

Article

Sustaining Inclusive, Quality Education during COVID-19 Lockdowns

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Abstract: With the sudden emergence of the COVID-19 pandemic forcing countries to close schools, the education of students worldwide had become a major challenge. Schools were forced to switch to online education, as that proved to be the only feasible option considering the adverse circumstances. The purpose of this research is to facilitate a quick transition to distance education should another lockdown be implemented. This is achieved by performing a literature review to determine how online education is regarded by students, along with what its advantages and challenges are. A survey has also been administered, with the purpose of assessing the usability of certain web conferencing platforms used in online education. The findings and results indicate an improving attitude towards degrees and courses acquired by online education, whilst also including the pitfalls and challenges teachers currently face during online education. The results of the survey suggest that certain web conferencing platforms appeal to the students more, with Big Blue Button being the platform most respondents rated favourably in the survey. Student feedback indicates that the transition to online education was successful, albeit somewhat challenging.



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Keywords: distance education; online education; higher education; COVID-19; ICT

1. Introduction

Distance education, the organic component of higher education around the globe, has impacted the lives of millions, providing a feasible way of earning their university degrees. This turned out to be true during the COVID-19 pandemic, when schools worldwide were closed during the spring of 2020. The only feasible way to continue the education of millions of children was to introduce online education and continue their classes on the web. This seemed to be an operation that was nearly impossible to carry out without preparation prior to the lockdowns; however, many schools succeeded. The reasons for this success could be attributed to both the availability of online platforms that facilitated communication, and the fact that the students possessed a device with which they could access their learning materials online. The actual shift to distance learning happened globally after the outbreak, with limited face-to-face contact and distance education becoming a new reality teachers and students had to accept and adapt to [1,2]. This posed a new challenge for many universities, including the University of Pannonia (with which the authors are affiliated), as these universities possessed vast experience in providing quality education for full-time students (face-to-face), and also part-time students by employing blended learning. This novel situation caused by a full transition to distance education has never happened before, and documenting the challenges the students and teachers faced is one of this paper's goals. To avoid the difficulties of such a sudden and unprecedented switch to distance education in the future, the results presented in this paper could assist teachers in designing and implementing distance education courses in case of another rapid switch. To define these concepts precisely, one must examine the key features of both distance education and e-learning. Ozadowicz (2020) discusses them as the following: the former being a collection of several methods with which the organisation of a new learning process takes

place (this also includes computer technology) by facilitating remote access to lectures. The latter explicitly employs computer technology (and related services) to support traditional education [3]. It is necessary to elaborate on the use of the word “technology” in this paper. In the conventional sense, technology is a word used in technical fields, being an umbrella term for skills and methods used in science and production. In education, we refer to a subset of the previous meaning: the hardware and software built with the purpose of facilitating the process of teaching and learning. This definition may seem straightforward; however, it has also caused a confusion in the design of online education, as it has diverted the attention of innovators from the educational approach of online education to the technical aspects of this form of teaching (see Section 3.1.2). In this paper, we primarily focus on online video conferencing platforms and related technology.

The goal of this research paper is to facilitate the quick transition to online education (should it ever be needed) by providing teachers a useful guide to assist them in transforming their course to an online course. We wish to achieve this by first performing a literature review of papers available. Afterwards, we formulate research questions and analyse the selected papers to answer those research questions, and to also extract additional information that may be of help when converting the class to online materials. We naturally know very well that other research papers have analysed research papers to a greater extent, aiming to be more informative; our goal was to provide a concise guide that can be consulted by teachers who may want to refer to its content: We merely wish to present other research papers dealing with advantages and challenges, acceptance issues, etc. A table has been included in Appendix A Table A1, which lists the selected research papers and their keywords and main purposes, allowing the reader to quickly identify the most suitable paper to fulfil their needs and answer their questions. To complement the literature review, we have also included a survey consisting of a quantitative component (survey administered to 83 students) and a qualitative component (the detailed, written feedback of six students involved in the transition to online education).

The quantitative component involved statements whose content and structure are based on the System Usability Scale [4], which is intended to be a “reliable tool for measuring [. . .] usability,” consisting of a “questionnaire with five response options for respondents” [4]. Our goal was to employ a reliable and well-tested tool that could enable us to identify any major issues affecting usability. The goal was to elicit feedback on six commonly used web-conferencing platforms in education, which could be the facilitators of distance education or blended education, with the latter being a “significant development of the 21st century” [5]. Webex, operated by Cisco, is a well-known platform often used by students involved with IT [6]. Zoom has seen a rise in users following the first quarantine due to COVID-19 [7]. Big Blue Button is also popular, and being free software, it can readily be integrated into an online education suite [8]. GoToWebinar is also a commonly used web conferencing software [9]. Microsoft Teams is marketed as part of the Microsoft 365 line of products [10]. Avaya Spaces is classified as a “Cloud-based team collaboration app” [11]. These six platforms were included in the quantitative survey for the respondents to rate. The qualitative component provided additional information to the conclusions extracted from the quantitative survey. We have aimed to formulate conclusions based on our research to provide guidelines to ensure the effortless implementation of sustainable and effective online education.

2. Materials and Methods

In order to create a concise yet informative guide to adopting materials in order to create an online class or course, we formulated research questions (along with hypotheses). Then, a literature review was performed on the selected literature, whose results could provide additional information and answer the research questions, verifying or falsifying the hypotheses. In order to ensure optimal results, the selection methodology was based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) chart [12]. This consists of identifying records, then screening for duplicates (if searching

several databases). Initially, 141 items were identified. This is followed by various selection criteria—some papers may not have met the quality criteria; others may not have been in English. Articles were then filtered out based on the criteria, with 27 research papers remaining for our literature review. The research comprised a quantitative and qualitative survey, focusing on the user experience and challenges of online education (including the phase of transiting from classroom education). A total of 83 surveyees responded to the qualitative survey conducted in April 2020, answering questions based on the System Usability Scale [4]. The survey was coordinated by five students of the University of Pannonia for the students of the Faculty of Information Technology. The responses were analysed, and the results were visualised in the form of charts, providing clarity in this research paper. The surveys were sent to the students via email, most of whom were between 18 and 24 (studying for their BSc degree). Since the link was sharable, external students and other people also had access to the survey. This did not affect the results of the survey, as the only criterion for the survey was to have been involved in higher education during the lockdowns. It is important to note that the survey was intentionally designed not to collect data that may discourage the surveyee from participating or elicit negative feelings (such as questions related to the gender of the surveyee, etc.). The survey was designed to solely focus on the questions related to the usability of certain web-conferencing platforms; as a result, details related to gender, ethnicity, and specific age are not available (in order to ensure a greater degree of anonymity). The evaluation of the SUS was a simple task: The odd-numbered questions were positive questions (e.g., “I think that I would like to use this system frequently”), whereas the even-numbered questions were negative (e.g., “I found the system very cumbersome to use.”). Once the survey was ready, the points were summed in the following order: One point was subtracted from each positive question’s score, and the negative questions’ scores were subtracted from five. Once the scores were summed, the result was multiplied by 1.923 (to extend it to a 0–100 scale). The result indicates how usable the system is (Table 1). The following table defined in the System Usability Score lists the categories depending on the score achieved [4].

Table 1. The quality assessment of SUS based on score achieved [4].

SUS Score	Quality Assessment
90–100	Best
80–89	Excellent
70–79	Good
50–69	OK/Fair
30–49	Poor
1–29	Worst

The qualitative survey included the written feedback of six students, who shared their experiences regarding the transition to online education. The combination of both the quantitative and qualitative survey results provide a clear insight into the challenges students face during online education, which can then be addressed with certain solutions. It is important to note that the results of the literature review and the qualitative research together act as a facilitator in designing more efficient and usable courses, as the current challenges and paradigms (literature review) and the most favourable platform (quantitative research) are all vital pieces of information needed for creating an online course for students on very short notice (should a lockdown of such duration and degree ever be implemented in the future). The research questions (RQs) and hypotheses (H) were the following:

- RQ1: Do the benefits of distance education outweigh the challenges?
- H1: The benefits outweigh the challenges of distance education; the challenges can easily be addressed.
- RQ2: Who uses distance education in the majority of cases?

- H2: People from rural or remote areas use distance education the most, who wish to pursue their first degree.
- RQ3: Does the available literature indicate that educational facilities are well-prepared for rolling out the blended-learning model?
- H3: The educational facilities are not yet well-prepared for distance/blended education; faculty require training in ICT.
- RQ4: Which platform seems to be the most suitable and usable for online education?
- H4: Based on our current experiences and observations, Zoom seems to suit the needs of most students. Zoom seems to be rather popular, thus seeming to be suitable.
- RQ5: How do the students assess the efficiency of the transition to online education?
- H5: The students may have faced several challenges, and are dissatisfied with the way online education is being conducted.

Previous experience has already indicated the success and prevalence of distance education in higher education and secondary education (when acquiring a trade). We argued that in general, it is the marginalised, remote population of the world that uses distance education the most, along with people who wish to earn their first degree. This seemed to be fitting as our second hypothesis, as many people cannot give up their job to pursue their academic goals, so studying while working seems to be feasible. Our other concern was related to the preparations the faculty of schools carried out in order to accommodate the great number of students studying via a distance education program. We believed that many members of the staff (especially if their field of interest is not IT-related) may not possess the skills required to use computers and smart devices with confidence and ease, using every function and program it can offer.

