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Education and Worklife in Times of Uncertainty

Challenges Emerging from the COVID-19 Pandemic in the Field of Sustainable Development

Edited by
Diego Monferrer, Alma Rodríguez Sánchez and Marta Estrada-Guillén

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About the Editors

Diego Monferrer

Diego Monferrer Tirado holds a Bachelor's Degree in Business Administration from the Universitat Jaume I in 2004 and Phd in Business Management (Marketing speciality) with mention of Extraordinary Doctoral Award by the same university in 2011. Currently he is Associate Professor in the Area of Marketing of the Department of Business Administration and Marketing of the Universitat Jaume I, exercising his teaching and researching work since 2007.

In terms of research, he has received a positive evaluation of 2 six-year research by the National Commission for the Evaluation of the Research Activity (CNEAI): 2007-2012 and 2013-2018. In this period, he has developed several lines of work that include service marketing, bank marketing, tourism marketing, service quality, relationship quality, brand management, sustainability, strategic marketing, international entrepreneurship, international marketing, public-private partnerships, and higher education. In 2014, he obtained the Young Researcher Award in the Area of Economic and Business Sciences of the IV edition of the Banco Santander Awards.

He has published 48 articles (30 of them indexed in JCR and/or SJR) in relevant journals such as International Business Review, International Journal of Bank Marketing, Service Industries Journal, Journal of Business Research, Journal of Services Marketing, Corporate Social Responsibility and Environmental Management, Journal of Cleaner Production, European Journal of International Management, Journal of International Entrepreneurship, Business Research Quarterly, among others. In addition, he has published 14 books (plus one in which he acts as editor), 14 book chapters and has made around 70 presentations at conferences of international relevance.

In the teaching area, in 2017 he obtained the University Teaching Excellence Award granted by the Social Council of the Universitat Jaume I in its VIII edition.

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Preface to "Education and Worklife in Times of Uncertainty: Challenges Emerging from the COVID-19 Pandemic in the Field of Sustainable Development"

We are currently experiencing a global emergency marked by a series of socio-environmental problems that seriously endanger the survival of the planet. A diverse range of authorities are now defending the urgent need to transition to a more sustainable society. These demands have turned sustainable development into a relevant topic in reseach, especially since the United Nations committed to achieving sustainable development goals by 2030. The United Nations Summit, held in New York in 2015, adopted the outcome document "Transforming our world: the 2030 Agenda for Sustainable Development"set out in 17 Sustainable Development Goals (SDG) and 169 targets to be implemented in the period 2016–2030. These 17 interrelated goals are designed to tackle a wide range of social, economic and environmental challenges. However, these goals will not be achieved without fundamental transformations in citizens'actions and behaviours, which are heavily dependent on the role education plays in this process. Accordingly, target 4.7 of SDG 4 (Quality Education) refers to the need to "ensure that all learners acquire the knowledge and skills needed to promote sustainable development."SDG 4 places human beings at the center of sustainable development, and emotional learning is a priority target. The question is stated as follows: is this objective being met?

On 11 March 2020, the World Health Organisation (WHO) declared novel coronavirus (SARS-CoV-2) an unprecedented global pandemic. Nearly every country across the globe is struggling to reduce the spread of the COVID-19 virus and to limit its health, societal and economic consequences. The full impact on community, work, family and its intersections is not yet clear (Fisher et al., 2020). As a response to that, with almost immediate effect, students, teachers and workers in general and across the globe were thrown into a new scenario of online work and education. In the midst of this emotional climate laden with fear, uncertainty, sadness and anxiety, millions of students all over the world were confined to their homes, and the entire educational community (including families) had to adapt to a distance education model. The same occur with workers of different disciplines; they have to balance work and life (including education of their kids) in the same place. Therefore, homes suddenly became schools, universities and workplaces all at the same time. With this dramatic turn of events, the health crisis threw a spotlight on the shortcomings of face-to-face education and working systems that did not provide sufficient resources or training—neither emotional nor technological—for teachers, parents and workers in coping with the situation they were facing. In the absence of a defined model, for instance, teachers had to adapt educational content in record time, using tools to communicate with students or carrying out online assignments that, in most cases, they had never used before. On the other hand, parents had to learn new strategies to act as mediator between teachers and students. At the same time, some parents/workers also need to adapt their work schedule and goals to meet the challenges of their work and family needs. These challenges were further compounded by the digital divide: Many households did not have—and still lack—internet access or have just one computer for the entire family or perhaps have unsuitable computer systems. This sudden enforced shift to mass online education—defined as emergency remote teaching—has brought to the surface a series of contradictions in education systems; the most obvious is obesrved in social environments at high risk of social exclusion and in poorer countries and confirms the social divide that stands in the way

of what was already a complicated digital transformation of education. Furthermore, this global crisis has also exposed the methods we apply in educatation and work, calling into question the use and application of new ways of thinking and acting, revealing the need for educational philosophies and methodologies focused on principles of social formation that help to build sustainable societies, to educate citizens to face the challenges of our current and future environment and to recognise the hurdles we face and react accordingly. In general, teachers, parents and workers in particular must not only analyse, debate and reflect on the limitations of the education system, but also the opportunities that our contemporary history is experiencing. COVID-19 is simply the tip of an iceberg that exposes a society with complex problems. The pandemic, far from an exclusively medical-health phenomenon, has emerged as a reality with a huge economic, social, political and, needless to say, educational impact. New alternatives and methods of thinking and acting are, therefore, called for. The prevailing worldview in education and also working life in general must be reinterpreted; we must configure a sustainable system, based on solidarity, for future generations and develop the capacity to generate new methods of collaborating that help to preserve life in the future by cultivating critical thought and proposing alternatives.

Against this backdrop, this Special Issue focuses on the study, evaluation and analysis of the opportunities the pandemic offers in three related aspects: first, for building an education for sustainable development. Second, for creating decent working conditions. Finally, to enhance health and well being both at the workplace and at home. Therefore, this book is framed with respect to the United Nations Sustainable Development Goals (SDG). Hence, the three main topics of the book cover the following SDG: objective number 3—Health and well being; objective number 4—Quality education; and objective 8—Decent work. Authors from a range of disciplines, such as education, psychology, management, social sciences and other areas related to sustainable development, have contributed with differrent manuscripts. They address the challenges of studying, working and living in times of uncertainty in order to build sustainable development in those areas from theoretical and applied research.

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Diego Monferrer, Alma Rodríguez Sánchez, and Marta Estrada-Guillén

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Article

Does Mindfulness Influence Academic Performance? The Role of Resilience in Education for Sustainable Development

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Abstract: A mindful person is prone to be open to novelty, attentive to distinctions, sensitive to context, aware of multiple perspectives, and focused on the present. Therefore, the role of mindfulness in educational contexts is gaining ground given the great possibilities it offers in developing students' competences in education for sustainable development (ESD). The main goal of this study is to explore how mindfulness plays a key role in the learning process in response to the need to develop students' emotional competencies in ESD, and specifically how mindfulness has an impact on academic performance through resilience. We tested the research model with a questionnaire addressed to 497 students from three higher education institutions and one secondary school. The results of a structural equation analysis confirm the study hypotheses. We find mindfulness is positively related to resilience, which leads to better academic performance. Thus, being mindful is a key competence in ESD since it allows young people to face their education with the highest possibilities of training, experience, and personal growth. This exploratory study offers further evidence of the need to invest in mindfulness to foster resilience and academic performance and represents a first step for designing additional interventions on this line.

Keywords: education for sustainable development; mindfulness; resilience; academic performance

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1. Introduction

Education for sustainable development (ESD) aims at developing competences that empower individuals to reflect on their actions, considering their current and future social, cultural, economic, and environmental impacts from a local and a global perspective [1]. Thus, it seems that in the last decade, fruitful research on integrating different competences for ESD became more evident (e.g., [2,3]). In this sense, competences for sustainable development (CSD) depart from a comprehensive and holistic view; CSD may be considered as a set of knowledge, skills, values, and attitudes necessary to ensure today's students and future leaders are ready to deal with complex issues regarding sustainability [4]. Several authors report on these competences, using different settings and models (e.g., [5]). In this sense, ref. [4] offers a complete and integrated view from various authors, including six main blocks of competences with similar characteristics: responsibility (values, ethics, reflection), emotional intelligence (transcultural understanding, empathy, solidarity, compassion), system orientation (interdisciplinary), future orientation, personal involvement (self-motivation, motivating others, learning), and the ability to take action (participatory skills) [4].

Further studies [6] also focus on the teaching strategies that foster competences or skills needed in search of sustainability in education, such as being critical, creative, being aware of problems, problem-solving skills, or cooperation, among others. Therefore, mindfulness, defined as the capacity of a person to focus attention on events, experiences, and states of the present moment, both external and internal [7], plays a pivotal role as a comprehensive competence in ESD. In other words, awareness generated in mindfulness is related to

emotional competences such as emotional intelligence (including the capacity to be aware of the own emotions and being conscious about others' feelings or feeling empathy). However, mindfulness is also related to how individuals perceive the world that surrounds them, including the resources that they have at hand, which is linked to academic competences. In fact, refs. [8,9] affirmed that mindfulness generates a higher intellectual capability and an openness to different thinking styles. In this vein, mindfulness might be related to ESD since it fosters CSD as emotional regulation, self-awareness, and future orientation [10–12]. Thus, the main goal of this study is to explore how mindfulness plays a key role in the learning process in response to the need to develop students' emotional competencies in ESD, and specifically how mindfulness has an impact on academic performance.

Mindfulness emerges as one of the most effective instruments for promoting awareness, cultivating the ability to be attentive, and increasing subjective wellbeing [13]. Thus, the authors [14,15] understand mindfulness as a "technology of the self" that exerts an action on the own subjectivity with the potential to cause effective changes in modes of existence in a more sustainable direction. Quantitative research [16] has shown a positive relationship between practicing mindfulness and pro-environmental attitudes and behaviors. Mindfulness would be promoting a double benefit [13]: on the one hand, it increases wellbeing by detaching it from materialistic and consumer logic; on the other, it actively promotes more sustainable behavior and lifestyle. From another perspective, the practice of mindfulness has spread rapidly among the world's adult population in recent years, following its proven effectiveness in regulating emotions and optimizing cognitive patterns. The number of studies and research on this practice and analysis of its efficacy with children and adolescents has been increasing due to its demonstrated effectiveness in improving more ecosocial behaviors, enhancing general wellbeing [17,18], improving psychological symptoms [19], and faster information processing. In the educational context, its practice has demonstrated effectiveness in cognitive performance and significant relationships in measures of stress, coping, and resilience [20]. However, there is still a shortage of papers on the influence of mindfulness on resilience in college students and even more on its role on ESD as a competence.

In sum, although the benefits of mindfulness are well-acknowledged in the educational literature, it is not considered a key element in ESD. Hence, the present study seeks to contribute to the literature of ESD in several ways. First, departing from the categorization of [4] and social psychology literature as our theoretical framework, we propose applying mindfulness as a core competence for ESD since it can be related to the six blocks of competences of ESD. Second, we try to empirically show the impact that mindfulness (as a competence) has on resilience and performance in higher education, thus, offering further empirical support for the need to consider mindfulness also on higher education. Finally, we consider that, in an educational context, mindfulness will not only have repercussions on students' consciousness regarding sustainability concerns, but it will also benefit the development of their empathic capacities and academic performance. Therefore, our study is an exploratory study which represents the first step for further intervention studies in higher education regarding how it contributes to CSD.

2. Literature Review

2.1. Mindfulness and Resilience

Mindfulness implies a state of consciousness in which attention is focused on events, experiences, and states of the present moment, both external and internal [7]. Thus, mindfulness is constantly being aware of events and experiences at the moment and accepting them as they are, rather than being absorbed in the past or worried about the future [21]. According to this definition, a mindful person is prone to be open to novelty, sensitive to context, and aware of multiple approaches to solving a problem [22]. Therefore, a mindful person might be more aware of the resources at hand. Thus, in our study, we follow this approach of dispositional mindfulness as a capacity to be conscious of events and experiences around. This approach is settled in both traditions on the study

of mindfulness: the Eastern based on self-regulation of attention that is present-oriented and is characterized by curiosity, openness, and acceptance [23]. This definition focus on meditative practice. Additionally, the Western approach in which mindfulness is defined by being in the present, sensitive to context and perspective, and guided (but not governed) by rules and routines [24]. Both approaches have their similarities and differences, "but the singularities of each approach can be placed within an underlying framework, wherein each contributes to the elucidation of the other" [25]. Therefore, we consider mindfulness as a capacity to be aware of the present moment, being conscious about the context and world that surround us. This capacity may help people to be aware of their own and others' emotions and the resources at hand when having difficult situations. This idea is related to the capacity to overcome obstacles and become even more resourceful after a difficult situation; that is, the capacity for resilience. Resilience is defined as an individual's capability to sustain a normal state of balance when exposed to exceptionally adverse situations [26]. Resilience does not eradicate stress or remove life adversities. Instead, it gives people the strength to handle problems effectively, overcome adversity, and move on with their lives [27]. In recent years, there has been growing research interest in discovering the facilitators of resilience. Beyond different character traits and skills, including self-efficacy, creative problem-solving skills, and the ability to focus on the present, mindfulness has been associated with resilience [28–30].

