will point out methodological challenges associated with this research. Then, we will ask if and how these results can be related to education after the pandemic, and what consequences and routes education after the pandemic might take.

2. Research on the Effects of the Pandemic

In the following, we will provide a short overview of the growing body of research reporting on the effects and experiences of the pandemic in education. We refer to international research (mainly existing reviews) about how the educational systems have managed to cope with the challenges of remote teaching during the crises and how these findings can be interpreted with regard to a post-pandemic future of education. Then, we will show that the interpretation of these results for the future of higher education can be interpreted quite differently.

Scholarly articles about education under the pandemic can be assigned to three categories, which we will discuss in the following section:

a. Prescriptive papers aggregating available knowledge about educational technology for "Emergency Remote Teaching".
b. Theoretical analyses reflecting and framing the debate.
c. Empirical studies on the effects of the pandemic on education.

Regarding (a): Several journals have published Special Issues about the pandemic providing a synthesis of experiences about "the best ways to respond to rapid shifts to digitally intensive learning" (https://www.springer.com/journal/11423/updates/19039268,

accessed on 1 March 2022) to inform the unassured practitioners that were confronted with an unprecedented challenge [1,2]. For example, *Educational Technology. Research & Development* has published a Special Issue, to "synthesize and inform the rapid development, deployment, and future of teaching and learning" [3,4].

It is not clear if and to what extent these pieces of advice from research did reach their audience and were able to provide the necessary knowledge to cope with teaching under the conditions of the pandemic. Furthermore, researchers from Ed Tech pointed out that "Emergency Remote Teaching", on the one hand, and "distance education with educational technology", on the other hand, have to be understood as two different challenges [5]. During the pandemic, teachers mainly were reproducing established practices of teaching and learning but with digital technology. Before the pandemic, the research literature on educational technology was heavily emphasizing the importance of re-composing instruction, rethinking instructional methods and making this a well-designed and coherent collaborative, strategic effort in a school. Based on these considerations of instructional design principles, concepts for digital learning should be outlined before a systematic map for the proliferation of technology is developed, including measures for training teachers [6].

Regarding (b): The journal *Postdigital Education and Science* has followed another, more qualitative approach, opening up the discussion based on a variety of data sources, personal testimonies and photographs, narratives and theoretical reasonings, describing "theory as an anti-pandemic practice" [7]. To some extent, this discussion questions mainstream approaches to research on Educational Technology (EdTech) which mostly has tried to capture phenomena by analytical observations in the tradition of empiricism.

Regarding (c): Then, a large number of empirical studies have addressed how education has responded to the pandemic and how shifting to remote teaching and home schooling made it possible to cope with the restraints of a lockdown. At the beginning of the pandemic, perceived failures to effectively move to digital learning often were related to a shortage of digital technology in education accompanied with insufficient experience of teachers on the use of digital technology for teaching. Additionally, some teachers were hesitant to adapt their teaching practices [8]. Furthermore, results have demonstrated how much conditions differed in the various parts of the world [9].

For the sector of schools, Bond et al. [10] have synthesized 81 studies from 38 countries with a focus on "what worked well in the online mode" (p. 9). They describe the variety of tools that had been applied successfully for remote teaching, pointing out that "standardized assessment for the online setting was challenging" (p. 13). They also refer to the fact that "social inequalities affected the capacity of some parents to provide materials and a suitable study space for their children" (p. 13). In this line of argument, Marinoni et al. [11] emphasize the (possibly) long-term effects of remote teaching that often did not reach students that needed support most desperately. While many pupils could benefit from caring parents and homeschooling, other students were not able to receive a compensatory treatment. Azorín et al. [12] explain why, for Spain, an often cumbersome remote schooling strongly has endangered the political goal to "leave no one behind".

Similar results are reported for the sector of adult education: Stanistreet at al. [13], summarizing studies in International Review of Education, stated that "A central message of all the articles in this special issue is that the move to online learning has reinforced inequalities of access and participation in education, not only in schools and universities, but in adult education too".