Section 3 consists of two subsections: First, the literature review is discussed in greater details, with the section being divided into further sub-subsections to increase lucidity. Then, the second subsection discusses the findings of the quantitative and qualitative research, including charts that clearly illustrate the results of the conducted survey. Section 4 discusses the findings of the research, and conclusions are made by answering the research questions.

3. Results and Discussion

3.1. The Literature Review

To conduct a literature review, the authors first selected databases in which querying for items was possible. The databases used were Web of Science, Scopus, and Science Direct. The authors' primary goal was to collect a list of journal papers that are of good scientific and quality standards. As a result, the authors did not hesitate to heavily rely on MDPI journals, as the published papers are reliable and of high standards. A total of 141 items were identified, and following a selection process employed for filtering out articles based on certain criteria (foreign language, not meeting standards, etc.), 27 full-text articles were identified, upon which the literature review was then performed. The process of the item selection is illustrated in a PRISMA chart in Figure 1 [12].

3.1.1. Advantages and Disadvantages

Multiple sources collected were dedicated to discussing the advantages and possible disadvantages of distance education. We wished to collect and itemise them from these sources and make a comparison, listing which advantages make distance education superior to (or at least as good as) physically attending school, and also discussing the disadvantages that may cause challenges, including possible solutions and fixes. It was noticeable that the popularity of distance education is nowhere near waning, and the number of enrolments is increasing. The comparison of the physical classroom and computer-based classes showed no difference in efficiency [13], thus proving that the differences noted are the consequences of external factors.

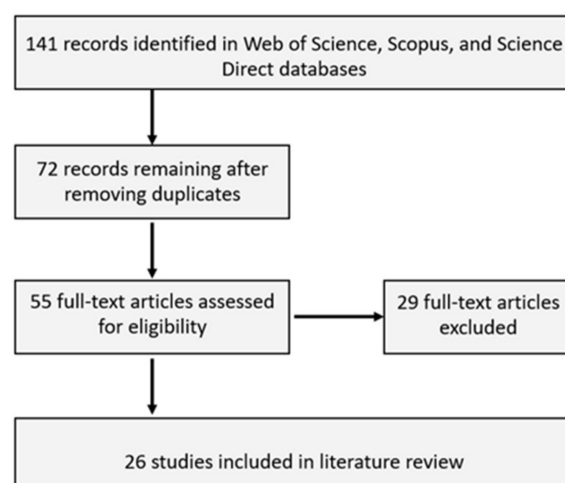


Figure 1. The selection process using the PRISMA chart.

The most commonly listed advantage of distance education is flexibility, including not having to commute and the ability to have a job. This is a crucial aspect, as many people who cannot take part in traditional education may be excluded due to the fact that they have a job they cannot give up. This spatial displacement also serves another, more important role: creating distance between students to slow the spread of COVID-19. By shifting a face-to-face course that is entirely online, the students and teachers do not have to come into each other's close proximity, thus resulting in a reduction in infection rates. As a result, this degree of flexibility provides further education for many people both in a temporal and spatial manner [14], providing more free time for important tasks such as skill development [15]. Not having geographical boundaries in distance education is an advantage for those who wish to complete a course from another country (or time zone). Learning at one's own pace facilitates the learning task, as each student has their own needs, and the pace of processing the learning material may significantly differ from person to person, and by accessing the online materials as many times as they please, students may have a better opportunity compared to the ones at traditional schools, reducing stress and increasing satisfaction. Teaching outcomes seem to be drastically affected by certain aspects of poor mental wellbeing, such as anxiety [16]. Therefore, it is vital that stress and anxiety related to the challenges of distance education be addressed with effective measures. Distance education has essentially overcome demographical and geographical challenges, offering students of all cultures and genders an equal opportunity to study [2]. Karatas and Tuncer [15] discussed further advantages, such as learning in an environment one is comfortable with, time and cost efficiency, and access to online tools and resources.

The factors discussed in the previous paragraph all contribute to accessibility, a criterion that has become increasingly valued in the 21st century. With access to global resources via the Internet, access to education is equalised. It is key to note that the use of "equalise" is deliberate: "Increasing accessibility" suggests that the status quo was acceptable, whereas "equalising accessibility" refers to ensuring every person's fair access to the resources they are entitled to. Increasing inequalities have been discussed, most of which have been caused or exacerbated by the COVID-19 pandemic [17]. The problems this has caused in education systems worldwide must be addressed to avoid further increase in inequality. Those most vulnerable to the adverse effects of inequality are the students living in low-income regions, where the lack of access to the Internet leaves many without the education they desperately need [17]. Inequality does not only exist in terms of equality of access. Intercultural interactions, which commonly occur in classrooms and schools of multicultural regions, could also be affected by inequality, especially if intercultural aspects are not taken into consideration by teachers and school administration. Research on aspects of intercultural education was done by Biasutti et al. [18], consisting of the administration of interviews with teachers participating in an Erasmus + project focused on

intercultural education. This case study, which was based on qualitative research, showed that participation in the project “offered an occasion to discuss (... and ...) examine practices, and develop teaching strategies for intercultural education” [18]. This indicates that the key to sustainable education relies on not only developing or adopting improved practices, but also sharing and discussing them with fellow-teachers.

The disadvantages discussed in the various sources are mostly due to the inherent nature of distance education. Nevertheless they can and should be addressed, mitigated, or improved. When learning online, it is unavoidable for teachers to not be able to receive the same quality of feedback from students as in a school classroom. A consequence of this, along with the spatial and temporal displacement of the teacher and their students, leads to a delay in feedback and lack of student motivation [19]. This challenge has partially been overcome by employing certain video-conference platforms to communicate with students “face-to-face.”

When not given immediate feedback, students may become demotivated as a result of missing face-to-face classroom interactions [15,20]. This may also occur when certain challenging components of the learning material are not clarified by the teacher. Distraction may also impact the performance of students, especially with ICT devices such as smartphones [20]. The most detrimental of disadvantages is the lack of credibility related to degrees earned through distance education. This scepticism could question the quality or validity of a job applicant’s degree, resulting in poor outcomes for employment.

Reduced social interaction may also bring about mental health issues and solitude. Additionally, while learning at one’s own pace was listed as a benefit of distance education, this may also pose a threat to progress: Some people may find it incredibly difficult to progress with their studies if they are not “forced” to study periodically, leading to procrastination and hindrance. Negative self-perception of one’s performance in online education is shown to often outweigh the positive self-perception students have. Hassan et al. [21] discussed this as being the result of students’ fear of failing courses (which could possibly be amplified by the teacher’s lack of presence). The students were shown to perceive their instructors as placing an additional burden on them (to compensate for the perceived easiness of online education), which was interpreted as harsh treatment [21]. This was also accompanied by fear of not being able to catch up with peers [21]. Other studies have indicated that online education during lockdown has had several adverse effects on students, especially young children. They were shown to be less active, combined with a less favourable diet, along with different sleep patterns [22].

3.1.2. Implementation of Distance Education

For a rather long time, university enrolments have been on the rise, but the capacities have not grown to accept such a large number of students. “Alternative delivery modes to face-to-face lecture-based instructions” must be formed [23]. Although attending university is an option for many people, the convenience of saving on travel time, the comfort of studying at home, and combining work with study proves to be satisfying [24]. Courses can be designed as entirely online (distance education) or combining physically attended lectures and online materials (blended learning). As many teachers and institutions are becoming familiarised with this method of education, a certain fuzziness can be observed in the concept of blended learning [5], which is yet to be resolved as this method becomes completely adopted. Fernandes et al. described blended learning as being “(...) accepted as the new norm in Higher Education (...)” [5]. During the process of course design, it is crucial to prepare the materials for use in a different form of education; Ellis [23] stated that instructional materials need to be adapted to the interactive environment, where the materials can and will be used differently compared to a regular textbook. Their research suggests that the “teaching and learning methods should be adapted to take advantage of the web’s interactive capabilities.” Interactivity is one of many benefits the web has, and must be exploited. Naturally, many other factors must be taken into consideration. The following list by Ellis [23] groups the guidelines of adapting a large course to the web:

- Course-level decisions:
 - Mode of web-based instruction
 - Adjunct
 - Mixed
 - Wholly online
 - Interactivity
 - Amount of interaction
 - Structure of the interaction
 - Incorporation of small learning communities
 - Operational issues
 - Hardware and software
 - Technical support
 - Bandwidth
 - Communication speed
 - Cost of course materials
- Instruction-level decisions:
 - Course objectives and learning outcomes
 - Critical content, types of learning, instructional methods, and media selection
 - Instructional materials
 - Instructional sequence
- Pedagogical decisions:
 - Course learning goals
 - Philosophical changes
 - Assessment and evaluation
 - Students
 - Instructors
 - Course
 - Instructional activities

Although every item on the list is important, the operational issues are the ones the instructor can influence the least. The devices available to each student vary, and making assumptions may result in designing materials that may not be equally accessible to every student due to technical differences. Other pitfalls may include lower bandwidth and other related technical issues in certain regions [19], so providing videos in lower quality (and lower file sizes) may benefit those with a slower Internet connection or data caps.