In the context of higher education, a growing number of theoretical and empirical research studies support the idea that mindfulness and resilience are connected (e.g., [31,32]). In this regard, ref. [33] concluded that the sustained practice of mindfulness can improve attentional and emotional self-regulation and affects students' capacity for resilience. Thus, it has been shown that when university students lack resilience, they are more likely to fall into situations of helplessness, apathy, depression, and anguish [34]. However, when they present high levels of resilience, they show a higher fit to university academic demands [35]. Along these lines, high levels of resilience have been associated with academic success [35,36]. Ref. [37] showed that individuals with greater mindfulness have greater resilience and, consequently, greater satisfaction with life. According to the authors, the awareness and acceptance aspects of mindfulness can facilitate the development of resilience and optimism, enthusiasm, and patience, characteristics of resilient individuals that can lead to a perception of wellbeing. According to [38], to maintain resilience, greater flexibility is required through attention and acceptance, skills that are integrated into mindfulness. In a study by [39], a positive relationship between resilience and mindfulness was observed, showing that both variables are revealed as predictors of psychological wellbeing in university students. However, there is still little research in this regard [40,41] and even more in the context of ESD. In this sense, mindfulness could be considered a holistic competence for ESD. In fact, following the previous categorization of competences for ESD [4], mindfulness might be related to responsibility, transcultural understanding, empathy, learning, and the ability to take action, and then it would be related to resilience. Thus, the challenge is to continue investigating this variable, which seeks, through education, to train tomorrow's citizens in creating a more sustainable world.

Therefore, according to previous evidence, we expect that:

Hypothesis 1. *Students' mindfulness is directly and positively related to their level of resilience.*

2.2. Resilience and Academic Performance

The study of resilience has attracted a growing research interest, especially in higher education settings, mainly because of the number of benefits that resilience has on students' wellbeing [42]. In this context, resilience helps students overcome stressful situations and pressure arising from their studies [43]. Since resilience is a dynamic capability through which students acquire the knowledge and skills to help them face an uncertain future with a positive attitude and optimism, resilient students will be able to cope with academic demands appropriately [44]. Moreover, resilience is one of the main dimensions

associated with psychological wellbeing and academic success [45]. Students' capacity for resilience will help them to persevere in their tasks and maintain a positive attitude when difficulties arise; this persistence in their studies might be directly related to academic performance. According to recent research, mindfulness and resilience seem to be related to academic performance in educational settings [46]. Hence, the relationship between resilience and its multiple benefits on wellbeing and performance is well supported in the literature, including resilience as a buffer effect preventing burnout or dropout [47,48] and resilience enhancing academic engagement [49]. Moreover, resilience is related to academic performance, although this relationship is mediated by other variables such as engagement and self-efficacy [42]. Thus, further research is needed to uncover the relationship between resilience and direct academic performance, such as the impact on students' grades.

Therefore, following previous research regarding the close relationship between resilience and performance we expect that:

Hypothesis 2. *Students' resilience is positively and directly related to their academic performance.*

3. Methodology

3.1. Sample Selection and Data Collection

This study was carried out as part of a collaboration agreement signed by three higher education institutions and one secondary school in three Spanish regions. The four institutions involved in the study offer onsite teaching.

This agreement allowed us to interview students from a broad range of spectrums (region, academic discipline, course, qualification, gender), which provided a diverse and highly representative sample, thus maximizing the reliability of the results.

Before the fieldwork, experts in the education area revised the questionnaire and pretested it on a group of 25 students. This process allowed us to improve the wording and confirm the suitability of the questionnaire. After this revision stage, we surveyed the students using an online questionnaire designed by the research team. Student anonymity was guaranteed to encourage participation, which motivated them to provide more honest answers. We also informed the students that we would aggregate the data to ensure confidentiality. Moreover, we followed the ethical standards, and our study passed the ethical committee of our university.

The questionnaire consists of 15 items: 10 related to mindfulness and 5 to resilience (see Appendix A). All items are measured on a 7-point Likert scale. All Likert-scaled indicators are expressed positively, and respondents have to state whether they agree or disagree with each statement included in the questionnaire.

The fieldwork took place between October 2018 and March 2019 and yielded a sample of 497 valid responses. We calculate descriptive analyses using SPSS to reveal the main characteristics of the sample (Table 1). The final sample comprises students mostly from University 1 (69%) and between 8% and 12% for the remaining participating institutions. From the total of 22 specific academic disciplines analyzed (covering a wide range from business and economic sciences, technological and experimental sciences, health sciences, and social sciences), 16 correspond to academic degrees, two to master's degrees, and four to second-cycle studies. Most students are second-year undergraduates (43.7%), followed by third-year students (20.9%). The fourth and first years represent roughly 14% and 10%, respectively, the secondary school around 8%, and the masters around 3%. The fifth and sixth years represent less than 1% each. The average age of the students in the sample is 22 years, and their average grade is 7.2 (out of a maximum of ten). Finally, the gender distribution is mainly female (74.6%).

Table 1. General sample characteristics.

Institution: Category (%)					
University 1 (69)		University 2 (12.1)		University 3 (11.1)	Secondary School (7.8)
Degree: Category (%)					
Business Administration [1]	(12.1)	Industrial design engineering [2]	(3.2)	Psychology [3]	(14.5)
Occupational therapy [1]	(11.1)	Mechanical engineering [2]	(1.8)	Medicine [3]	(3.2)
Labour relations and human resources [1]	(10.7)	Agri-food engineering [2]	(2.4)	Nursing [3]	(2.4)
Tourism [1]	(5.6)	Chemical engineering [2]	(1.6)	Audio-visual communication [4]	(11.7)
Finance and accounting [1]	(2.0)	Electrical engineering [2]	(1.0)	Advertising and public relations [4]	(5.2)
Economics [1]	(0.8)	Master in human resources management [1]	(0.8)	Second cycle studies [1,4]	(8)
Master in marketing [1]	(1.8)				
Course: Category (%)					
First (9.9)	Second (43.7)	Third (20.9)	Fourth + (15.1)	Postgraduate (2.6)	Secondary school (7.8)
Gender: Category (%)		**Age average**		**Academic grade average**	
Male (25.4)	Female (74.6)	22 years old		7.2	

Note: [1] represents disciplines from business and economic sciences; [2] represents disciplines from technological and experimental sciences; [3] represents disciplines from health sciences; [4] represents disciplines from social sciences.

3.2. Measurement Instruments

We followed [50] recommendations to prevent self-generated validity in the questionnaire design. Thus, we carefully ordered and wrote the questions in simple language with user-friendly terminology. We also sorted the analyzed constructs differently from the hypotheses (antecedents → mediating variable → consequences).

All the scales correspond precisely to their theoretical definitions, and we adapted them from well-known and validated scales in the literature. The reliability information (Cronbach's alpha) for the scales is presented in the Results section, Table 2.

Table 2. Correlation factors, means, and standard deviation (n = 497).

	Mean	**S.D.**	**MIND**	**RESIL**	**PERF**
Mindfulness	5.398	0.727	(0.804)		
Resilience	5.323	0.851	0.532 **	(0.784)	
Academic performance	7.156	0.883	0.105 *	0.174 **	-
Gender	0.25	0.435	0.058	−0.050	−0.174 **

* Significant correlation ($p < 0.05$). ** Significant correlation ($p < 0.01$).

Mindfulness. We measure mindfulness with the ten-item scale developed by [51] (e.g., "I get involved in almost everything I do.").

Resilience. We assess resilience with the five-item scale developed by [52] (e.g., "Dealing with difficult peers (or situations) helps me grow.").

Academic performance. Finally, we measure academic performance directly from the students' academic records.

We include students' gender as a control variable according to previous studies that mention the possibility of influencing students' achievements (e.g., [53]). We use the following categorization: 0 = female, 1 = male.

We follow Brislin's reverse translation method to guarantee equivalence between the original items and those used in other language versions. Two bilingual translators worked on the translation, one to translate from English to Spanish, and the other to translate the resulting Spanish version back into English without referring to the source text. The translators then compared the two English versions and judged them to be practically identical, which confirmed that the Spanish version accurately represented the two English versions. We show in Appendix A the complete scales used in the study.

3.3. Scale Validity and Reliability

First, using SPSS, we calculate descriptive analyses (i.e., means, standard deviations) and inter-correlations, and we use Cronbach's alpha coefficient [54] to check the scale's reliability ($\alpha > 0.7$).

We conduct Harman's single-factor test [55,56] to test common method variance bias. The results of the confirmatory factor analysis with the 15 indicators loading into a single factor (χ^2 (87) = 309.421; CFI = 0.890; RMSEA = 0.072; BBNFI = 0.855; χ^2/df = 3.557) shows a poor fit, thereby indicating that the single factor does not account for all the variance in the data. Therefore, we do not consider common method variance a problem in our research.

Next, we implement structural equation modeling (SEM) by AMOS to test the hypothesized model (see Figure 1), following the recommendations for mediating analyses for latent constructs and multiple mediators [57,58]. We test three models to verify the hypotheses: "M1.Proposed" assumes that mindfulness is positively related to resilience that in turn is conducive to academic performance; and in "M2.Partially Mediated", resilience partially mediates the relationship between mindfulness and performance, and, as recommended by [59], we also test an alternative model to show that the order of the mediating variables in our model is not arbitrary. Consequently, we test "M3.Alternative", in which mindfulness mediates the relationship between resilience and performance.

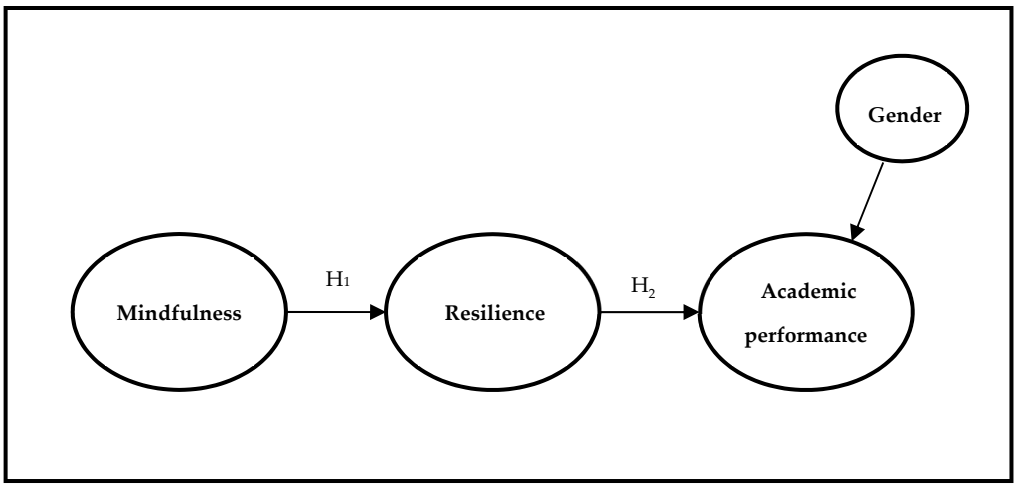

Figure 1. Hypothetical research model.

For the SEM analyses, we follow the maximum likelihood approach by testing absolute and relative indices for the goodness of fit [60]: the χ^2 index, Goodness of Fit Index (GFI), the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), the Tucker–Lewis Index (TLI), and the Incremental Fit Index (IFI). Values below 0.08 for RMSEA [61] and higher than 0.90 for the remaining indices [62] indicates an acceptable fit. Finally, we compute the Akaike Information Criterion (AIC) to compare competing non-nested models; the lower the AIC index, the better the fit.

4. Results

Table 2 shows that all Cronbach's alpha coefficient values are above the minimum acceptable value of 0.7 [63].

Furthermore, the pattern of correlations indicates that, as expected, there is a positive and significant relationship between mindfulness and resilience. Note that the correlation of resilience and gender with performance is significant.

Model Fit: Structural Equation Modeling

Table 3 displays the results of the structural equation analyses. We fit our proposed model (M1) to the data. Mindfulness and resilience consist of ten and five indicators (items), respectively.

Table 3. Fit indices of the Structural Equation Models (n = 497).