For higher education, Bond et al. [14] provide a mapping of 282 empirical studies. Most of the studies relate to the individual reactions and attitudes of teachers and students confronted with the pandemic. Händel et al. [15] report that many students lack the necessary skills for self-regulated learning and have suffered from "stress-related emotions (worries, tension, joy, and overload) as well as social and emotional loneliness". Several studies demonstrate the frustration of students and teachers with the situation [16,17] and point out issues of mental health [18]. Still, incoming evaluations of students' learning

prove that remote emergency teaching in many cases was able to deliver similar and in some cases even better results than before [4].

Kaqinari et al. [19] show the substantial differences between countries in the intensity and breadth of using digital technology [20]. Laufer et al. [21] present results of interviews with leadership from higher education in 23 countries pointing out the necessity of "closing the digital divides and pathways forward ... towards inclusive, long-term visions for digital education, which emphasize collaboration over individual gain". Thus, concerns about the rise of inequity as a consequence of the pandemic in the various sectors of education are growing [22–24].

Most of the published articles can be subsumed as empirical research papers. Due to the largely differing conditions, they provide an inhomogeneous view of positive and negative effects of the pandemic. In order to evaluate these findings with respect to the future of education, we will first need to look into the research designs—and their limitations—that these papers typically are based on.

3. Limitations of Research on the Pandemic

The most basic approach of research papers has been to ask students (and sometimes teachers or parents) about their experiences with learning during the pandemic. These data were important to identify the most oppressing needs for developing measures of teaching. However, from a research perspective, such a single point of data makes it difficult to interpret since they lack a reference from before the pandemic.

In other cases, two points of data collections—before and during the pandemic—have been available and allowed for a comparison. The question, however, remains how these two datasets should be interpreted and what such a comparison is able to reveal. Most often, it is assumed that the use of educational technology—as a reaction to the pandemic—can be interpreted as a *treatment* and would allow for an analysis of the effects of EdTech on learning. However, the introduction of EdTech has been confounded with many other changes and challenges for schools and families that came with the pandemic. Therefore, a comparison of learning before and during the pandemic cannot be attributed to the (increased) use of Ed Tech alone.

Furthermore, we have to consider that schools and countries have reacted to the pandemic quite differently. Some were reluctant to quickly adapt their methods of teaching, others switched more easily. Therefore, if we compare the two samples—before and during the pandemic—we are not able to learn about the effects of EdTech on learning, but about the way an institution has responded to the challenges of the pandemic and how they introduced digital technologies and instructional solutions.

More complicated, we have to consider that educational institutions are not the same and a strategy that is helpful at one institution might not be appropriate for another. A school might be privileged and have easy access to technology and motivated teachers; other schools might have to address students that were barely reachable since they did not have proper means to access the internet while staying at home.

Finally, we have to consider social, cultural and national aspects that interfere with all of the above correlations. Some countries have provided digital tools and appliances quickly, other countries were still struggling with deeply rooted cultural skepticism against digital technology (e.g., like in Germany: [8]). From this perspective, aggregations as well as comparisons between countries must be interpreted quite cautiously. It never is clear what factors contribute to the observed differences. It never is obvious to what extent it is appropriate to compare two institutions from different countries and in what dimensions they are distinct. From research methodology, it seems highly problematic to aggregate studies from various parts of the world assuming that the pandemic has affected educational systems similarly around the world. Additionally, comparisons between countries seem difficult since they do not consider other organizational and cultural differences in an educational system that exist independently from the pandemic and most probably produce interaction effects that are not easy to control.

As a summary, we have identified different explanations for comparing data on learning before and during the pandemic. Research articles attribute possible effects as a result of:

1. the pandemic (broadly);
2. the use of EdTech on learning;
3. the use of EdTech under the special conditions of a pandemic (as "Remote Emergency Teaching");
4. the different institutional responses of using EdTech during the pandemic,
5. teachers'/students' characteristics facing an institutional response to using EdTech during the pandemic;
6. national, cultural, social, and socio-economic conditions contributing to the above effects.