The role of the teacher is transformed by distance education. In conventional education, the technology is merely an optional supplement to the teacher, whereas in distance education, technology is a substitute for the teacher [25]. However, the benefits of technology used in online education may also benefit the students in other ways: The inherent problems of distance education, such as the lack of contact, may be partially overcome. Keegan [25] stated that the use of technology in higher distance education is beneficial. Impeded interaction between students, and other disadvantages that may hinder progress and student achievements, may also be mitigated with technology being integrated into distance education. Naturally, sufficient media competence is required to successfully communicate and prosper in online education, as it is crucial for the process of instruction [26]. A lack of technical skills is often found to be an obstacle of online education [19]. Regarding the issue of innovation, one issue tends to be the focus on technological innovation, and not the educational approach itself. The sudden demand for implementing distance education has contributed to stress for students and teachers alike, requiring “lots of quick adaptations in academic regulations, less familiar (. . .) methods of assessment (. . .)” [21]. The sudden switch to online education (as a result of lockdowns implemented worldwide) was surprising for both teachers and students alike [3].

The demographic is also important in terms of defining who the material is aimed at. One's expectations of the average student in distance education could be someone from a remote region pursuing their very first degree. However, research indicates that the users of open education resources are people who already have a university degree [27]. This is rather likely to be a consequence of already working at a job requiring their degree, and distance education allows them to advance their studies or earn a degree in a different field.

The process of e-learning implementation was discussed by Poulouva and Simonova, who discussed the basic steps and characteristics [26]. The steps of implementation have been well-defined, providing an excellent guide. The first step involves the acquisition of new hardware, software, and equipment (with an emphasis on user-friendliness), as the lack of essential equipment is often an obstacle impeding education [19,26]. This user-friendliness is to ensure the right degree of accessibility has been achieved, thus not excluding any student. Other criteria could be the use of free software (free as in free use, not merely gratis), or software that has been designed to accommodate the needs of people with physical/visual challenges. The second step is developing the general media competence of the participants, increasing computer literacy [26]. This naturally includes the faculty, too, not only the students. It is important to note that this training must begin from the essentials, building up a confident set of skills. Teachers were required to work even harder during the pandemic, and this was mostly without being given additional training [28]. This impedes sustainability, as significant strain can easily lead to burnout, issues related to mental wellbeing, and a high turnover rate among faculty. Thus, it is crucial to properly manage human resources in higher education. Tasci and Titrek pointed out that sustainable leadership (in education) is achievable by "increasing staff capacity" [29]. This is also of great importance, as "lifelong learning extends beyond the short-term gains of higher education institution" [29]. Consequently, the goals and methods of sustainable education are a collection of policies that prioritise long-term improvements.

Unfortunately, the digital competence of teachers is not necessarily adequate to function properly in online education. Sánchez-Cruzado et al. carried out a study involving 4883 teachers, assessing their digital competence [30]. The results of the study indicate an expectable trend among teachers, many of whom have been forced to use online solutions for the first time in their careers. It was revealed that teachers require development of their digital competencies as "the total competency level of the teachers participating in this study is [. . .] a low intermediate level" [30]. The COVID-19 pandemic has fortunately brought about several positive, much-needed changes in the implementation of education. For example, it has catalysed the introduction and use of educational technologies [3]. Alternatives to traditional education were sought by authorities, and discussions have been stimulated on the need for modernising methods and tools [3]. Another important field these computer skills contribute to is knowledge management, defined by Poulouva and Simonova as "[. . .] the strategy how to work with information, gain and process it, apply in professional work [. . .]." The third step is the application of general computer literacy in education [26]. This incorporates the process of teaching and studying whilst being supported by ICT. In cases when ICT is needed to support learning processes, new platforms and devices must be appropriated by the actors of the education process [28]. A prevalent, and very much damaging, misconception was how many lecturers believed that experience (in e-learning) automatically implied adequate skills in online education [31]. The morale of educators was lowered by online education brought on by the pandemic. Junus et al. discussed how the learning goals were not deemed to be achievable by lecturers [31]. Apart from the development of digital skills, the pedagogic approach employed in online education should be modified to meet the requirements and challenges presented by this relatively new form of education. The idea of using traditional approaches could prove to be outright counterproductive, as it inherently attempts to transfer explicit knowledge [32]. Since teachers had no other option but to develop their digital skills due to lockdown, the lack of experience in technology and online education platforms did have a negative impact on the quality of education their students received [1].

Another issue, which tends to be less discussed in this field, is the attrition rates of distance education courses in comparison with traditional courses or lectures. As may be anticipated, attrition rates prove to be higher for online courses compared to conventional courses [14,24]. Although this may not be surprising, the reasons for this higher attrition rate may not be too obvious: It was pointed out that the reasons were related to a lack of teacher/instructor experience and the different types of didactics employed in the educational methods, along with the students' acceptance issues [14,24].

The innovation of online education has been somewhat misinterpreted in the field of pedagogy, as innovators have shown a tendency to not focus on the educational approach, instead innovating the technology used to power this form of education and in the classroom [32]. To mitigate arising issues, it is important to emphasise the significance of first developing a suitable methodology, and then tailoring the technology to suit the needs of this form of education. An example would be to introduce innovative practices (such as critical thinking and reflexive learning), which are much required [32]. Currently, distance education still requires amendments, as it inherently has embedded inequalities [15]. The implementation process itself consists of two constituents, which function well if properly designed: synchronous teaching and asynchronous work. The former consists of every process done at a certain scheduled time, such as online meetings, webinars, consultations, and quizzes [3]. Asynchronous work (learning) consists of tasks not scheduled or regulated, and thus can be done at one's own pace and at any time. This includes studying learning materials, taking online tests (e.g., Moodle), and collaborating with peers [3]. Ozadowicz (2020) described the COVID-19 pandemic's effect on education as promoting asynchronous, independent learning combined with online synchronous discussions [3]. Naturally, this novel situation has challenged even the more experienced teachers, and has increased the difficulties students face. To mitigate these difficulties, cooperation is required from the teachers, who must "(...) promote the transition from synchronous to asynchronous learning (...)" [16].

3.1.3. Acceptance of Technology and Distance Education

The acceptance of technology and distance education also affects the user experience and enjoyability of the courses provided online. Hong et al. [33] focused on crucial determining factors that affect the degree of enjoyment and ease of use perceived by the user. It is important to note that the users' self-confidence in their abilities and skills (related to the integration of ICT) are also key factors, which must be recorded prior to defining the ease of use; this confidence was defined in the research paper of Hong et al. as self-efficacy.

Two personal traits were shown to positively relate to the understanding and incorporation of these technologies: innovativeness and self-efficacy [33]. When associated with hedonic values, certain technologies may also be received with greater enthusiasm. Smartphones may be considered to perfectly fit this category. Their versatility makes them both suitable for education and a major distractor. Although certain voices advocate for the adoption of smartphones to aid the studies of students, many students use their smartphones for other purposes. Martínez et al. indicated smartphone use as a distractor as well as a useful device in the classroom [20]. Their research results indicated limited use of smartphones for educational purposes, and the use of social media and text messages exceeded the time spent on the phones for class-related activities [20]. Cicha et al. (2021) also discussed the positive effect of hedonic values of technology on acceptance, stating that "(...) enjoyment had the robust significant effect (...)" on acceptance [1]. This is a significant attribute of user acceptance, and the future designs of educational platforms must focus on providing sufficient user experience to keep the users engaged and active.

Other factors that may indirectly affect user experience are the design of interfaces used in distance education and content quality [14]. These findings indicate student priorities, which should be taken into consideration by software developers and manufacturers in the future. "User experience" (student satisfaction) was shown to correlate with "student perceptions of and actual experiences of online studies" [21]. Naturally, the students'

competences also affected their satisfaction with the online courses during the pandemic lockdowns. Hassan et al. [21] also discussed the following factors contributing to satisfaction: “(. . .) computer competency, technology orientation, and smooth course delivery.” Other studies also included social influence and perceived enjoyment as contributing factors [34,35]. Nevertheless, study satisfaction was shown to decrease over time in another study [2]. Fortunately, the resilience of students was observed in another study, which showed that the relationships students had with their teachers and peers did not seem to suffer as much as may have been initially expected; unsynchronised learning may not necessarily have a major impact on relationships [16].

3.2. Results of the Surveys Administered to Students

The following two subsections discuss the results of two surveys conducted at the University of Pannonia. These surveys were inspected by the student council, and both surveys were anonymous and voluntary, providing the university students an opportunity to express their thoughts and opinions regarding online education and video-conference platforms.

3.2.1. Quantitative Research

A total of 83 people responded to the survey administered via Google Forms, providing feedback on the platforms they had used in the past. Figure 2 illustrates the percentage of surveyees familiar with each web-conferencing platform.