Model	χ^2	df	GFI	RMSEA	CFI	TLI	IFI	AIC
Model 1 (M1)	358.94	114	0.92	0.07	0.88	0.86	0.88	436.94
Model 2 (M2)	423.18	116	0.91	0.07	0.85	0.83	0.85	497.18
Model 3 (M3)	428.26	117	0.91	0.07	0.85	0.83	0.85	500.26

Notes. χ^2 = Chi-square; df = degrees of freedom; GFI = Goodness of Fit Index; RMSEA = Root Mean Square Error Approximation; CFI = Comparative Fit Index; TLI = Tucker–Lewis Index; IFI = Incremental Fit Index; AIC = Akaike Information Criterion.

Our results show that M1.Proposed (in which mindfulness has a positive relationship with resilience, which is in turn related to academic performance) adequately fits the data. M2.Partially mediated model (in which we also directly relate mindfulness with performance) also shows good fit indexes; however, the AIC is higher in this second model (M2 AIC = 497.18), which, according to [64], implies there is a better fit for M1. Moreover, in M2, the direct relationship between mindfulness and performance is not significant (β = 0.01, n.s). Finally, we test M3.Alternative, in which mindfulness mediates the relationship between resilience and performance. As expected, the results are favorable to M1 since M3 shows a higher chi-square and AIC when compared to M1. Hence, the results displayed in Figure 2 provide favorable evidence for M1: (1) there is a positive and significant relationship between mindfulness and resilience, β = 0.66, $p < 0.01$; and (2) there is a direct significant relationship between resilience and performance, β = 0.18, $p < 0.01$. These findings also demonstrate that mindfulness and performance are fully mediated by resilience.

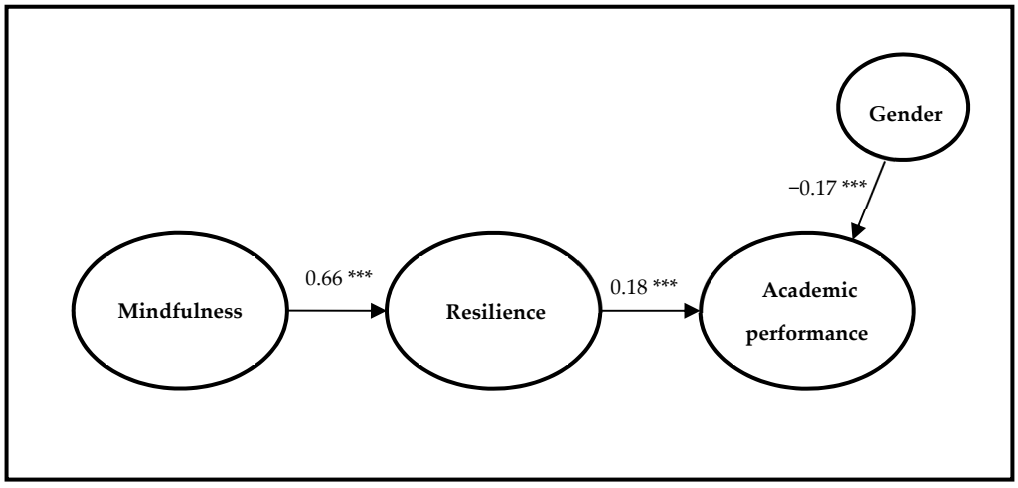

Figure 2. Empirical results of the research model. *** Significant correlation ($p < 0.05$).

5. Conclusions

The main goal of this study is to explore how mindfulness plays a key role in the learning process in response to the need to develop students' emotional competencies in ESD. Our results show how students' mindfulness has a positive impact on resilience. At the same time, resilience has a positive relationship with academic performance. Therefore, the results confirm our hypotheses regarding the role mindfulness plays as a promoter of resilience (Hypothesis 1) and the impact resilience has on academic performance (Hypothesis 2). Although it was not an aim of our study, we also find that gender is significantly and positively related to performance. Thus, women have higher grades than men, although the relationships between variables remain the same. Gender is a demographic variable that discriminates against students' academic achievements. For instance, research has shown female undergraduate grade point average to be higher than that achieved by male students after the first year of study [65] and across three years of undergraduate studies [66,67].

In sum, the main question we have attempted to answer in this research is whether mindfulness influences students' academic performance through resilience. Our study provides empirical evidence that the mindfulness–academic performance relationship is mediated by resilience. Our results can be generalized since they are obtained from three higher education institutions and one secondary school in three Spanish regions, comprising 22 academic disciplines from different areas.

Theoretical and Practical Implications for Education in Sustainable Development

We propose a model that relates the mindfulness construct, which has been revealed as an interesting tool to promote greater sustainable awareness, with the resilient capacity of university students and its impact on academic performance. Our study goes in line with previous research in terms of empirically showing the relationship of mindfulness and resilience in general (e.g., [29]) and specifically in education (e.g., [28] or [32]). Therefore, our research supports the benefits of mindfulness in higher education, adding the relationship with academic performance. Note that academic performance is objectively measured in our work (through students' grades), which gives extra value and support for our results. In this vein, most of the previous literature on mindfulness and resilience has been linked to students' wellbeing or self-efficacy, including subjective measures (e.g., [32]), which shows a part of the picture. However, our study, together with the recent research of [46], is the first one that offers additional data regarding mindfulness and resilience's impact on students' academic performance in higher education. On the other hand, the added value of our study departs from the idea that mindfulness needs to be considered as a key holistic competence in the competences for sustainable education according to previous research [4].

In this line, our research novelty relates to the need to contextualize our model into ESD. In recent years, interest has grown in developing skills for sustainable development in the classroom. Thus, one of the most recent advances in higher education for sustainability is the strong emergence of the discourse focused on the development of competencies for sustainability and its connection with the use of pedagogical approaches. Therefore, the well-known frame of reference proposed by [68] aims to connect the competencies for sustainable development with pedagogical approaches to provide a more complete, holistic, and systemic sustainable education for future leaders, decision-makers, educators, and agents of change. According to UNESCO, using different pedagogical approaches allows students to develop various learning processes that will help them improve their skills and abilities to learn and think. In this sense, higher education institutions, as essential agents of change for social development, are making a notable effort in incorporating development needs and social welfare into university curricula. The use of mindfulness as a pedagogical tool in the university and at other educational levels is gaining in strength, given the great possibilities for training students in individual sustainability. Ref. [69] affirms that "individuals committed to sustainability are characterized by creating harmony, interconnection, and relatively high levels of self-awareness in their values, thoughts,

behaviors, and actions, in addition to cultivating continuous individual growth in their physical abilities, emotional, social, philosophical, and intellectual. Individual sustainability means having a well-developed and proven value system that is aware of the importance and interconnectedness of all global biological systems and our rightful place among them". Thus, the practice of mindfulness in the classroom involves the incorporation of strategies and tools that allow young people to face each educational stage with the highest possibilities of use, training, experience, and personal growth [70–72]. It also contributes significantly, as demonstrated in our work, to the development of sustainable individual competencies such as resilience, which will contribute, in the mid-and long term, to the development of more sustainable societies.

Furthermore, it is worth mentioning that, as indicated by [73], in university education, technical professional skills have generally been enhanced to the detriment of socio-personal skills, emotional self-regulation, resilience, and stress control—key aspects to be considered within the curricular program. The development of these socio-emotional skills can be enhanced with mindfulness techniques. Various works, such as this one, have empirically analyzed how mindfulness benefits university students [74] and, in turn, these capacities have yielded better academic performance and general wellbeing.

This research has some limitations, which in turn open lines for future research. For instance, the sample consists mainly of higher education students and a smaller group of secondary school students. It would be useful to validate the analysis at different education stages and compare the differences between them. Moreover, most students are from a specific Spanish community; therefore, future research could replicate this study in other Spanish locations and in different countries to consider other cultural and geographical settings. Finally, most of the subjects in our sample are women; thus, having a more balanced dataset would allow us to compare gender differences.

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Appendix A

Mindfulness

1. I like to investigate things	1	2	3	4	5	6	7
2. I am always open to new ways of doing things	1	2	3	4	5	6	7
3. I am alert to new developments	1	2	3	4	5	6	7
4. I "get involved" in almost everything I do	1	2	3	4	5	6	7
5. I am very creative	1	2	3	4	5	6	7
6. I attend to the 'big picture'	1	2	3	4	5	6	7
7. I am very curious	1	2	3	4	5	6	7
8. I try to think of new ways of doing things	1	2	3	4	5	6	7
9. I like to be challenged intellectually	1	2	3	4	5	6	7
10. I like to figure out how things work	1	2	3	4	5	6	7

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Resilience

1. I am getting better in my studies because I learn from my mistakes	1	2	3	4	5	6	7
2. Dealing with difficult classmates (or situations) enables me to grow	1	2	3	4	5	6	7
3. I see challenges as an opportunity to learn	1	2	3	4	5	6	7
4. I find ways to handle unexpected situations	1	2	3	4	5	6	7
5. I bounce back when I confront setbacks in my studies	1	2	3	4	5	6	7

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sustainability

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Article

Psychosocial Impact of the COVID-19 Pandemic on Healthcare Professionals in Spain

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Abstract: In December 2019, a new virus called SARS-CoV-2 appeared, and the disease it produced was named COVID-19. After the pandemic situation was declared by the World Health Organization in March 2020, an increasing worsening of the mental health of the population, especially healthcare professionals, became apparent. To determine the psychosocial impact of the pandemic on healthcare professionals in Spain, a longitudinal study was conducted at two time points separated by 5 weeks (n time 1 = 169; n time 2 = 65). Participants completed an online questionnaire assessing depression, anxiety, and stress (Depression Anxiety Stress Scale, DASS-21), burnout (Maslach Burnout Inventory—MBI), resilience (Brief Resilience Scale—BRS), and health-related quality of life (SF-36 Health Questionnaire). The results showed high levels of depression, anxiety, stress, and burnout, as well as moderate levels of resilience and low levels of quality of life at the first assessment. Resilience was negatively related to negative experiences, and positively related to the quality of life, also at the first assessment. Overall, there was an improvement in the mental health of healthcare professionals when comparing the two assessments. In this improvement, having COVID-19 in the first assessment had a positive effect on perceived mental health in the second assessment.

Keywords: resilience; depression; anxiety; stress; burnout; health-related quality of life; healthcare professionals; COVID-19

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1. Introduction

A new epidemic disease characterized by a respiratory tract infection progressing to bilateral pneumonia emerged in December 2019 [1]. The etiological agent was a new coronavirus named SARS-CoV-2, which produces a disease named COVID-19 [2]. Its spread was such that the World Health Organization (WHO) declared a pandemic situation on 11 March 2020 [3]. A few weeks earlier, on 31 January 2020, the Spanish National Microbiology Centre had already declared the first case of coronavirus in Spain, detected in La Gomera (Canary Islands) [4]. By September 2022, more than 613 million people had been infected with the virus worldwide, and more than 6.5 million had died [5]. This situation has led to a borderline health crisis, which is also reflected in an economic and social crisis [6].

Although it is a new virus, the clinical manifestations and evolution of this disease seem to be well established [7–9]. Moreover, an indirect consequence associated with the virus is its impact on mental health, not only in COVID-19 patients but also in the rest of the population [10]. In this regard, since the beginning of the pandemic, data have been collected on symptoms related to depression, anxiety, and post-traumatic stress [11,12].

Given that, in normal situations, healthcare workers face a wide variety of job demands that are often very intense, such as work overload, the constant need to concentrate, or the

performance of tasks for which they are not adequately trained [13], it is to be expected that mental health problems will be greater in this group than in the general population during the COVID-19 pandemic. Some studies show symptoms related to depression, anxiety, or insomnia in such professionals [14–17]. Already during the SARS outbreaks in 2003 and the Ebola virus disease in 2014, there was an increase in these symptoms, resulting in an increase in psychiatric disorders such as depression, anxiety, and post-traumatic stress disorder in frontline healthcare workers [18].

According to the Dual Spiral Model of Occupational Health [19], the existence of an imbalance between job demands and the job resources available to employees to cope with these demands is considered a psychosocial risk. This imbalance will have consequences (in the short or long term) on the psychosocial health of employees that may turn into 'psychosocial harm' or negative experiences such as depression, anxiety, burnout, technostress, etc., or the reduction of positive experiences such as work engagement or job satisfaction. These psychosocial harms, in the longer term, may have consequences for the organization in the form of 'organizational harms' such as absenteeism, reduced performance, involuntary turnover, etc., situations that are undesirable in general but particularly harmful at the health care level during a pandemic.