In most cases, reported studies are not based on representative samples and often do not relate to a baseline before the pandemic that would allow for comparisons. When analyzing the research on education during the pandemic, it has also been recognized that much of teaching and learning has moved "undercover", becoming more difficult to observe and to analyze than before (cf. [25]). Given the enormous impact of the pandemic on all levels of society, it is difficult to clearly identify causes for certain effects of the pandemic. The educational research literature primarily has focused effects of remote teaching, home schooling, etc., on learning results. However, the pandemic has affected people's health and wellbeing to a much larger degree, resulting in an increase in depression, anxiety and other disorders in youths and adolescents [26]. Therefore, given the complexity of the chain of effects of the pandemic, we should be cautious not to simplify possible interrelations of causes and effects within the realm of education. To some degree, we probably must accept that it will not be possible to isolate the effects of the various parameters of education and educational technology on learning. People have been confronted by existential threats, they have been suffering from the virus or were afraid of catching the virus. People have lost their jobs and income, they developed depression and other disorders—with highly differing degrees of concerns in the various parts of the world where countries have reacted completely differently during the pandemic, and we must be careful not to generalize our experience with "education during the pandemic".

Some studies have followed the most basic assumption, namely that an observed difference is a result of "the pandemic" or a result of the exposure to "EdTech" in education. Such a parsimonious explanation does not follow the discussion in EdTech research that, for a long time, has abandoned a deterministic view towards digital technology in learning. EdTech does not have a direct impact on teaching and learning as such, but should be seen as a potential to provide different learning experiences—if methods of instruction are adapted and innovations are introduced to an institution [27,28]. Educational change is not an immediate result of digital technology but of the joint effort of teachers and students to improve their practices of teaching and learning—while applying digital technology [29].

4. After the Pandemic

The question remains what research about education *during* the pandemic tells us about the time after the crises? (How) can we extrapolate from these experiences to the future of education? How will these experiences shape the future of learning? Whereas a lot of articles have been published about the shift towards digital learning during the pandemic, the move *out of the pandemic* seems to attract less attention with researchers. This can partly be attributed to viewing post-pandemic times as "shifting back to normal", which obviously would not need further attention because it simply implies the reinstatement of an old system and a recollection of learned practices from before the pandemic. With this, why would you need to analyze the return to something that was known about before?

Several researchers point out the social problems that the pandemic has intensified. There is ample evidence that the pandemic has widened social gaps in societies. Students with restricted housing conditions, limited internet access and poor digital equipment have been impaired by the pandemic more drastically. For example, Mac Domhnaill et al. [30]

have demonstrated the impact of high-speed broadband availability on student engagement with distance learning during this period in Ireland. Blundell et al. [23] state "that the crisis does in itself have the potential to exacerbate some of these pre-existing inequalities fairly directly" (also [22,24]). In a study from Ives [31], students reported that most areas of quality of instruction were poorer after the transition, with *student engagement* dropping by the largest effect size. Chakraborty et al. [16] have presented data that indicate that students have experienced online education during the pandemic as more stressful and affecting their health and social life. Interestingly, however, Iglesioas-Pradas et al. [32] found an "increase in students' academic performance in emergency remote teaching and support the idea that organizational factors may contribute to successful implementation of emergency remote teaching". Together, these results would *not* encourage us to continue with an extended use of digital teaching as introduced during the pandemic.

To some extent, teachers had tried to adapt their teaching with the use of educational technology. Will this contribute to a change in their attitudes and practices of teaching after the crisis? On the one hand, it might be assumed that the—to some extent—positive experience with educational technology will have a lasting impact on their behavior. Furthermore, students simply will increasingly expect the comfort of a digital delivery of instructional materials and interactive learning experiences. These experiences will not just be forgotten after the crises.

On the other hand, after the crises, we hopefully will not need to wear masks, we will not need to keep social distance, etc. We will return "back to normal"—also in education? Neil Mosley [33] asks: "So what has changed in the online education landscape of higher education? Well to a certain extent it's as you were". More controversially, Teräs et al. [34] ask: "Will they reinforce capitalist instrumental view of education or promote holistic human growth?", pointing out the political implications of the directions the educational system can take.

While many universities are declaring a "return to normal" this transition is not as smooth as often anticipated. Politicians and university leadership declare that universities are "open again" and are relieved to call teachers and students to return to classes. However, some teachers and students are reluctant. Some teachers want to continue using the digital technology they have learned to adapt their instructional goals to successfully. Similarly, some students have come to learn the conveniences digital tools offer for flexible learning. At universities, students might have changed their routines, some have moved their domicile farther away or have picked up a job not easily compatible with fixed appointments in a lecture hall. Recently, Zawacki-Richter [35] has demonstrated how expectations of teachers and students have changed with the experience of the pandemic.