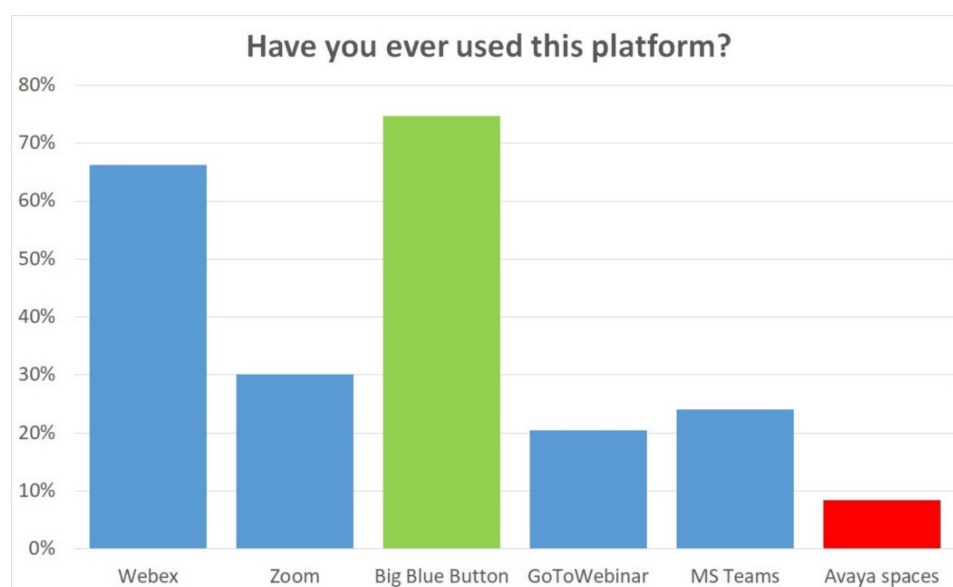


Figure 2. The percentage of surveyees using the platforms in the survey.

The following questions prompted the surveyee to answer on a scale of 1–5 (1 = “Strongly disagree,” 5 = “Strongly agree”). Naturally, since only a smaller demographic was surveyed, the results must not be considered to be fully representative; instead, only certain deductions can be made. Figure 3 illustrates how appealing the platforms proved to be to the users. The results indicate that Zoom was the most preferred platform, whereas Avaya Spaces seemed to be the least appealing in terms of motivation to use the platform again in the future. As with every other question, the small number of users responding to questions related to Avaya Spaces impacted the results; thus, caution is advised when making further deductions. Figure 4 shows the user feedback on system complexity. The respondents found GoToWebinar to be the most complex and Big Blue Button to be the least complex.

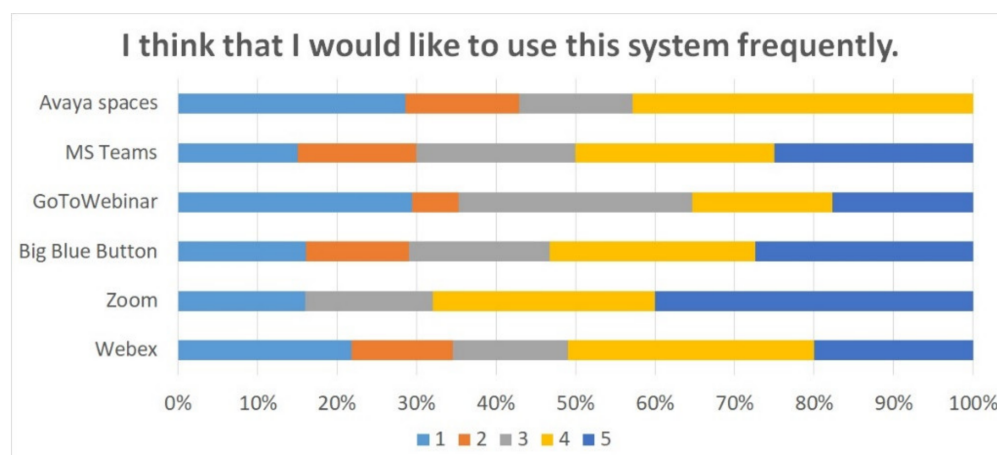


Figure 3. Popularity of the platforms among surveyees.

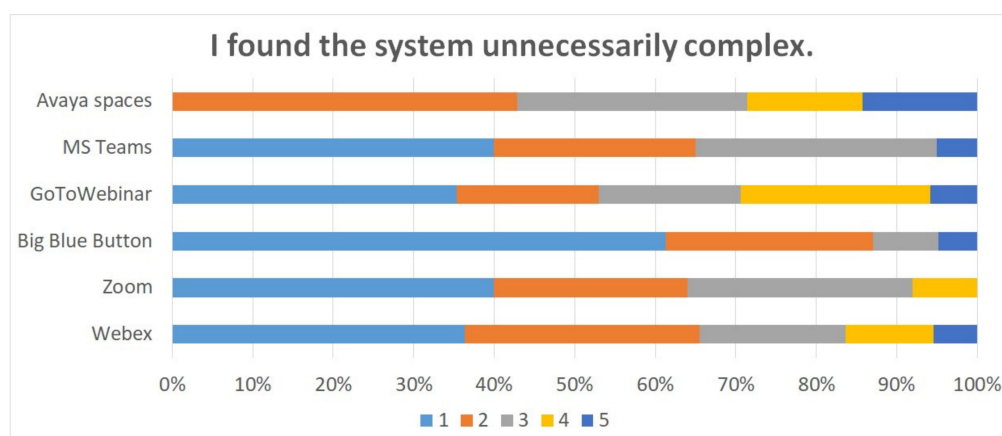


Figure 4. Reported complexity of the platforms.

User-friendliness is a critical issue of online education. Figure 5 illustrates the perceived ease of use of each platform. Most platforms were reportedly easy to use, with Big Blue Button being the easiest of all platforms. The respondents indicated that they would be least likely to require the help of a technical person when using Zoom, which is illustrated in Figure 6.

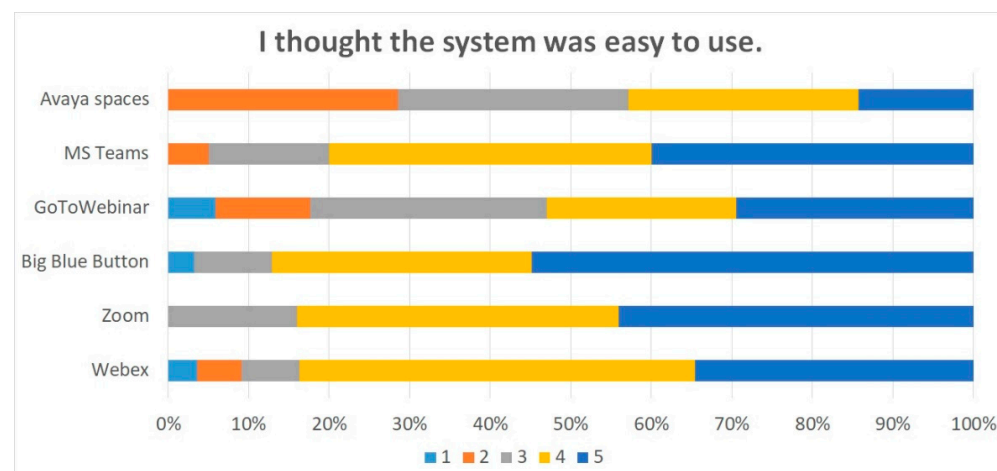


Figure 5. Ease of use of the platforms reported by surveyees.

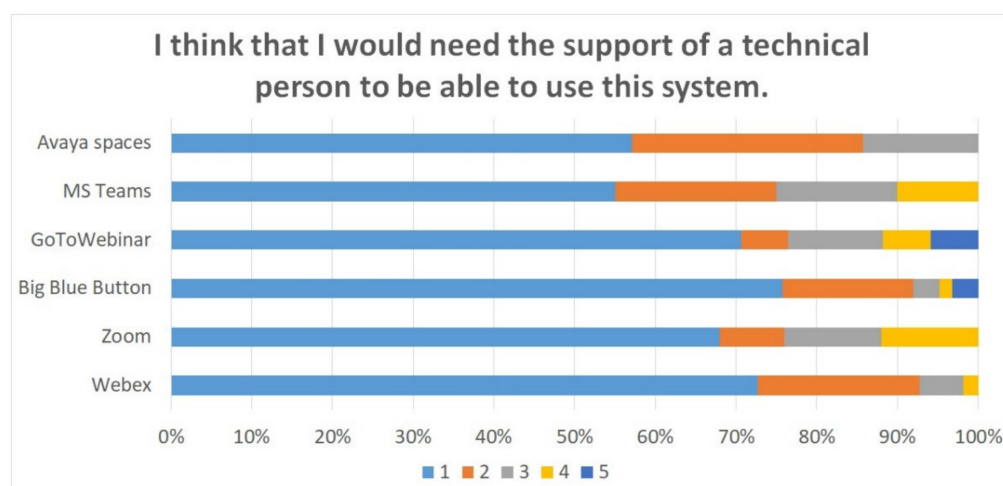


Figure 6. The need for the assistance of a technical person for each platform.

The intuitive integration of features in web-conferencing software may contribute to the enhancement of user experience, thus facilitating the process of learning. Most responses rated Big Blue Button as the platform with the best integration of features (Figure 7), while also describing it as the least inconsistent (Figure 8). Big Blue Button was also determined by most responses as a system one could learn very quickly (Figure 9).