Burnout could be defined as a prolonged response to chronic personal and relational stressors at work, determined by the dimensions known as emotional exhaustion, depersonalization/cynicism, and professional inefficacy [20], and is relatively common in healthcare professionals [21]. Emotional exhaustion refers to feelings of not being able to give more emotionally and a decrease in one's emotional resources. Depersonalization refers to a response of negative distance, feelings, and cynical behavior toward other people, who are usually the service or care users. Professional inefficacy refers to diminished feelings of competence and achievement at work [22]. Since the beginning of the COVID-19 pandemic, higher levels of burnout have been reported in healthcare professionals [23,24].

Health-related quality of life (HRQoL) is a comprehensive concept that attempts to assess all factors that impact an individual's health. It does not refer to other aspects of quality of life that do not directly impact health, such as the political or economic circumstances being experienced [25]. Previous research has shown that the health situation experienced since the emergence of the coronavirus has had a negative impact on the HRQoL of the population [26–28]. In addition, other studies have found that those with suspected or confirmed COVID-19 appear to have poorer levels of HRQoL [29]. Despite this, few studies have focused on HRQoL levels, specifically in healthcare professionals who have worked during the pandemic.

According to the Dual Spiral Model of Occupational Health [19], employees' personal resources, such as self-efficacy or resilience, can modulate the relationship between job demands and job resources and are responsible for two distinct psychological processes that develop over time in the form of spirals: (1) the health deterioration spiral and (2) the motivation spiral. On the one hand, the deterioration spiral occurs if the employee has low levels of personal resources, as he/she will perceive it difficult to effectively control his/her work environment, which will increase his/her perception of imbalance between his/her job demands and job resources and the likelihood of experiencing psychological damages such as burnout. On the other hand, having high levels of personal resources will increase the likelihood that the person will perceive that they can adequately control their environment, which will reduce their perception of imbalance between job demands and job resources, causing them to experience positive consequences such as satisfaction, constituting the motivation spiral. The existence of these two types of spirals allows us to understand that two employees with the same level of job demands and job resources manifest different levels of burnout or satisfaction.

Therefore, one of the personal resources that can have a positive effect on the mental health of employees in general, and healthcare employees in particular, is resilience. Resilience can be defined as the ability to overcome with perseverance the difficulties experienced in different areas of life [30]. As mentioned above, healthcare professionals are

exposed to a multitude of job demands and do not usually have sufficient job resources to compensate for them, so this personal resource takes on greater importance in their work reality. In the context of a health crisis such as the one experienced, some research shows low levels of resilience, as reflected in some studies carried out, for instance, in Ethiopia [31], which leads to an increase in the psychological distress of health professionals. Another study carried out in Spain shows moderate levels of resilience in healthcare employees during the COVID-19 pandemic [14]. In contrast, despite the difficulties generated by this health crisis, there is also literature that supports an important capacity for resilience on the part of health professionals, as shown in another study carried out in the United Kingdom [32]. Other research has shown other positive effects of resilience, the presence of which mitigated the professionals' fear of the coronavirus [33].

The main objective of this research is to test the levels of resilience of healthcare professionals at the beginning of the fourth wave of the COVID-19 pandemic in Spain, to analyze how these levels are related to the levels of depression, anxiety, stress, burnout, and HRQoL experienced, and to determine the evolution of the mental health of employees at the end of the fourth wave.

This general objective is divided into the following specific objectives:

1. To test the levels of resilience, depression, anxiety, stress, burnout, and HRQoL of the healthcare employees at the beginning of the fourth wave (Time 1, T1);
2. To relate the levels of resilience at T1 with the levels of depression, anxiety, stress, burnout, and HRQoL of the healthcare employees;
3. To test whether the levels of depression, anxiety, stress, burnout, resilience, and HRQoL improve at the end of the fourth wave (Time 2, T2) compared to T1;
4. To analyze whether not having COVID-19 affects the levels of anxiety, depression, stress, burnout, resilience, and HRQoL experienced at T2 compared to T1.

To achieve the objectives, the following hypotheses are proposed:

Hypothesis 1a (H1a). *Healthcare professionals will have high levels of depression, anxiety, stress, and burnout at T1.*

Hypothesis 1b (H1b). *Healthcare professionals will present low levels of resilience and HRQoL in all dimensions (i.e., general health, physical functioning, physical role, emotional role, social functioning, body pain, energy/vitality, and mental health) at T1.*

Hypothesis 2a (H2a). *The higher the level of resilience, the lower the level of depression, anxiety, stress, and burnout at T1.*

Hypothesis 2b (H2b). *The higher the level of resilience, the higher the level of HRQoL in all dimensions at T1.*

Hypothesis 3a (H3a). *Healthcare professionals will have lower levels of depression, anxiety, stress, and burnout at T2 compared to T1.*

Hypothesis 3b (H3b). *Healthcare professionals will have higher levels of resilience and HRQoL in all dimensions at T2 compared to T1.*

Hypothesis 4a (H4a). *Healthcare professionals who have passed COVID-19 at T1 will have lower levels of depression, anxiety, stress, and burnout at T2 compared to T1.*

Hypothesis 4b (H4b). *Healthcare professionals who have passed COVID-19 at T1 will have higher levels of resilience and HRQoL in all dimensions at T2 compared to T1.*

2. Materials and Methods

2.1. Design

This study was conducted using a quasi-experimental, longitudinal (pre-test and post-test), quantitative, within-group design. Data were collected at two different time periods: at the beginning of the fourth wave of the pandemic in Spain (mid-March 2015, T1) and when the fourth wave was ending five weeks later (early May 2021, T2).

2.2. Sample

Participants were chosen by non-probabilistic convenience sampling. Several inclusion and exclusion criteria were considered for participation in the sample:

Inclusion criteria:

- Healthcare professionals practicing their profession in Spain;
- Having been active and working in the healthcare practice for some time since the beginning of the pandemic.

Exclusion criteria:

- Healthcare professionals who were retired, unemployed, or on sick leave from the beginning of the pandemic until the time of the research.

Considering these criteria, the study sample, in a first evaluation (T1), is composed of 169 people, of whom a high percentage are women (82.2%). The mean age was 31.40 years (SD = 9.96), and the range was between 20 and 66 years. Slightly more than a third (39.9%) live in the community of Andalusia. Of the subjects, more than two-thirds are graduates, with the nursing profession being predominant (72.5%). Most of the participants have not suffered COVID-19 or do not know it, compared to 21.9% who had. Slightly more than half of the subjects have been working during the pandemic for the Public Health Service with a temporary contract. A high percentage of the sample worked full-time in a hospital (86.4%).

Of the aforementioned sample, 65 professionals participated in a second evaluation (T2), of whom a high percentage were still women (84.6%). The mean age was 31.82 years (SD = 9.88), and the range was between 20 and 64 years. A high percentage had been vaccinated against this disease (90.8%). More than half of this sample was working in Public Health Care, while the rest worked in Private Health Care or in both. Most of these professionals also worked in hospitals (69.2%). The others worked according to the following distribution: 13.8% in primary care, 7.7% in private centers, 4.6% in nursing homes, and 4.6% in pharmacies.

2.3. Procedure

The authors used social networks and e-mail as a means of disseminating the online questionnaire through which the participants were evaluated. The questionnaire was created using the Microsoft Forms platform (https://www.microsoft.com/es-es/microsoft-365/online-surveys-polls-quizzes (accessed on 15 March 2021)). At the beginning of the questionnaire, participants were asked to create a code to match the two questionnaires and to guarantee anonymity. At the end of the T1 questionnaire, an e-mail address was requested to send the questionnaire again at T2.

2.4. Instruments

The Brief Resilience Scale—BRS, validated by Rodríguez-Rey, Alonso-Tapia, and Hernansainz-Garrido in Spanish [34], consists of 6 stated items that are answered on a five-alternative Likert-type scale (from 1: strongly disagree to 5: strongly agree) [35]. Cronbach's α at T1 = 0.77 and at T2 = 0.91.

The Depression Anxiety Stress Scale, DASS-21, an abbreviated version of the DASS questionnaire, and validated in Spanish by Daza, Novy, Stanley, and Averill [36], is a self-administered scale consisting of 21 items that measure three dimensions: depression (α T1 = 0.86, α T2 = 0.80), anxiety (α T1 = 0.82, α T2 = 0.82), and stress (α T1 = 0.87, α T2 = 0.87). Responses are rated using a 4-point scale (from 0: has not happened to me, to 3: has happened to me a lot or most of the time), and the total score is calculated by summing them.

The Maslach Burnout Inventory—MBI, validated in Spanish by Bresó, Salanova, Schaufeli, and Nogareda [37], is a questionnaire that assesses burnout through three dimensions: emotional exhaustion (α T1 = 0.88, α T2 = 0.91), cynicism (α T1 = 0.79, α T2 = 0.82) and professional inefficacy (α T1 = 0.80, α T2 = 0.76). The questionnaire consists of 15 items that are answered according to a seven-point frequency scale (from 0: never to 6: always). The higher the score in all the dimensions, the higher the level of burnout.

Finally, we used the Spanish version of the SF-36 Health Questionnaire developed by Alonso, Prieto, and Antó [38]. It is a generic scale designed to be preferably self-administered, consisting of 36 items grouped into 8 dimensions: general health (T1 α = 0.81, T2 α = 0.85), physical functioning (T1 α = 0.95, T2 α = 0.93), physical role (T1 α = 0.89, T2 α = 0.91), emotional role (α T1 = 0.88, α T2 = 0.79), body pain (r T1 = 0.70, $p < 0.0001$; r T2 = 0.74, $p < 0.0001$), energy/vitality (α T1 = 0.85, α T2 = 0.83), mental health (α T1 = 0.85, α T2 = 0.78), and social functioning (r T1 = 0.73, $p < 0.0001$; r T2 = 0.88, $p < 0.0001$), and an extra item asking about health evolution. The items are answered according to a five-point frequency scale (from 1: always, to 5: never), so the higher the score obtained, the better the state of health.

2.5. Ethical Considerations

This study was approved by the bioethics committee of the University of Burgos (code IR06/2021), respecting the four Helsinki principles [39] and in accordance with Law 15/1999 of 13 December on the Protection of Personal Data [40].

In addition, the participants were informed about the legal and ethical aspects derived from the research on the first page of the questionnaire, which also included informed consent.

2.6. Data Analyses

All analyses were conducted with the SPSS Statistical Package (Version 25, IBM Corp, Armonk, NY, USA), and the level of significance was set at $p \leq 0.05$.

First, several one-sample Student's *t*-tests were calculated. Pearson correlations, Student's *t*-test for independent samples, and Student's *t*-tests for paired samples were then calculated.

3. Results

3.1. Student t-Test for One Sample

To test H1a and H1b, several one-sample *t*-tests were performed. The results show statistically significant differences in all the proposed variables apart from the body pain dimension (see Table 1). For the comparison of the data, the average values (from now normative mean) obtained in various previous studies were used [34,37,41,42]. To be able to compare the HRQoL dimensions, the scores were transformed to a 0–100-point scale.

Healthcare professionals show high levels of depression, anxiety, stress, emotional exhaustion, and professional inefficacy, as well as slightly low (moderate) levels of resilience. However, lower values than the normative mean are obtained in cynicism, general health, physical function, physical role, emotional role, social functioning, energy/vitality, and mental health. Levels of bodily pain are very similar to those of the normative sample. Thus, the hypotheses are partially confirmed.

Table 1. Comparison of resilience, depression, anxiety, stress, burnout, and HRQoL levels from the research with normative levels.

				Student *t*-Test		
	M_n	M_S	*SD*	*t*	*df*	*p*
Resilience	3.15	3.02	0.72	−2.332	168	0.021
Depression	2.28	4.69	4.36	3.866	168	0.0001
Anxiety	2.74	5.39	4.61	5.987	168	0.0001
Stress	4.71	8.26	5.11	8.8939	168	0.0001
Emotional exhaustion	2.86	3.27	1.27	4.150	168	0.0001
Cynicism	2.49	1.98	1.40	−4.728	168	0.0001
Professional inefficacy	4.05	4.67	0.83	9.682	168	0.0001
General health	80	72.78	16.09	−5.829	168	0.0001
Physical functioning	94.42	53.41	10.34	−51.558	168	0.0001
Physical role	91.13	78.46	20.62	−7.983	168	0.0001
Emotional role	90.19	77.43	19.59	−8.460	168	0.0001
Social functioning	96.03	70	23.32	−14.508	168	0.0001
Body pain	82.35	82.31	20.75	−0.026	168	0.979
Energy/vitality	69.99	56.42	17.27	−10.209	168	0.0001
Mental health	77.72	68.99	16.66	−6.805	168	0.0001

Note. M_n = normative mean; M_s = sample mean; M = mean; SD = standard deviation; df = degrees of freedom.

3.2. Pearsons Correlations

To test H2a and H2b, different Pearson correlations were carried out. The results are in the expected direction for all the variables measured, except for professional inefficacy and physical functioning, which do not show significant relationships. Table 2 shows that there are significant and inverse relationships between resilience and levels of emotional exhaustion, cynicism, depression, anxiety, and stress. That is, the higher the level of resilience, the lower the levels of burnout, depression, anxiety, and stress among healthcare professionals.