So, some institutions proclaiming the return to standard operating procedures believe they are returning to a pre-digital "back to normal" but they oversee how past experiences have shaped expectations and prospects of teachers and students alike. The notion of "hybrid courses" has become popular, which seems to have evolved as a descriptive, albeit vague term that opens various possibilities to organize courses in a wide range of activities on campus and remotely [36,37]. Skulmowski and Rey [38] speak about COVID-19 as an accelerator for the digitalization of (higher) education and expect major reform initiatives as a result of the exposure to technology during the pandemic. Rapanta et al. [39] ask "how can this experience help bridge the gap between online and in-person teaching in the following years?". Rather cautiously, they assume "that the 'forced' experience of teaching with digital technologies as part of Emergency Remote Teaching can gradually give place to a harmonious integration of physical and digital tools and methods for the sake of more active, flexible and meaningful learning". Laufer et al. [21] encourage educational leaders "to move beyond the emergency adoption of online learning towards inclusive, long-term visions for digital education, which emphasize collaboration over individual gain".

Basically, education is facing two options to continue after the pandemic. One perspective relies on the idea of a rollback and implies the return to established routines of teaching and learning before the pandemic. With this view, emergency remote teaching

with digital tools is perceived as an exceptional case that will be and can be abandoned when the necessity for education via a distance is over. Many teachers and officials—often implicitly—follow this view of post-pandemic education as a "shift back to normal"—a pre-digital view.

Another view perceives the introduction and extended use of educational technology during the pandemic not only as a temporary "emergency tool" to bridge the distance between teachers and students but as a fast-track to move the educational system into a digital age. Based on evaluations of experiences during the pandemic, this perspective would want to pursue the future of education based on a digital environment—not making learning in a social environment on-campus obsolete but to extend the learning experience with richer opportunities in new approaches to teaching and learning. However, such a view will need to be implemented thoroughly and will need further discussion with teachers and other stakeholders in the fields. We would assume that the increased availability of digital technology will not automatically lead to a larger uptake of new teaching approaches and strategies based on interactive, self-regulated or cooperative learning models. Such models of instructional reform would need the instigation of deeper discussions within educational organizations and the implementation of strategies of proactive change in these institutions.

5. Outlook

Despite a large amount of published research, it is still difficult to grasp a clear picture of the effects of the pandemic on education in the various sectors of education worldwide. Our analysis is not based on a systematic review of research findings on education during the pandemic; our aim has been to investigate research designs of published research on education during the pandemic. We have unraveled the methodological limitations of these approaches and outlined that it is not possible to predict the future of education based on the results of these studies.

Studies on the impact of remote emergency teaching and other measures to cope with the pandemic are important but the reported effects are often difficult to interpret due to a range of methodological issues and constraints. It is not possible to directly attribute the effects of learning with educational technology during the pandemic to the use of EdTech as such since the pandemic has impacted several dimensions of students' and teachers' lives.

These studies have provided much detailed knowledge about the conditions and effects of the use of EdTech during the pandemic, but they are limited with regard to insights on how EdTech can and should support learning in the future. Furthermore, it does seem problematic to extrapolate the future of education in the different regions of the world based on these analyses.

We have outlined a pre- and post-digital view on education after the pandemic—associated with different interpretations of the role of educational technology—and how these views affect current efforts to shape the future of education after the pandemic. A pre-digital *back to normal* as well as a post-digital position striving *for a digital normal* can equally be forecasted and justified based on the current discussions and findings. The direction educational systems will take seems largely open. Zhao [40] points out the "opportunity to rethink education" after the pandemic, but it seems open to what extent the educational systems will take up this opportunity. In *Nature*, Lockee [41] argues that the pandemic "could permanently change how education is delivered". Yet, it could—but also could not. As Teräs et al. [34] advise, we will need serious and thorough debates about the future of education and how teaching and learning can be developed to address the challenges of a post-pandemic future.

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