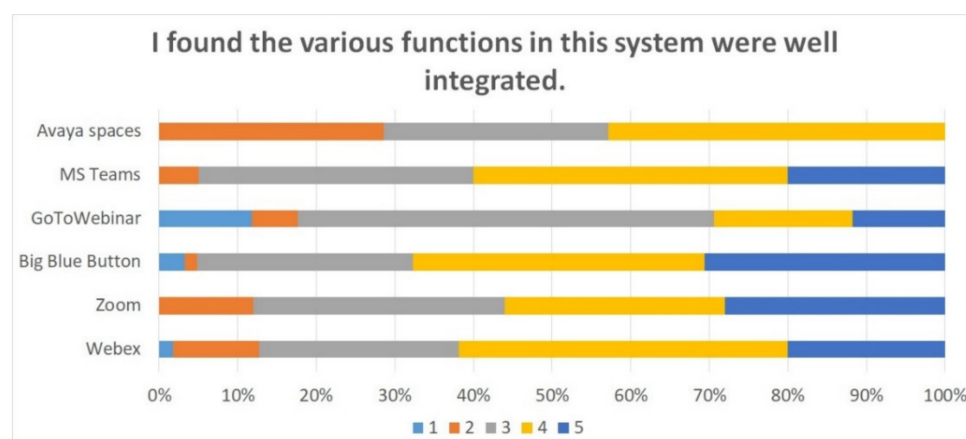


Figure 7. The integration of functions in each platform.

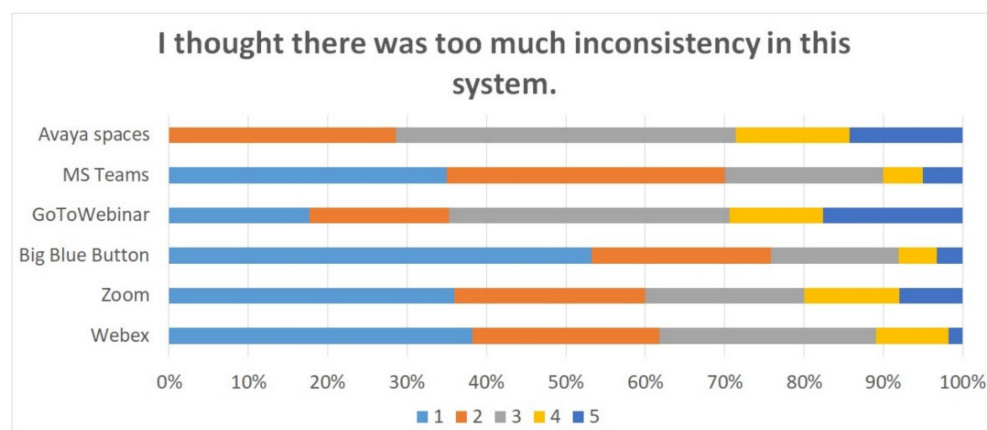


Figure 8. The inconsistency in each system.

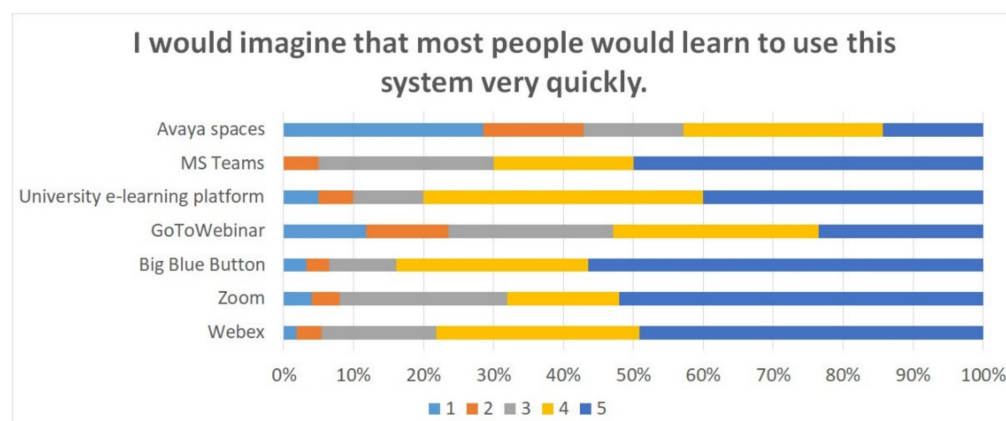


Figure 9. The ease of mastering the use of the examined platforms.

Big Blue Button was also rated as the least cumbersome to use (Figure 10). This is a significant factor, as using efficient tools for teaching students facilitates the teacher's task immensely. In addition, user confidence was also reported to be the greatest when using Big Blue Button (Figure 11). Other challenging factors may be the requirement of training/tutorials before using a platform. The surveyees reported that Webex required the least amount of preparation before use, contributing to its popularity (Figure 12).

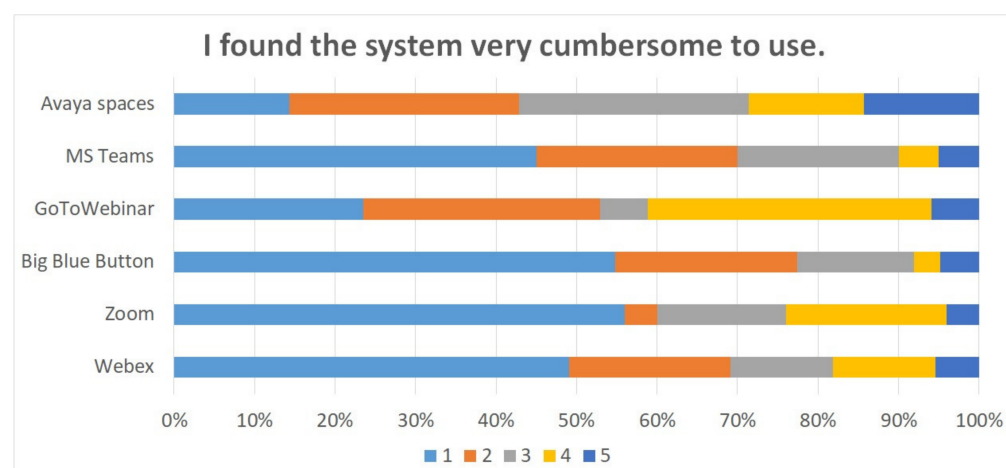


Figure 10. The responses to how cumbersome each system proved to be.

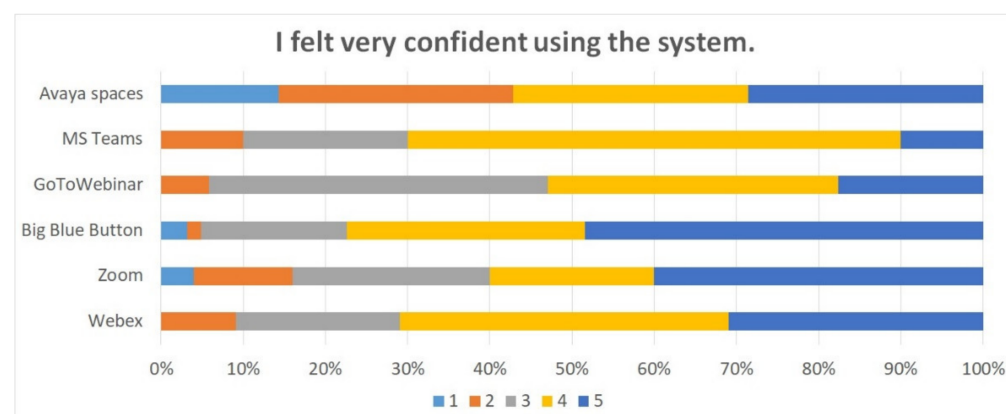


Figure 11. User confidence during the use of each platform.

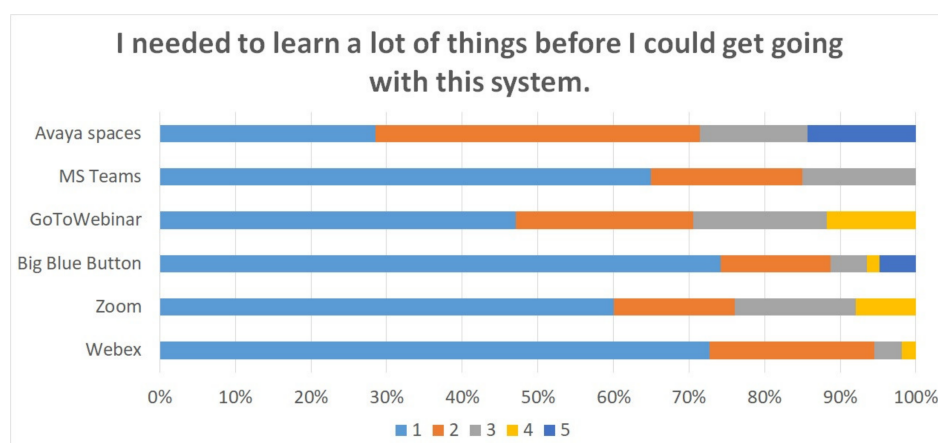


Figure 12. Required preparation for the use of platforms.