Table 2. Relationships between resilience, depression, anxiety, stress, burnout, and HRQoL.

Variables	Resilience	
	r	*p*
Depression	−0.356	0.0001
Anxiety	−0.337	0.0001
Stress	−0.400	0.0001
Emotional exhaustion	−0.322	0.0001
Cynicism	−0.280	0.0001
Professional inefficacy	−0.087	0.258
General health	0.439	0.0001
Physical functioning	0.130	0.093
Physical role	0.220	0.004
Emotional role	0.350	0.0001
Social functioning	0.366	0.0001
Body pain	0.263	0.001
Energy/vitality	0.389	0.0001
Mental health	0.454	0.0001

In addition, the results also show significant positive relationships between resilience and all dimensions of HRQoL. That is, the higher the level of resilience, the better the level obtained in general health, physical role, emotional role, social role, body pain, energy/vitality, and mental health. Thus, H2a and H2b can be confirmed.

3.3. Student t-Test for Paired Samples

To contrast H3a and H3b, several Student's *t*-tests for paired samples were performed. As can be seen in Table 3, the results indicate that there are significant differences in all the variables evaluated except for cynicism, professional inefficacy, general health, physical

functioning, physical role, and emotional role. For body pain and emotional role, the differences were tendentially significant $p \leq 0.01$. The healthcare professionals presented less emotional exhaustion, as well as higher levels of resilience in T2. In addition, they showed lower depression, anxiety, and stress, as well as better HRQoL in social functioning, bodily pain, energy/vitality, and mental health. Therefore, the hypotheses are partially confirmed.

Table 3. Mean differences in depression, anxiety, stress, burnout, resilience, and HRQoL between T1 and T2.

					Student *t*-Test		
	M_{T1}	SD_{T1}	M_{T2}	SD_{T2}	*t*	*df*	*p*
Depression	5.29	4.02	3.49	2.56	2.299	64	0.025
Anxiety	5.94	4.76	4.86	4.28	3.365	64	0.001
Stress	9.65	5.07	8.43	4.87	2.354	64	0.022
Emotional exhaustion	3.53	1.42	3.05	1.45	3.920	64	0.0001
Cynicism	2.22	1.45	2.17	1.54	0.384	64	0.703
Professional inefficacy	4.65	0.85	4.62	0.77	0.276	64	0.784
Resilience	2.85	0.65	3.04	0.77	−2.665	64	0.010
General health	3.48	0.83	3.60	0.82	−1.469	64	0.147
Physical functioning	2.69	0.48	2.73	0.43	−0.774	64	0.442
Physical role	3.85	1.06	4.02	1.03	−1.254	64	0.215
Emotional role	3.74	0.93	3.96	0.87	−1.881	64	0.065
Social functioning	3.32	1.17	3.74	1.14	−3.207	64	0.002
Body pain	3.95	1.07	4.18	1.03	−1.954	64	0.055
Energy/vitality	2.57	0.79	2.75	0.84	−2.186	64	0.032
Mental health	3.23	0.80	3.45	0.69	−0.067		0.005

Note. T1 = time 1; T2 = time 2; M = mean; SD = standard deviation; df = degrees of freedom.

3.4. Student t-Test for Independent Samples

Finally, to contrast H4a and H4b, several Student's *t*-tests for independent samples were conducted using the change scores (i.e., T2 minus T1) of the variables of interest. As can be seen in Table 4, the results show significant differences in emotional exhaustion, depression, stress, and social functioning. Participants who had passed COVID-19 improved their emotional exhaustion ($p = 0.009$), depression ($p = 0.04$), stress ($p = 0.015$), and social functioning ($p = 0.05$) more at T2 than those who had not passed the COVID-19 or do not know. Therefore, H4a and H4b are partially confirmed.

Table 4. Differences in depression, anxiety, stress, burnout, resilience, and HRQoL depending on COVID-19.

	COVID-19 Yes		**COVID-19 No, or Don't Know**		**Student *t*-Test**		
	M	*SD*	*M*	*SD*	*t*	*df*	*p*
Depression	0.7	3.56	−2.17	4.34	2.250	60	0.040
Anxiety	−0.4	3.31	−1.01	3.85	0.474	60	0.637
Stress	0.7	1.94	−1.54	4.36	2.595	60	0.015
Emotional exhaustion	0.05	0.49	−0.55	1.03	2.837	60	0.009
Cynicism	0.1	0.99	−0.18	1.17	0.700	60	0.487
Professional inefficacy	−0.3	1.18	−0.02	0.71	−0.999	60	0.322
Resilience	0.25	0.63	0.18	0.55	0.345	60	0.732
General health	0.04	0.87	0.13	0.64	−0.388	60	0.700
Physical functioning	0.03	0.17	0.001	0.37	0.233	60	0.817
Physical role	0.02	0.93	0.22	1.11	−0.524	60	0.602
Emotional role	0.001	1.13	0.31	0.83	−1.028	60	0.308
Social functioning	−0.05	0.64	0.47	1.06	−2.071	60	0.051
Body pain	0.25	0.54	0.27	0.98	−0.060	60	0.952
Energy/vitality	0.001	0.66	0.24	0.64	−1.079	60	0.285
Mental health	0.22	0.63	0.21	0.63	0.021	60	0.983

Note. M = mean; SD = standard deviation; df = degrees of freedom.

4. Discussion

Since the onset of the COVID-19 pandemic in March 2020, the scientific literature has provided increasing evidence of its psychological impact on society [10,43,44]. The aim of this study was to increase the evidence of the effect of the pandemic on the mental health of healthcare professionals in terms of resilience, depression, anxiety, stress, burnout, and HRQoL. First, participants were tested for their levels of these variables.

Participants showed higher levels of depression, anxiety, and stress obtained at T1, than those found in the scientific literature. A review of 12 articles based on samples from the same context showed mean scores of stress, anxiety, and depression in frontline professionals in Spain, notably lower than those obtained in our study [43]. Other research conducted with Croatian participants [45] and with participants from Vietnam [35] also found moderate levels of all three variables among their health professionals. As regards the levels of emotional exhaustion, cynicism, and professional inefficacy, these were also high at T1 (H1a). Similar results were obtained in several previous research studies. On the one hand, a large percentage of healthcare professionals reported high scores in at least one of the MBI domains [24]. On the other hand, there is also evidence of high levels of emotional exhaustion and cynicism, with higher burnout among frontline staff [46]. Another large-scale study reports moderate levels of emotional exhaustion and cynicism among nurses in several countries [47].

There was already evidence that healthcare professionals are among the public servants with the worst levels of resilience and quality of life [48]. This same reality was found in our research, where participants showed slightly below levels of resilience and below-average levels in almost all dimensions of HRQoL (H1b). There is evidence in different studies of a tendency for mental health to worsen in professionals who have worked directly with COVID patients compared to those who treated other patients [31,35,47,49,50], with higher levels of depression, anxiety, and stress also found among these professionals.

Secondly, we tested how healthcare professionals' resilience was related to their levels of depression, anxiety, stress, burnout, and HRQoL at T1 when the existence of the fourth wave of the pandemic in Spain was already known. The results allow us to confirm H2a and H2b; that is, the higher the level of resilience, the lower the depression, anxiety, stress, and burnout, and the better the HRQoL. Similar results were found in other research conducted with Spanish [14], South Korean [51], and Philippines participants [50] that also shows that high levels of resilience protect against experiencing depression, anxiety, stress, or burnout [14,51,52], associating resilience with lower psychological distress [53]. Although there is little evidence of the relationship between resilience and HRQoL in healthcare employees in the context of the COVID-19 pandemic, the literature has previously reported that resilience is a positive predictor of quality of life [54–58], which supports the results obtained in our research.

As suggested by the Dual Spiral Model of Occupational Health [19], resilience would act as a personal resource that would affect the perception of job demands and job resources, positively affecting the occupational health of healthcare professionals. The greater ability to adapt and cope with adversity in healthcare professionals has been investigated previously, confirming that work engagement, autonomy, and independence at work are related to resilience [59]. This also supports the results related to research objective three, which was to test whether levels of depression, anxiety, stress, burnout, resilience, and HRQoL improved at T2 compared to T1.

Specifically, the results showed that healthcare professionals showed lower levels of depression, stress, and emotional exhaustion (H3a) and higher levels of resilience in some dimensions of HRQoL, such as social functioning, energy/vitality, or mental health (H3b). These results were expected given the context in which the research was conducted, a first assessment was conducted when COVID-19 cases were increasing due to the fourth wave of the virus in Spain, and a second assessment, five weeks later, when cases were declining [60] and a vaccination campaign was being implemented by the Spanish government [61]. These findings provide evidence that medical teams are

also a vulnerable mental health population, despite the fact that research often focuses more attention on the people they treat. They are a clear example of miss-recognition or dis-recognition of the difficulties/pain/trauma also experienced by other types of communities in different contexts [62].

Finally, another objective was to test whether COVID-19 influenced the occupational health evolution of healthcare professionals. The results showed that those employees who had had the disease in T1 had improved their levels of depression, anxiety, emotional exhaustion, and social functioning compared to those who had not had the virus or were unaware of it. These results are not consistent with those obtained in previous studies. The literature reports that those who have passed the illness with mild pneumonia criteria have a deterioration in health-related quality of life [63]. In this line, there are data on low scores in the physical role, emotional role, and social functioning while maintaining high scores in general health, energy/vitality, and mental health [64]. Another study conducted with Bangladeshi participants describes that doctors who had symptoms compatible with the disease had higher levels of depression or anxiety [65]. There is also evidence of a positive association between experiencing burnout and having tested positive for COVID-19 [66].

Although not consistent with previous studies, our results can be interpreted from the Dual Spiral Model of Occupational Health [19]. It is possible that if healthcare employees have had the disease, they perceive lower job demands (i.e., less fear, less time pressure, less emotional overload) and greater personal resources (i.e., greater control), which would allow them to experience lower levels of psychosocial harms such as depression and stress, and higher levels of positive experiences such as social functioning. Previous studies have reported that almost half of healthcare professionals experienced fear of being infected by COVID-19, which increased their burnout levels [67].

Overall, the emergence of COVID-19, which meant that the treatment of illness and the management of hospitals became an issue of national/global importance, had the main consequence that the importance of medical teams was much more recognized and received more attention in the media. This has led to an important change in the recognition, meaning, and importance of their professions for the population, which may have contributed to the improvement in their mental health, as observed in this study, and also observed in other types of populations [68].

In addition, there are two other factors that help to better understand the results obtained. On the one hand, none of the participants in our study developed severe symptoms from COVID-19. In this sense, severity has been related in previous studies with a psychological impact on healthcare professionals [69] and also in the general population [70–72], showing higher levels of depression and anxiety in those whose symptomatology had been worse (i.e., long COVID). In this sense, the severity of the illness has been considered a risk factor associated with anxiety [73].

On the other hand, in our study, we assessed the effect that having passed the virus before the first assessment had on the mental health of employees five weeks later. Two of the job demands that have most affected the perceived stress of healthcare professionals during the pandemic are, on the one hand, the perceived risk of infection [33] and, on the other hand, the monitoring of protective measures to prevent the spread of the virus (e.g., hygiene behaviors) [74]. It is to be expected, therefore, that those professionals who had passed COVID-19 would have less fear of contagion [33,75] and would perceive fewer of these types of job demands, improving their mental health indicators. In addition, the second assessment of the participants coincided with a vaccination campaign promoted by the Spanish government's Ministry of Health [61], which may have further increased the perception of security against the virus.

Despite their psychological improvement, having passed the virus may lead to a relaxation of prevention measures, which could increase the likelihood of future reinfections. It is therefore recommended that hospitals establish suitable communication channels so that frontline employees can be kept well informed, which previous research has shown helps them to maintain adequate protective measures [76].

Limitations and Future Research

The results of this study should be interpreted considering some limitations. Firstly, only 65 healthcare professionals participated in the two evaluations. There was, therefore, a rather large experimental mortality (104 people did not respond to the second assessment). Future similar studies should increase the sample to verify the results obtained in our research and to be able to generalize the data. Moreover, the sample was largely composed of women, so the results should be explored in samples with a greater representation of men.

Another limitation of the research is that we did not directly assess job demands and job resources, so their mediating effect between resilience and the experiences assessed could only be hypothesized. In future studies, it would be advisable to also assess demands such as work overload, role conflict, or role ambiguity, which are very common demands among healthcare professionals [77], as well as job resources such as social support received from colleagues or supervisors, which is often related to better occupational health [78].