The final items of the survey focused on technical aspects of each platform. The chat feature, which can be very useful when a user's microphone fails to operate correctly, may also contribute to the interactivity of the online classes. The degree of this contribution was included in the survey, and the majority of users agreed that the chat feature does increase interactivity (Figure 13). An overwhelming majority of surveyees agreed that the ability to replay the recorded video footage of the lecture does in fact facilitate the learning process (Figure 14). Audio/video quality was also included in the survey; despite (usually) not being a platform-specific issue, the users were prompted to rate the audio/video quality (Figure 15).

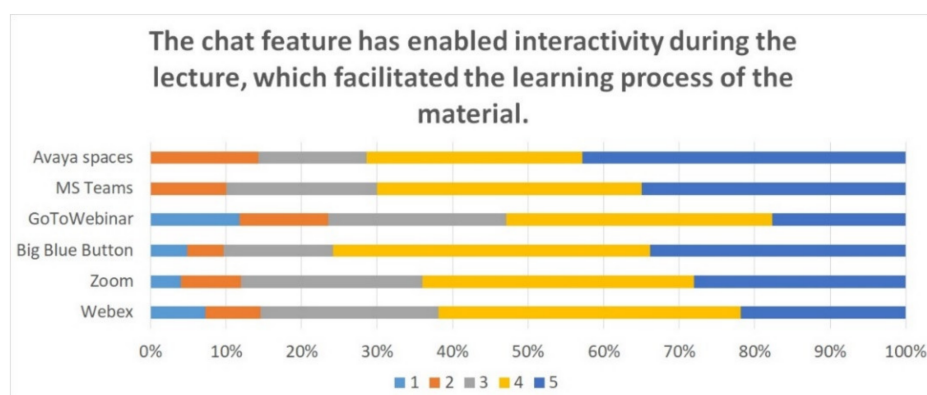


Figure 13. The surveyees' responses to how the chat function enables interactivity.

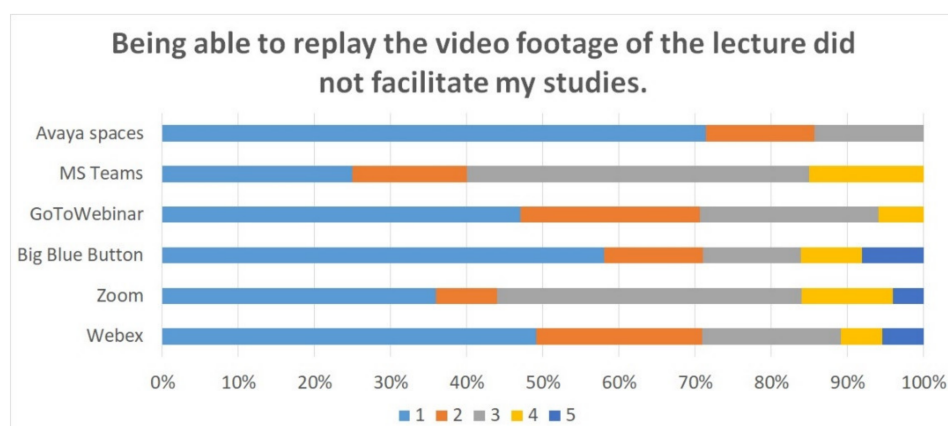


Figure 14. How replaying the recorded lecture facilitates the studies of the users.

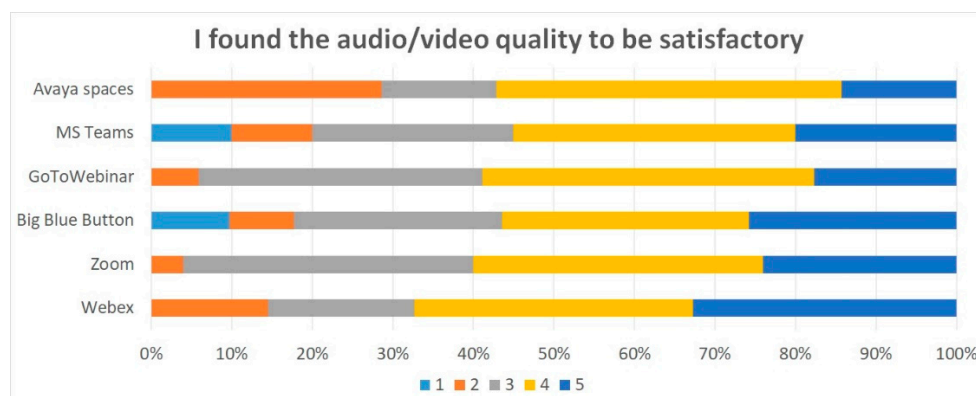


Figure 15. Audio/video quality of each platform.

The listed web-conference platforms all been proved to be usable and suitable for hosting lectures online, with some performing better at certain tasks or features. The average SUS scores are shown in Figure 16. With its score of 77.91, Big Blue Button was rated the most favourably in most aspects, with other platforms requiring minor development to address issues observed in the previous figures.

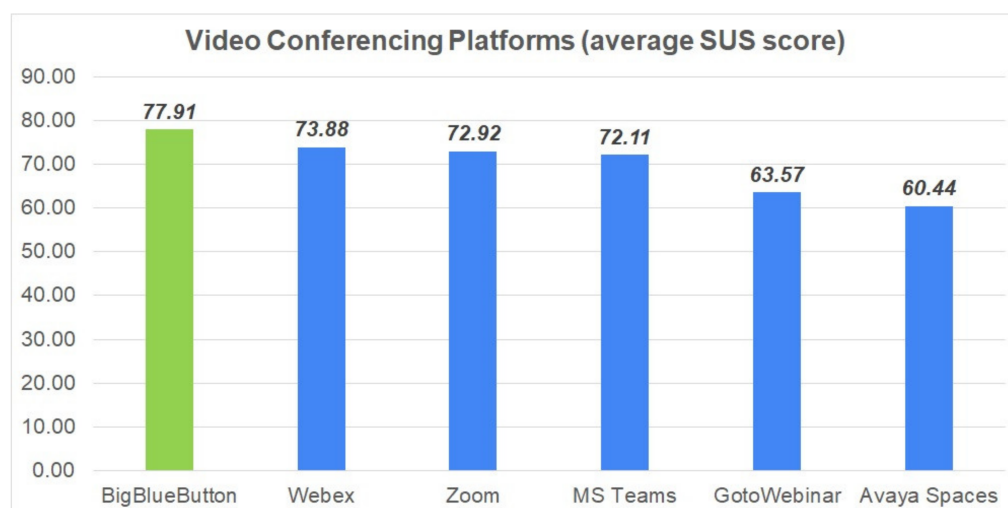


Figure 16. The average SUS scores of the video-conferencing platforms included in the survey.

3.2.2. Qualitative Research

As part of the qualitative research phase, six university students from the seminars held by the authors of this paper submitted their experiences and feedback on this novel situation of the nationwide transition to online education. The notable reluctance to participate in this survey may indicate a lack of motivation, or the discomfort of having to elaborate on such serious topics, despite being guaranteed complete anonymity. The students were asked to assess the efficiency of the education they received, and take note of any challenges they faced or issues that were encountered (including both the technology used and external factors). The students discussed the merits of online education, several challenges (which can be addressed), and also their views on the future of online education. It is key to note that the transition period (a matter of weeks) was rather sudden, and was exceptionally demanding for the teachers and students alike, especially with the uncertainty of the circumstances [19]. The students praised the system for allowing them to manage their time and schedule, allowing them a greater degree of freedom. One student even added that for most of their lectures, being online was sufficient, and did not require any in-person consulting with their instructor. Another student expressed their

dismay, as their instructors decided to use a great variety of different web-conferencing platforms, which many students found very confusing to manage (most platforms requiring registration/password to use). They also noted that using one single platform would have been more beneficial. The long period of lockdown had a deteriorating effect on the students' mental wellbeing, and the surveyed students unanimously agreed that in-person lectures had become treasured, especially by students who started their university studies in 2020. Several students also noted that gamification also improved the quality of lectures, compared to the demotivating dullness of online classes.

The feedback also indicated an initial scepticism regarding the transition, although the merits included better time management and greater independence. Another student expressed their satisfaction with the new system, lauding the availability of the recorded lectures, which could be replayed on demand. They also noted that the teachers made a great effort to ensure that every student had the fair opportunity to excel and progress in their studies, despite facing the challenges posed by the new situation. This is also supported by previous research done by Ozadowicz (2020), who stated that "(...) switching to full distance education, remote teaching and learning processes are not necessarily associated with the loss of their educational value" [3]. Several students also noted that teachers coordinated many more assignments due to the transition, overwhelming the students. Regarding assessment issues surrounding the switch to online education, the university the authors are affiliated with implemented several measures and practices to sustain the credibility of online examinations. One measure was the mode of written assessment implemented during lockdowns. For tasks requiring paper-based test-sheets (ideal for drawing), the students used their smartphones to take a photograph of their test, which they then proceeded to upload to the university's content management platform (Moodle). As many online testing platforms do not fully support drawing and similar functions, this seemed to be a very convenient and effective method for certain types of written assessment. Oral final examinations were also modified to adapt to the novel situation of distance assessment. Some universities gave permission for the professors to ask the students to rotate their webcams to inspect the surroundings before examinations. The university the authors are affiliated with ruled that students were to reply to examination questions without delay, ensuring credibility. Future research must be focused on this topic, as the switch to distance education alone proved to be rather challenging, let alone distance examination.

4. Discussion on Answering Questions and Hypothesis Verification

In this section, the research questions will be answered, along with the verification or falsification of the hypotheses. Based on the hypotheses, theses (T) will be formulated. RQ1 can be answered with the publications used in Section 3.1. Not having to commute and the greater degree of flexibility in a spatial and temporal manner [14] were listed as major benefits compared to traditional classes. Furthermore, studying at one's own pace was also a major advantage, although this was also shown to be a disadvantage for certain students (who are more susceptible to distraction). Some challenges included a delay in teacher feedback and the fact that smartphones, which are commonly used among students, can easily be a distractor during classes and studies [20]. The former can be overcome by employing a communication platform that could help the students ask their questions, whereas the latter can be resolved by redesigning certain class activities, which could then rely on using their smartphones. An excellent example could be coordinating a task that relies on students using their phones to gather more information on a topic, which could then be used as part of a presentation or discussion. Considering these advantages and challenges, we can confidently verify H1 and form the following thesis: T1: The benefits of distance education outweigh the challenges, which can be easily resolved.

RQ2 is related to who benefits the most from distance education. One may believe that people in remote areas and those pursuing their first degree would be the most prevalent among students in distance education. Research indicates that more often than not, it is

people who already have a degree who take part in distance education [27]. H2 is thus falsified, and the following thesis can be formulated: T2: People who already have a degree take part in distance education more commonly than those who have not yet earned a degree.

RQ3 can be answered by analysing the sources related to acceptance. Poulouva and Simonova discussed the process of e-learning implementation, which includes the forming of general media competence for both students and faculty [26]. The reason why it is so important to place emphasis on both parties is because students are the consumers of the material and do need to have a good understanding of how ICT technology is used. However, it is also paramount that the teachers also possess the right skills needed to confidently use a computer, and also possess the skills of creating quality content that is aimed at the students who take part in distance education. Since most of the materials are uploaded, and then downloaded by the students, it is important that the material be stored correctly (i.e., text in a readable document/PDF). Furthermore, acceptance issues were discussed by several authors, who studied the patterns of acceptance and which external factors influence the degree of student acceptance [14,34]. This indicates that schools may not have conducted the sufficient amount of research to ensure acceptance by both the faculty and students. We encourage further research in order to increase acceptance, as the students may be affected in several ways: Attrition rates adversely affect student attitude and motivation [14,24]. H3 can be verified, and the following thesis can be formulated: T3: Faculty and students require further preparation and training before entering distance education.

The quantitative research revealed that the students were mostly satisfied with the web-conferencing systems available, although some proved to be more appealing to the students. A total of 83 responses to the survey were processed, revealing how the surveyees assessed the platforms regarding their usability and other related qualities. Based on the responses to the survey, Big Blue Button proved to be the most suitable, as its average SUS score was the highest; Big Blue Button was rated the most favourably. This answers RQ4 by falsifying H4. T4: According to the results of the survey conducted, Big Blue Button was rated the most favourably according to our analysis.

RQ5 is discussed in the previous section, with six students providing their feedback on the matter. Despite having initial scepticism, the transition to online education was rather favourable (facilitated mostly by their teachers). The challenges they have faced were not too serious, mainly being related to the numerous platforms employed, or the amount of work assigned by certain teachers. H5 can only partially be verified, as student satisfaction was reportedly greater than anticipated. T5: Despite facing several minor challenges, the students are relatively satisfied with the way online education is being conducted.

The goals of this research paper were to assess the online conferencing platforms most commonly used in online education by students and the analysis of the relevant literature in order to assist teachers in creating online courses within a short time period. This may prove to be useful in another COVID-19 situation, when the rapid development of courses for a large group of students is required to reduce the spread of infection. The challenges listed may also prove to be useful, as teachers planning new courses could become familiar with the pitfalls and possible design flaws of online education, and could thus introduce measures to mitigate these impeding factors. The results supporting T1 include the multitude of challenges students face, and by identifying them, online courses can be improved. This is related to T5, which is an actual consequence of student satisfaction (mitigating challenges can increase student satisfaction). The results verifying T4 reveal the platform students found to be the most usable, which also enables teachers to choose an online conferencing platform.

5. Conclusions and Limitations

The COVID-19 pandemic has taken its toll on nearly every aspect of life, which indicates how urgently development is needed in these sectors. In terms of education,

development of sustainable means of teaching during a pandemic could possibly mitigate the challenges of distance education, although one must be aware that not all problems can be solved by technology and science alone [32]. The sustainability of education has been affected gravely by school closures and the consequent switch to online learning [17].

We express hope that the findings of this research paper may be of great assistance either to those who wish to amend the way online education is implemented at their institute, or to those who wish to implement online education. The properties and issues related to the web-conferencing platforms could be used to address the issues in the future, enhancing user experience. With the development of increasingly better online platforms for education, an increasing number of students will have access to education in the future, providing a sustainable way of improving the living standards of people in every region of the world. We express hope for further research in this field, as the education of future generations determines the future and sustainability of the world. This development process must primarily focus on the challenges the students faced during the lockdown period, as they had to rapidly adapt to online education. Isolation, severely reduced socialisation, and lack of teacher feedback (as discussed in the section on disadvantages/challenges) are issues that must be addressed during the development of new tools. The best interest of the students must be taken into consideration when designing new methods and the technology powering them.

During the lockdown, the quality of sustainable education was jeopardised. Teachers and students alike found the software used in education somewhat challenging, and many students also did not have access to smart devices that are very much needed in distance education. The interpretation of sustainability extends to mental health and welfare: The opportunity for socialising is virtually non-existent with online education, possibly leading to depression [22]. When considering the security of education in the long run, a sustainable and readily applicable solution must be adopted, as this appalling educational crisis must not repeat itself. Sustainability is not restricted to the improvement of the students' user experience itself; it extends to the promotion and development of education, providing every student the opportunity to prosper in life.

A great multitude of other papers have dealt with online education during the pandemic, with several focusing on the video conferencing platforms used by schools and universities. This research paper may not be unique in the sense of analysing these platforms; however, the criteria involved are significantly different from many previously conducted studies: Usability was the primary concern of our research. A comparison to other recently published papers indicates how the scope and criteria of our research differs from other papers. Correia et al. (2020) compared videoconferencing systems with usability in mind. The systems involved in the analysis were Zoom, MS Teams, Skype, and WhatsApp. Of these platforms, our research dealt with the first two (covering a total of six platforms) [36]. The analysis evaluated "learning related features" such as breakout rooms, chat functions, and raising a virtual hand. Their usability analysis included scoring categories from 1 to 5, and then calculating an average of the aggregate score. The results of this analysis suggest that Skype proved to score the most on accessibility (avg. 87.3%) [36]. Our research analysed more platforms, and we employed the System Usability Scale as an effective tool for usability evaluation (with data being provided by a quantitative survey). Correia et al. (2020) also discussed significant issues regarding online education. It has been noted that when addressing the connectedness of online education, "... videoconferencing systems should not be a panacea ... " [36]. The necessity of a more human-centred approach in the "design and optimisation" of these conference systems has also been noted. The results of our research are congruent with this statement, as the difference between the best and poorest average SUS score was far from being insignificant (17.47%).

Sidpra et al. (2020) evaluated numerous platforms selected from 50 commonly used videoconferencing platforms, dividing them into two categories (depending on predefined conditions) [37]. The selection from 50 platforms is significant, as it provides a comprehensive analysis in this field and assists teachers in choosing the most suitable platform for the

courses they have designed for online education. The two categories of videoconferencing platforms are to differentiate between the certain types of groups: smaller webinars or larger lectures. The criteria for the smaller group was a monthly flat rate of USD 50, hosting at least 50 people for over 2 h on multiple platforms (Windows, iOS, Android, Linux). The larger group's criteria only differed in the price and minimum hosted participants: USD 75/month for at least 250 people [37]. In both categories, MS Teams proved to be the most favourable platform. The rationale for this result was discussed as being attributed to its cost efficiency, high capacity of participants, and the myriad of features included [37]. Our research complements this paper well, as it is crucial to assess the acceptance and usability of platforms simultaneously.

Another promising aspect of online education is continuing its use following the pandemic. This idea, which may be considered a novelty, was discussed by Nikou (2021). The use of web-based videoconferencing after the lockdowns significantly depends on user adoption as a factor [38]. Similarly to the previously discussed research paper, this study also discussed the acceptance of videoconferencing, not focusing on individual platforms, but rather the method itself (its continuation in the future). The Technology Acceptance Model was used, which is a standard modelling method of user acceptance. Research involved 61 undergraduate students in the form of an anonymous online questionnaire, intended to evaluate the surveyees' attitudes regarding the continued use of web-based VC systems for attending lectures and seminars following the end of the COVID-19 pandemic [38]. Student satisfaction and attitudes being elevated by perceived usefulness was also discussed, a finding that was also observed in other research papers discussing similar issues. As with the previous paper, the results of our research complement the results of this paper: Acceptance and usability must be considered simultaneously; however, the former depends on student attitude, whereas the latter relies on the ability to access the features of the web-conferencing software.