Moreover, we did not put forward any hypothesis comparing different professional categories when it is possible that depending on the type of work carried out by the healthcare professionals, the effect of resilience, of the context in the two evaluations carried out or of COVID-19, was not the same. Future studies should attempt to collect a larger number of participants in each category to make statistically representative comparisons. However, there are no studies based on Spanish healthcare professionals that include such diverse professional categories, which may also be a strength of this study.

Finally, future research could test the effect of interventions aimed at increasing the perceived importance of health professionals on their mental health. In other professions, such as the military, such methodologies have been shown to be effective in improving mental health and resilience in the army [68].

5. Conclusions

This research has highlighted the powerful psychosocial impact that the COVID-19 pandemic has had, and continues to have, on healthcare professionals in Spain. High levels of depression, anxiety, stress, and burnout were found, as well as slightly low levels of resilience and low levels of HRQoL. Evidence has also been obtained of the positive effect of resilience on the different variables evaluated.

Furthermore, the research has shown that not only personal resources can improve the occupational health of healthcare professionals but also that the context in which they carry out their work and having contracted and overcome COVID-19 also have a determining influence on their perception. Thus, it seems that when infections are declining and professionals have overcome the disease, their levels of depression and stress improve, and their levels of some dimensions of HRQoL, such as social functioning, increase.

This paper invites to reinforce the existing literature on the mental health of the population during the pandemic, that of healthcare professionals who have been closely involved in these circumstances. Moreover, it should serve as an impetus for further research focused on exploring the medium and long-term consequences of the already evident impact of the pandemic on them.

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Challenges and Difficulties Related to the Professional Performance and Training of Peruvian Medical Residents during a Pandemic

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Abstract: Physicians that pursue postgraduate studies must simultaneously manage activities related to their academic training and their duties as specialized in a hospital. The aim of this study was to determine the challenges that affect the professional development and growth of 142 first-year medical residents from a private university in Peru, during the COVID-19 pandemic. The residents responded to an online questionnaire with eight open-ended questions soliciting the identification of two difficulties or challenges per question. Descriptive analysis of the challenges that were detected was carried out and two binomial logistic regression models were tested to evaluate the effect of academic and personal factors on professional development. A structural regression model with three predicting factors (Academic training, Mentorship and use of ICT, and Health conditions) was also tested to predict professional development. Over 80% of the residents expressed having problems with their professional performance, activities, and attention span during the residency. The adjusted logistic regression model explained 42% of the effect of factors that make the emergence of challenges for medical residents more probable in the performance of professional activities. Likewise, the structural regression model indicated a good fit, where all three factors significantly explained medical residents' professional performance; however, the Mentorship and use of ICTs factor was the best predictor of professional performance during the residency program.

Keywords: pandemic; medical education; medical training; work life; Peruvian physicians

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1. Introduction

The advent of the COVID-19 pandemic brought many changes to programs that were, essentially, in-person. Adding virtual education to programs that were essentially in-person could have been based on a democratic perspective looking to diversify opportunities and access to education for students and college students [1]. However, virtuality has differentially impacted the college student population, configuring different situations and contexts [2,3], some of which have been negative for many students.

Based on their socioeconomic status, college students from different academic levels experience and perceive online classes, vocational training, and postgraduate studies during the pandemic in different ways. For example, a study of college students from different engineering fields reported that the students emphasized the advantages of online education for their personal and professional development during the pandemic, but the notion that the pandemic brought adverse consequences for student's health and quality of life was also highlighted [4]. Other studies have reported differences in perception amongst the college community regarding the implementation, process, and effects of eLearning and education during the pandemic which are dependent on geographical and

socio-economical location: the northern, southern, eastern, or western hemispheres [1]. Unequal access to quality online education during the pandemic has also been reported by students of various disciplines [5].

Various studies have reported on the effects of student connectivity and accessibility to the internet and to other technological gadgets, of teacher's skills for technological resources and online classes, as well as of student self-teaching/learning skills, on the assessment of advantages and the effectiveness of postgraduate online courses during the pandemic [6–10]. Thus, during the pandemic, students have valued remote learning, comfortability, user-friendliness, accessibility, and student-centered education as important advantages of online classes. Nonetheless, students have also reported that online classes are inefficient and ineffective for teaching practical skills (for example, in Anatomy); they do not promote student participation or comments, they require many technological resources, attention is limited, and there is a risk of plagiarism by the student [11].

In other findings, during online classes due to the pandemic, students mentioned having connectivity issues, financial problems, and dedicating around 16 h a week to their homework; they considered that online classes were not enough to learn, so they had to dedicate extra time and resources for autonomous learning [12].

In a systematic review paper about Latin American college students' participation and compromise to online learning due to the COVID-19 pandemic [13], the authors concluded with five requirements that must be considered for online learning in Latin America: (a) transformation of higher-level education, (b) providence of adequate professional training, (c) improvement of internet connectivity, (d) guaranteed quality online learning in higher-level education, and (e) emotional support. Similarly, a study about ergonomic and health changes perceived by Peruvian (in the city of Lima) college students during online classes due to the COVID-19 pandemic, found that 44% presented weight variations and 84% presented muscular pain, with a prevalence of back, neck, waist, shoulder, and neck pain [14]. Additionally, 79% presented eye discomfort (burning, itching, dryness, eye strain, and tearing during class); only 46.3% practiced physical exercise and more than 40% varied their intake of liquids and fruit consumption [14].

Research regarding medical training and education during the pandemic has also been conducted. Sierra et al. [15] noted that 59% of physicians in training, in Mexico, received classes via Zoom; 67% of the survey respondents rated the learning experience in prerecorded lessons or video conferences as the same or worse than in-person classes; 80% pointed out that the main limitations of live video conferences are the scarce interactions with their professors and classmates, as well not enough capacity to concentrate. A study with Hungarian students in their third and fourth year of medical school, during the pandemic, reported that via long-distance education and by making use of materials that were available at home, they were taught basic surgical knot and suture techniques as well as basic laparoscopy; therefore, students achieved the learning goals and they gave ratings of satisfactory and equivalent to the performance achieved in in-person modality before the pandemic [16].

Rajab et al. [17] reported a study with medical students in Saudi Arabia where 42% manifested having little or no online learning experience before the pandemic; 63% preferred combining online and in-person learning; 59% reported having trouble with communication during class; and 57% stated proficiency in using technological tools. An important aspect of the study was that 48% expressed having felt anxiety or stress regarding the pandemic. Despite these limitations, 71% of the college population that was surveyed believes that the COVID-19 pandemic has strengthened their trust in the efficacy of online medical services, and 76% noted that they wished to integrate their online training experience during the pandemic to their professional practice.

Various studies have reported on the diversity of situations that affect students in medical training. Literature on this topic is significant, has been reported from different parts of the world [6,18–26], and continues to grow. However, for specialization teaching or postgraduate contexts (like medical residency programs), the effect of virtual classes may

be more harmful than good for student health because of the demands of their professional activity and the long hours that they have to spend in a hospital. Having this in mind, there are other factors that are associated with medical residency programs and can affect physical and emotional health, such as stress, anxiety, fatigue, muscular pain, sleep disorders, and weight, amongst others.

For the Present Study

One of the research questions that guided this study was: What are the variables that most frequently influence the activities, professional performance, and attention of medical residents who are enrolled in a private university in northern Peru for their second specialization? A second question was: How is the latent variable of professional performance during the medical residency (academic development and professional training) influenced by other latent variables that are configured from indicators of Academic and professional training received during the residency; Quality of mentorship and/or classes in the university and/or hospital; Accessibility and management of virtual environments to take classes and receive training; Problems related to eating, sleeping, and body weight; Physical and ocular discomfort; Loss of close family and friends due to COVID-19; and Other associated problems?

The aim of this study was to determine the effect of variables like Academic and professional training; Challenges and conditions related to virtual classes during the residency; Physical health factors (Academic Training); Quality of mentorship and/or classes in the university and/or hospital; Accessibility and management of virtual environments to take classes and receive training; Problems related to eating, sleeping, and body weight; Physical and ocular discomfort; Loss of friends and family due to COVID-19; and Other associated problems, on the professional performance of medical residents during the residency program. A second aim was to identify the variables that most frequently influence the activities, professional performance, and attention of residents in their second medical specialty program.

2. Materials and Methods

2.1. Participants

The study consisted of 184 medical students enrolled in the first year of their residency program, for their second medical specialization, at a private university in the city of Trujillo, Peru. According to Soper's formula for Structural Equation Models (SEM), the minimum sample size required to be able to detect the effect in the frame of the Structural Equations Model (SEM) for a medium a priori effect size (0.3), the desired level of statistical power (0.80), the number of latent variables (3), the number of manifested variables (7), and the level of desired probability (0.05), corresponds to 119 cases [27]. Furthermore, for an Analysis of Multiple Regression, the minimum sample size that is required, according to Soper's calculator [27], is 103 cases for a medium a priori effect size of 0.15, the statistical power of 0.80, considering a number of 7 predictors, and a level of probability of 0.05. Therefore, the sample size of this investigation is acceptable considering the aim of this research paper.

The final sample consisted of 142 first-year medical residents (66 women and 77 men) who had previously read and signed informed consent to participate in the study. The age of the participants varied between 25 and 48 years, with a median of 32.

The medical residents that participated in this study were from different clinical and surgical specialty backgrounds which are provided by third-level hospitals in Peru; these hospitals have the capacity to satisfy health needs via specialized outpatient care. Third-level Hospitals have these medical specialties: Gynecology and Obstetrics, Rehabilitation Medicine, Intensive Care, Internal Medicine, Oncology, Nephrology, Pneumology, Neurosurgery, Neurology, Ophthalmology, Orthopedics, Traumatology, Otolaryngology (ENT), Pediatrics, Psychiatry, Rheumatology, Urology, and others.

Selection process. During a virtual meeting, the 184 residents were introduced to the investigation that was being conducted and all their questions were answered. Most questions were oriented towards knowing if they would receive benefits if they responded to the survey; they were informed that they would not receive direct benefits, but that their intervention would facilitate knowledge regarding the factors and relations between factors that could contribute to their learning. Students were guaranteed no reprisal or harm if they decided not to participate in the study. The significance of scientific research related to the educational model adopted because of the health situation due to the pandemic was emphasized. Every resident was provided with informed consent which they sent back through the online teaching platform they used.

Characteristics of the medical residency program in Peru. The medical residency is a program that a physician enrolls in to get their second specialization in Medicine. The model implies activities of assistance, conferences related to topics of the medical specialty, and general courses that must be imparted in every specialty (health management, epidemiology, scientific research). The program is three to four years long, carried out in a facility that allows assistance, where residents are tutored by a professor from the university that works in that facility and is specialized in the medical specialty the residents are training in. Generally, doctors finish the residency in three years. These residents are joined through a competition held by the National Council of Medical Residents where they have to pass a national-level exam. The population of this research paper was configured by residents that did their residency program in hospitals located in Northern Peru, but it is important to highlight that the contest is held nationwide.

2.2. Instruments

A questionnaire was developed, and it consisted of eight open-ended questions that asked for an assessment of training and the conditions in the medical residency (Residency Program) during the academic cycle of August–September 2021. The questionnaire is attached in Appendix A, and it includes eight aspects: Academic and professional training received during the residency; Activities, professional performance, and attention during the residency; Quality of mentorship and/or classes in the university and/or hospital; Accessibility and management of virtual environments to take classes and receive training; Problems related to eating, sleeping, and body weight; Physical and ocular discomforts during the residency; The most important loss due to COVD-19, of family members, friends, colleagues, or coworkers; and other problems that affect academic development and professional formation in the residency. These eight general categories were determined by the panel of researchers for this study and were based on the literature that was consulted.

Answers to all eight questions of the survey were assessed in terms of a dichotomy: no difficulty (0) and difficulty (1). Satisfactory evidence of validity of the internal structure was obtained based on a CFA with a robust WLSMV estimator: X2 (19) = 18.856, p = 0.403; CFI = 0.996, TLI = 0.993, RMSEA = 0.018 [CI 90% 0.000, 0.077]; McDonald's omega coefficient of 0.794 is evidence that the questionnaire offers adequate reliability; an ordinal coefficient theta for internal consistency of 0.809 also supports reliability.

2.3. Ethical Aspects

Residents were presented with all the information available so that they could have knowledge of the intended research. Actions of autonomy, justice, and non-maleficence were emphasized (the conversation about beneficence was aforementioned). Residents were asked to evidence their willingness to participate with sincere and unhindered answers. Regarding the questions and their answers, participants were assured that not sending in the answers would not affect anybody because recollected data would be anonymous. Students that wished to participate in the study had to send their informed consent via email.