The circumstances, methods, and results of the research cannot be applied to every situation, and limitations do apply. The literature review included 27 items and the quantitative survey included the responses of 83 surveyees, whereas only six university students submitted their detailed feedback. Furthermore, detailed research is required to fully understand the underlying issues of distance education, which has caused challenges for students. The qualitative component of this research requires further surveys to fully verify, as only six students volunteered to provide their anonymous feedback. This reluctance, however limiting it may prove to be in this study, indicates some challenging issues students face, which must also be researched in the future. The results of the other papers closely related to our research may differ, yet they do not contradict each other. On the contrary, they indicate that the platforms deemed most suitable in each paper (BigBlueButton, Skype) are very usable and practical platforms to use.

This research includes a literature review, a quantitative survey, and a qualitative component consisting of the written feedback of six university students. The results of the research show that despite the multitude of challenges students and teachers alike have faced, the benefits of distance education outweigh the disadvantages, with further pedagogic development mitigating challenges in the future. The literature review also revealed that faculty staff are often in need of further training, as many teachers are still not prepared for using online videoconference and content-management platforms. The quantitative online survey indicates that the surveyed university students rated BigBlueButton most favourably among the platforms included in the survey. The results of the qualitative component reveal that the students were generally satisfied with how the online lectures were being held, although some difficulties were encountered. The future of sustainable education is in creating an easily applicable and versatile learning suite (including materials, methods, etc.) that can be flexibly used in any region of the world, regardless of infrastructure.

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Informed Consent Statement: Not applicable.

Data Availability Statement: The questionnaire was anonymous. The data used has been included in Section 3.

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

Appendix A

Table A1. Summary table of selected publications.

Publication	Key Words	Main Purpose
Adinolfi and Giancotti, 2021 [32]	business education; knowledge management; pandemic; change management; virtual project-based learning	The post-pandemic reorientation of a master's training program in leadership and change management is explored.
Biasutti et al., 2021 [18]	professional development; teacher education; migrant integration; intercultural education	The professional development of teachers participating in a development project is analysed. The objective of the project was the development of intercultural education, and the analysis was to determine the effects of participation in this program. Intercultural education enables the successful integration of children with an international background.
Cassibba et al., 2021 [28]	COVID-19 pandemic; university mathematics professors; teaching mathematics at a distance; blackboard teacher; teacher beliefs	The challenges and issues of teaching mathematics during the COVID-19 lockdown is discussed. A questionnaire was issued to the teachers involved, the results of which revealed the adoption of new technological artifacts.
Cicha et al., 2021 [1]	e-learning; distance learning; higher education; COVID-19; coronavirus; pandemic; first-year students; expectations; attitude; technology acceptance	The expectations and attitudes concerning online education of first-year students in higher education are examined using the General Extended Technology Acceptance Model for E-Learning. The results indicate that motivation for students during the switch from face-to-face classes to online classes can be achieved by ensuring a sense of self-efficacy and hedonic properties (feeling of pleasure).
Ellis, 2007 [23]	Net-based pedagogy; web-based instruction; large course design; instructional design; instructor support; e-learning	Provides information on how quality courses can be designed by discussing the theory of designing large online courses.
Fernandes et al., 2016 [5]	concept-based terminology; blended learning; definition; domain expert; concept; characteristic	The advantages of a methodology design relying on a concept-based approach are discussed with regards to blended learning.
Ferraro et al., 2020 [16]	pedagogy; sport science; transdisciplinary; childhood learning; technologies; relationship; civil education approach; distance learning; COVID-19; education	A questionnaire was issued to assess the perceived effects of distance education on mental wellbeing, classroom performance, and relationship with peers.
Ferrero-Guillen et al., 2020 [22]	COVID-19; table distribution optimization; table location problem; genetic algorithms; genetic operators	During the pandemic, governments worldwide issued regulations on distances between people and seating at schools to minimise the spread of the disease. A genetic algorithm is proposed, which optimised the previously prescribed pattern, significantly increasing the distance between seats and tables in the test scenarios.
Goncalves et al., 2020 [19]	distance learning; higher education; online learning; digital pedagogies; students	A quantitative survey is performed to examine the attitudes of students regarding distance education during the COVID-19 pandemic.

Table A1. Cont.

Publication	Key Words	Main Purpose
Hassan et al., 2021 [21]	distance education; online learning; academic self-perceptions; workload; technical support; course satisfaction; higher education; COVID-19 pandemic	The students' perception of performance and satisfaction with online courses is examined, with results indicating a link between self-perception and satisfaction, along with the importance of student motivation.
Hong et al., 2020 [33]	educational policy; elementary education; self-efficacy; technological innovativeness; technology acceptance model	To highlight certain factors that have a great effect on acceptance of educational policies. The traits are identified and discussed.
Huang et al., 2020 [35]	higher education; internet use; perceived ease of use; structural equation modelling; technology acceptance	Perceived ease of use is important in discussing acceptance, and the key factors influencing this perceived ease of use are identified in this paper.
Junus et al., 2021 [31]	instructor readiness; e-learning readiness; online teaching; pandemic	Research is done to assess the readiness of teachers to switch to online education during a pandemic. The results indicate good skills in using e-learning platforms, but many lack a strategic solution for such situations.
Karatas and Tuncer, 2020 [15]	COVID-19; emergency distance education (EDE); English language skills; pre-service teachers; English as a Foreign Language (EFL)	Analysing the effects that emergency distance education had on language development in English as a Foreign Language classes.
Keegan, 2014 [25]	educational technology; adult education; lifelong learning; distance education; impact of technology; e-learning; higher education; European program; Hochschule	The effects of technology are examined and discussed, focusing on how technology and teachers function in a traditional vs. online setting.
Lee, 2020 [27]	open educational practices; open educational resources; online education; distance education; open university	The actors and beneficiaries of open education were defined in the past, however, this research suggests that more research should be done to open education to the disadvantaged, and at the same time, the image of those in greatest need of distance education may need to be redefined.
Lorente et al., 2020 [17]	COVID-19; right to education; ICTs in education; SDG4; comparative education	Following the switch to distance education, the possibility of inequalities regarding access to education is discussed. The results indicate inequalities, with the need for inclusion being emphasised.
Martinez et al., 2020 [20]	smartphone mobile; media in education; uses of mobile phones in education; social issues of technology use; higher education	Smartphones have appeared in the classroom, both as the students' accessories and as a tool to assist learning. Their adoption as part of the class requires the training of staff and substantial efforts, although it does have the potential to facilitate learning.

Table A1. Cont.

Publication	Key Words	Main Purpose
Mullen, 2019 [13]	cognitive orientation; face-to-face learning; master's students; online learning; socially just schooling; synchronous delivery	The modality of education is scrutinised, and a comparison is made between online and face-to-face learning, with results indicating that online computer-based classes proved to be equally efficient in achieving the goals of education.
Ozadowicz, 2020 [3]	e-learning; distance learning; blended learning; flipped classroom; engineering higher education; COVID-19 pandemic; building automation	Online education during the COVID-19 pandemic has faced many challenges when applied to lectures requiring physical presence (e.g., laboratory classes). A modified blended-learning model is proposed, and methods and tools are also discussed.
Poulova et al., 2009 [26]	e-learning; distance learning; university education	This study discusses the process of e-learning becoming a standard at Czech universities, with methods of ICT implementation also added and discussed in detail.
Pregowska et al., 2021 [2]	distance learning; distance education; online courses	A detailed history of distance education is discussed from the very beginning up to today's situation (pandemic), also including the point of view of teachers.
Sánchez-Cruzado, 2021 [30]	digital skills; ICT competencies; teacher training; digital literacy; linear regression model	The results of a study involving the assessment of teachers' digital skills are presented and a teacher training plan to address the issue is proposed.
Schulmeister, 2006 [24]	e-learning; multimedia; higher education; United States of America	This study examines the situation in the USA, focusing on the reasons for the great number of student enrolments in distance education.
Tao et al., 2019 [14]	MOOC; technology acceptance model; usability; perceived enjoyment; perceived quality	Research is conducted to examine the various factors influencing the acceptance of open courses in higher education, which provides a better understanding of how perceived quality and usability affect acceptance.
Tasci and Titrek, 2019 [29]	lifelong learning; higher education; sustainable leadership; Turkey	An increasingly important characteristic of modern education is lifelong learning, a key to sustainability. A qualitative research method is used to interview a group of middle-level managers regarding strategies, challenges, and experiences of the implementation of lifelong learning. The results indicate that the definition the managers used are close to the definitions used in other studies.
Zhang et al., 2020 [34]	e-learning system; blended learning; mandatory environments; structural equation modelling; UTAUT; updated D&M IS success model	Blended learning environments are based on an e-learning system, and the acceptance and adoption of this very system are analysed, with results indicating that social influence and system quality have a significant effect on the successful adoption and acceptance of these systems.

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