2.4. Procedure

Once the medical residents expressed their desire to participate in the study by sending in their informed consent, an email was sent to them, on the first week of December 2021, containing the questionnaire in Microsoft Word and indicating that they had a maximum of one week to send it back via email. Two days before the deadline, every student that expressed consent to participate in the study was sent a reminder. All surveys that were sent in before Tuesday, 14 December 2021, were included in the study.

2.5. Data Analysis

Completed questionnaires were revised online by the research team and exported to Microsoft Excel. Subsequently, content analysis was conducted, and general categories were created for each one of the eight questions. Apart from the seventh question, which included eight categories, every other question contained between five and six categories depending on the various difficulties and challenges the participants expressed in their answers. The answers were organized by conceptual similarities according to the common difficulties or characteristics that were expressed. The resulting categories for each question are mutually exclusive. Appendix B lists the categories that were derived from each one of the eight questions.

Once the categories were formed, the database was restructured by making sure that each one of the participant's answers was allocated to one of the possible categories per question. This data was imported into JASP, which is a free software for statistical analysis provided by the University of Amsterdam. Descriptive frequency analyses and cumulative percentages were calculated for each question and its categories using JASP 0.16.2; logistic regression analyses were also computed.

The structural regression model analysis was calculated with R (version 4.2.1) [28] using the Weighted Least Squares Mean and Variance (WLSMV) estimator considering that latent variables are configured from manifest variables with categorical values. The adjustment to the structural model is based on what the literature recommends, in other words, the model is considered valid when the Chi-square goodness-of-fit test presents a *p*-value that is greater than 0.05; CFI and TLI resulting in $\geq$0.90 indicate a good fit and $\geq$0.90 indicate a great fit [29,30]; indices resulting in $\leq$0.08 for SRMEA and SRMR indicate an adequate fit and $\leq$0.06 indicate a great fit [29,30].

3. Results

The descriptive analysis of the various challenges and difficulties medical residents face during their professional training and practice, in the context of the COVID-19 pandemic, is presented below.

3.1. Academic and Professional Training Received during the Residency

The challenges that first-year medical residents are faced with regarding academic and professional training received during the residency are presented in Table 1. According to the data, 93% of the residents stated that they experienced difficulties in their academic and professional training. The main problem, referred by the participants, was related to management and organizational aspects of the residency program directed by the university which is also related to the orientation and mentorship of the residents (28% of the sample). A second problem, highlighted by 21% of the sample, was related to the activities schedule and the short amount of time that they had because of hospital activities. A third aspect that was pointed out as a problem was the scarce academic activity and teacher performance (17%). To a smaller extent, 15% of the residents expressed that their relationship with tutors, the senior residents, and the assistants during the residency was challenging.

Table 1. Prevalence of challenges presented during academic and professional training.

Type of Challenge	N	% [CI95%]	Cumulative %
Assistants, senior residents, and tutors	21	14.8 [9.9, 21.6]	14.8
Teachers and scarce academic activity	25	17.6 [12.2, 24.7]	32.4
Inadequate equipment and didactic resources	15	10.6 [6.5, 16.7]	43.0
Incompatible schedules and times	30	21.1 [15.2, 28.6]	64.1
University, mentorship, orientation, and organization	41	28.9 [22.1, 36.8]	93.0
No problems	10	7.0 [3.9, 12.5]	100
Total	142	100	

3.2. Activities, Professional Performance, and Attention during the Residency Program

Challenges in the performance of professional activities are presented in Table 2. Around 80% of the residents stated that various difficulties were presented when offering their professional services and activities during the medical residency. Most of the residents (32%) mentioned that the main problem was the distribution of activities and the workload. A second aspect that affected professional performance had to do with problems related to the services that were provided by the hospital where the residency program was taking place, the lack of medical specialties, and challenges related to patient demand (14%). The categories that remain were perceived by the residents as presenting similar levels of difficulty and in smaller proportions (between 11% and 12%).

Table 2. Prevalence of challenges presented during professional activities and performance.

Type of Challenge	N	% [CI95%]	Cumulative %
Professional activity	18	12.7 [8.2, 19.1]	12.7
Distribution and workload	45	31.7 [24.6, 39.7]	44.4
Program venue, facilities, equipment, and electronic services	15	10.5 [6.5, 16.7]	54.9
Professional services, specialization, and patient demand	20	14.1 [9.3, 20.8]	69.0
Support and supervision of senior residents	16	11.3 [7.1, 17.5]	80.3
No difficulties	28	19.7 [14.0, 27.0]	100
Total	142	100	

3.3. Mentorship and/or Class Quality in the University and/or Hospital

The quality of mentorship and/or classes in the university is presented in Table 3; 78% of the residents reported difficulties. The fourth part of the sample referred to problems of accessibility, and 2 out of every 10 residents mentioned that the quality of the tutoring sessions and/or classes had been negatively affected because of poor planning and organization. Likewise, for a lower percentage of residents, challenges were related to teacher or hospital mentor support (17%) and schedules (16%).

Table 3. Prevalence of challenges due to mentorship and/or classes in the university and/or hospital.

Type of Challenge	N	% [CI95%]	Cumulative %
Teacher or hospital mentor support	24	16.9 [11.6, 23.9]	16.9
Schedules	22	15.5 [10.5, 22.3]	32.4
Planning and organization of the university/residency program	29	20.4 [14.6, 27.8]	52.8
Accessibility issues	36	25.4 [18.9, 33.1]	78.2
No problems	31	21.8 [15.8, 29.3]	100
Total	142	100	

3.4. Accessibility and Management of Virtual Environments for Classes and Training

Around three-fourths of the sample of medical residents mentioned challenges related to accessibility and management of virtual environments for classes and training (Table 4). Connectivity represented the biggest problem (30%). Likewise, every 2 out of every 10 residents mentioned that they experienced problems with access to equipment or workspaces and with the overall management of the institution.

Table 4. Prevalence of challenges related to accessibility and management of virtual environments for classes and training.

Type of Challenge	N	% [CI95%]	Cumulative %
Access to equipment, workspaces, or rooms	32	22.5 [16.4, 30.1]	22.5
Connectivity issues	42	29.6 [22.7, 37.5]	52.1
Programming and planning by the institution	31	21.8 [15.8, 29.3]	73.9
No problem	37	26.1 [19.5, 33.8]	100
Total	142	100	

3.5. Problems Related to Eating, Sleeping, and Body Weight

During the pandemic, around 80% of the residents mentioned problems related to eating, sleeping, and body weight (Table 5); the most prevalent, affecting at least half of the residents, were skipping or postponing meals and sleep disorders. The data shows that 28% of the residents mentioned having difficulties due to a poor diet and variations in weight.

Table 5. Prevalence of challenges related to eating, sleeping, and body weight.

Type of Challenge	N	% [CI95%]	Cumulative %
Skipping or postponing meals	35	24.6 [18.3, 32.3]	24.6
Poor diet	20	14.1 [9.3, 20.8]	38.7
Weight loss or gain	21	14.8 [9.9, 21.6]	53.5
Sleep problems	36	25.4 [18.9, 33.1]	78.9
No problem	30	21.1 [15.2, 28.6]	100
Total	142	100	

3.6. Physical and Visual Discomfort

According to Table 6, a total of 8 out of 10 residents have experienced physical and ocular discomfort. One-third of the residents expressed musculoskeletal disorders. Likewise, an important part of the sample (30%), mentioned feeling fatigue, headaches, and migraines. Only 10% referred to vision-related discomfort.

Table 6. Prevalence of challenges related to physical and visual discomfort.

Type of Challenge	N	% [CI95%]	Cumulative %
Generalized fatigue	22	15.5 [10.5, 22.3]	15.5
Headaches and migraines	21	14.8 [9.9, 21.6]	30.3
Vision problems	14	9.9 [5.9, 15.9]	40.1
Stomach, skin, and lower limb disorders	8	5.6 [2.9, 10.7]	45.8
Musculoskeletal disorders	46	32.4 [25.3, 40.5]	78.2
No discomfort	31	21.8 [15.8, 29.3]	100
Total	142	100	

3.7. Loss of Family Members or Close Friends Due to COVID-19

Data presented in Table 7 shows that 40% of the residents lost a family member or a close friend to COVID-19. Around 28% reported the loss of family members, both close relatives and next of kin. Additionally, 12.7% of the residents mentioned the passing of friends and coworkers due to COVID-19.

Table 7. Prevalence of challenges related to the loss of family members or close friends due to COVID-19.

Type of Challenge	N	% [CI95%]	Cumulative %
Close friends and acquaintances	12	8.5 [4.9, 14.2]	8.5
Colleagues, coworkers (in the Health field)	6	4.2 [1.9, 8.9]	12.7
Close relatives	34	23.9 [17.7, 31.6]	36.6
Direct family members	6	4.2 [1.9, 8.9]	40.8
None	84	59.2 [50.9, 66.9]	100
Total	142	100	

3.8. Other Challenges That Affect Academic Growth and Professional Training

According to the data presented in Table 8, at least 64% of the residents identify additional challenges that affect their academic growth and professional training. A group of residents (18.3%) identified the inefficiency of the residency program, and the lack of academic materials, internet service, and arrangements as a problem. Other difficulties that were referred by 19.7% of the residents were work overload, lack of rotation, mistreatment, and problematic work relationships and environment. The third group of problems, mentioned by 26% of the residents, was related to health issues, fear of COVID-19, and being away from their families.

Table 8. Prevalence of other challenges that affect academic growth and professional training.

Type of Challenge	N	% [CI95%]	Cumulative %
Being away from family	12	8.5 [4.9, 14.2]	8.5
Lack of academic material, internet service, and arrangements	11	7.7 [4.4, 13.3]	16.2
The pandemic and fear of COVID-19	7	4.9 [2.4, 9.8]	21.1
Health and personal problems	18	12.7 [8.2, 19.2]	33.8
Inefficiency of the residency program-training	15	10.6 [6.5, 16.7]	44.4
Work relationships, work environment, mistreatment	6	4.2 [1.9, 8.9]	48.6
Time, work overload, no rotation	22	15.5 [10.5, 22.3]	64.1
None	51	35.9 [28.5, 44.1]	100
Total	142	100	

3.9. Factors That Are Associated with Difficulties Regarding Professional Activities or Services Provided during the Medical Residency

After multivariate logistic regression analysis, crude and adjusted by sex and age of the participants, the possibility of confounding factors related to sex and age was discarded. The results of two binomial logistic regression models to evaluate the effects of academic and personal factors associated with challenges related to professional activities or services provided during the residency are shown in Table 9. The adjusted regression model shows almost similar relations between the predictor variables and the dependent variable (professional performance), in relation to the crude model.

Table 9. Binomial logistic regression models for professional growth during the medical residency.

Factor	Crude Model [a]		Adjusted Model [b]	
	p	OR [95% CI]	*p*	OR [95% CI]
F1: Academic and professional training (1)	0.138	3.31 [0.68, 16.05]	0.173	3.08 [0.61, 15.50]
F2: Quality of the mentorship and/or classes provided by the university (1)	**0.027**	**3.39 [1.15, 10.03]**	**0.029**	**3.41 [1.14, 10.21]**
F3: Accessibility and management of virtual environments to take classes (1)	**0.015**	**3.74 [1.29, 10.82]**	**0.016**	**3.76 [1.27, 11.10]**
F4: Diet, sleep, and body weight problems (1)	**0.022**	**4.67 [1.25, 17.44]**	**0.023**	**4.62 [1.23, 17.29]**
F5: Physical and ocular discomfort (1)	0.896	1.09 [0.28, 4.30]	0.720	1.31 [0.30, 5.69]
F6: Loss of family members and close friends due to COVID-19 (1)	0.414	0.65 [0.23, 1.83]	0.392	0.63 [0.22, 1.80]
F7: Other challenges that affect academic growth and professional training (1)	**0.020**	**3.58 [1.23, 10.43]**	**0.024**	**3.45 [1.18, 10.09]**

Note: The text in bold letters indicates a significative relationship ($p < 0.05$). [a] Crude multivariate regression model, [b] Multivariate model adjusted by sex and age, OR = odds ratios, CI = confidence intervals. (1) Residents that presented difficulties related to performing professional activities and providing services during the medical residency program.

The global goodness-of-fit test of the adjusted model was satisfactory because the log-likelihood value of −2 reduced significantly with respect to the base model (Δ −2LL = 42.67); McFadden's R2 indicated very good model fit (R2McF = 0.31); the Hosmer and Lemeshow test also indicated good model fit (X2 (8) = 4.494, $p = 0.81$); the area under the curve AUC-ROC allows for the correct classification of 86% (over the critical value of ≥ 70%), evidencing that the result that was found corresponds with a good logistic model; also, according to Nagelkerke's R2, the model allows for the explanation of the DV based on the risk factors at 41.7%. Consequently, all these measurements support the adjusted logistic model as valid for the explanation of challenges that first-year medical residents find when performing professional activities or providing a service during the residency program.

On the other hand, according to the Odds Ratio (OR) values, four factors that were considered in the model, affect the medical resident's performance negatively (OR > 1). Specifically, medical residents with difficulties related to the quality of the mentorship and classes provided by the university (F2); accessibility and management of virtual environments to take classes (F3); diet, sleep, and body weight (F4); as well as other challenges that affect academic and professional training (F7), have 3 to 4 times more probability of encountering difficulties when performing professional activities and providing services during the residency program, than the residents that did not experience or identify those challenges.

3.10. Explanatory Structural Model of the Difficulties Related to the Professional Performance of Medical Residents

With the purpose of offering a robust and parsimonious model which allows for the explanation of the professional performance of medical residents in relation to latent variables (constructs) based on indicators that were directly measured, a structural model was tested using a structural regression modeling technique (Figure 1). The manifest variables of perceived challenges related to "academic and professional development" and "other factors that affect academic development" make the "Academic Training" construct; the manifest variables "mentorship and online class quality" along with "access and use of technology for virtual education" constitute a latent variable because they refer to the teaching-learning construct which is an inherent part of medical resident's training; a third construct is represented by two manifest variables that are linked to the concept "Health Condition".

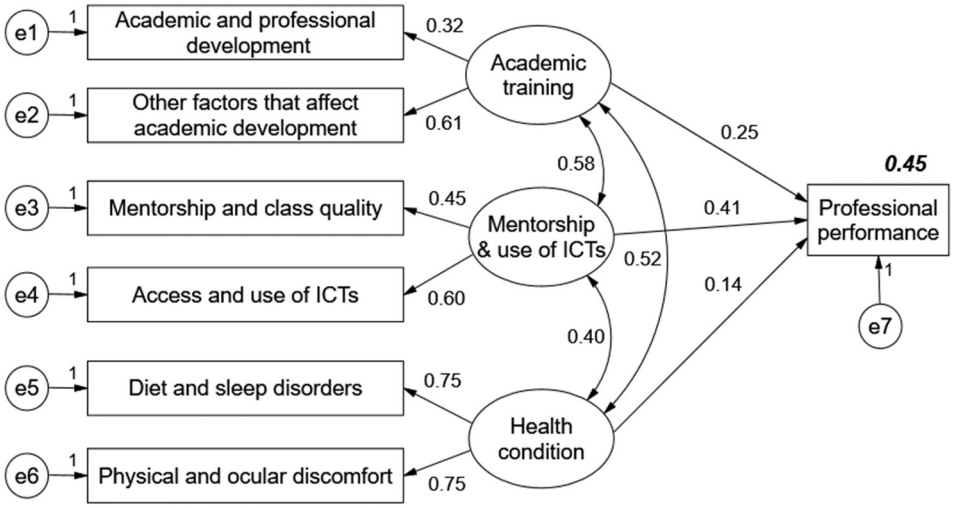

Figure 1. Explanatory structural model of the difficulties related to the professional performance of medical residents.

The structural model (Figure 1) is valid because it presents very satisfactory goodness-of-fit indices: $\chi 2$ (9) = 13.578, p = 0.138; CFI = 0.97; TLI = 0.92; RMSEA = 0.06 [0.00, 0.12]; SRMR = 0.04; in other words, the results indicate that the structural model presents adequate fit ($\chi 2$), acceptable parsimony ($\chi 2/gl$ = 1.51), very good—good fit for incremental adjustment indices (CFI and TLI), and good fit for absolute fit indices (RMSEA and SRMR).

Figure 1 shows that challenges related to academic training, mentorship, access to ICT, and health problems, have a direct impact on 45% of the overall difficulties related to professional performance during the residency. According to the coefficient paths or estimated parameters, the factor with the most impact is the one related to problems with mentorship and the use of ICT for online education. The second factor that directly aggravated professional performance was the one related to problems with academic training. Finally, health problems also negatively affect the quality and efficiency of the professional performance of medical residents.

4. Discussion

In light of the results of the present study, the first aspect to highlight is that 80% of the physicians who were surveyed and went through postgraduate specialization training (the medical residency in Perú) expressed having difficulties in their professional performance during the residency program. What are the reasons for the challenges that medical residents experience in their residency programs which affect their professional development? The results suggest that one of the main contributing factors has to do with the academic and professional training challenges that resulted from the shift to online classes due to the pandemic, considering that the program is planned to be (and essentially was) an in-person program. This finding aligns with the results that were reported in previous studies about student perceptions of pertinence and quality of online classes due to the pandemic [7–10,13,15]. Students that participated in such studies expressed their contention with the training quality of professional competencies via online classes due to the pandemic. Nonetheless, the results of the present study paint a considerably wider picture, where 93% of the students expressed having difficulties in their academic training and not just disagreement with the quality of the training. This should be considered an important factor because medical residencies are advanced levels of education (in Peru they are equivalent to a postgraduate specialization). Therefore, for a big part of the sample of residents that were surveyed, specialized training has not been satisfactory, and they consider that this factor (online training) is a problem that affects their professional growth in the residency program. These difficulties, which were revealed during the

training of medical residents, can have an impact on the fulfillment of their professional competencies [31].

A second aspect that resulted as relevant was the one concerning the health conditions of medical residents during the pandemic and their residency program; specifically, conditions related to diet, sleep, and body weight disorders, as well as physical discomfort and problems with their vision. Apparently, these are common symptoms related to online medical training during the pandemic [4,14]. However, the data from this study must be considered with caution when trying to explain the relationship between physical health issues and the professional performance of medical residents. Residents expressed having physical health problems and this might be due to the nature of their professional medical activity at such a specialized level (postgraduate) in a hospital, or to the additional activities that the resident had to perform during the pandemic such as online classes, tutoring sessions, and homework.

The findings of this study coincide with the results that were obtained by other researchers when studying health problems in medical students taking classes during the COVID-19 pandemic. Similar to what was found in this study, other papers have reported that medical students have various physical health problems [23,26]. Likewise, most of the symptoms reported by medical students are associated with emotional and mental health issues [19,21], such as depression [18], anxiety [24], and stress [22,25]. Another aspect to consider is the risk of burnout among medical residency students [32].

A third aspect related to the challenges medical residents face during their professional training includes two fundamental factors of the specialization training process: the quality of mentorship and accessibility to, as well as management of, virtual environments. Both aspects have been identified as factors that hinder the performance of medical residents. The first aspect is related to the supervision and support teachers give students, aspects which have previously been reported as fundamental for growth within the discipline and professional development [7,33,34]. Clearly, the difficulty for medical residents to receive tutoring sessions, support, and feedback on their learning is an essential part of why they express having problems in their training as medical residents.

In this sense, medical residents face two main problems in their professional and academic development during the pandemic: (1) Their services and performance are affected by the circumstances and the risk of transmission that exists in their places of work (hospitals that host their residency program) and during their commute to the hospital which may involve public transportation; (2). Their performance is also affected by the tutoring and support they receive during training. The present study found that the quality and pertinence of mentorship and support during the training of medical residents is perceived as an aspect that affects professional and academic performance.

Another factor that presents difficulties for the professional performance of medical residents is the problem with access to online resources and connectivity issues. The medical residents that were surveyed for this study expressed that the places that host their residency programs do not have the resources or conditions for online work, this being taking online classes, having mentorship meetings, searching for information that is up to date, or any other professional activity that requires virtual resources. Given that in-person gatherings are limited, students would hope that the hospitals that host their residency programs could provide better conditions for access to technological resources and overall connectivity. Accessibility issues in postgraduate medical training programs have also been reported by Pomares-Bory et al. [8]. In addition, after a systematic revision of Learning in Latin American Higher Education during the COVID-19 Pandemic, Salas-Pilco et al. [13] suggested two aspects related to college training during the pandemic that needed urgent attention: (a) improving internet connectivity, and (b) a guarantee of quality online learning for higher education.

Inequality of opportunity to access virtual environments and unequal availability of technological resources in the hospitals that host residency programs can be determining factors for the differences in academic growth and professional performance of medical

residents. Thus, residency program hosts or venues can hinder equality of opportunity to access training and experience professional growth through virtual environments [1–3,5,6], contributing to inequality in higher-level specialized medical education.

When considering the effect of second-order latent variables (such as Academic training, Mentorship and use of ICT, and Health conditions) over the professional performance of medical residents, the factor with the most predictive power is Mentorship and use of ICT, followed by Academic training. This finding means that, for medical residents during the pandemic, health conditions are important, but factors associated with mentorship and academic training are better at predicting their professional performance.

As a final note regarding the use of medical simulation education, during the COVID-2019 pandemic, postgraduate medical programs in Peru did not use simulation teaching because both training and professional attention were offered in person.

5. Conclusions

Professionals that pursue medical residency programs during the pandemic face two situations they must simultaneously consider while receiving specialized training in public hospitals that belong to The Ministry of Health of Perú. On the one hand, residents must take academic courses and have tutoring sessions; on the other, they must also perform professional activities related to a medical specialty.

In the case of this group of Peruvian medical residents that are enrolled in a private university and perform professional activities in different hospitals, the factors that primarily affect their professional development and growth during the residency program are the challenges related to academic training and tutoring during their first year of the program. Furthermore, an important percentage of these first-year medical residents expressed having experienced diet, sleep, and body weight disorders, as well as physical discomfort and problems with their vision. Although these health problems influence the occurrence of certain difficulties while residents are providing professional medical services, once the effects of academic training and tutoring during the residency are controlled, they can also be predictors of the professional performance of these physicians in training.

The present study allowed the knowledge of variables that explain, through self-reports, the challenges first-year medical residents face in relation to their professional performance, development, and growth. Future research should be oriented towards the comparison of these types of relationships in contexts with and without a pandemic. This will allow for a better understanding of how the current pandemic situation affects the training process and health conditions of medical residents.

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Institutional Review Board Statement: The study was conducted according to the Principles of the Declaration of Helsinki. The administration of questionnaires and research on medical residents was authorized by the high board of the Universidad Privada Antenor Orrego of the City of Trujillo for strictly scientific purposes. In addition, because the study was exploratory, of short duration, and had no funding, no ethical revision and approval were solicited.

Informed Consent Statement: Informed consent was obtained from every participant involved in the study.

Data Availability Statement: The authors manifest that the data (answers to the questions and the database), sans personal information of the participants, will be available and can be solicited by contacting the first author of this paper. Shared data will comply with the consent provided by the participants regarding the use of confidential data.

Conflicts of Interest: The authors declare no conflict of interest that could have an inappropriate influence on the representation or interpretation of the results of the investigation. This investigation was free of institutional encroachment or interest. No funding was provided by any institution or person that could distort our findings or weigh in on the decision of publishing results.

Appendix A

Formative Assessment and Conditions Questionnaire

GENERAL INFORMATION

Sex _____ Age _____ Date _____ Current Training Cycle _____

Residency Location _____ Year of enrollment _____

Dear student, this questionnaire aims to identify the difficulties you may have faced in your formation during the current academic cycle.

Please, respond honestly.

Instructions:

Write, at least, two difficulties you have faced during this cycle (August–December 2021) in each one of the different aspects listed below:

1. Academic and professional training received during the residency

   _____
   _____

2. Your activities, professional performance, and attention during the residency

   _____
   _____

3. The quality of your mentorship and/or classes in the university and/or hospital

   _____
   _____

4. Accessibility and management of virtual environments to take your classes and receive training

   _____
   _____

5. Problems related to eating, sleeping, and body weight

   _____
   _____

6. Mention some of the physical and vision-related discomforts you have had

   _____
   _____

7. Mention the most important loss you have had, due to COVD-19, of family members, friends, colleagues, or coworkers

   _____
   _____

8. Mention any other problem that currently affects your academic development and professional formation in the residency

   _____
   _____

Appendix B

Table A1. Categories that resulted from the answers to each one of the eight questions.

Factors	Categories/Descriptors
1. Academic and professional training received during the residency	Inadequate equipment and didactic resources Incompatible schedules and times Teachers and scarce academic activity Assistants, senior residents, and tutors University, mentorship, orientation, and organization I do not have problems, it is okay
2. Activities, professional performance, and attention during the residency	Distribution and workload (overload) Program venue, facilities, equipment, and services Professional activity The support and supervision of senior residents, tutors, and/or teachers Professional services, specializations, and patient demand No difficulties
3. The quality of your mentorship and/or classes in the university and/or hospital	Schedules Teacher or hospital mentor backup Planning and organization of the university/residency program Accessibility issues (coverage and connectivity) No problem
4. Accessibility and management of virtual environments to take your classes and receive training	Equipment, cellphone Connectivity issues Access to equipment, workspaces, or rooms Programming or planning by the institution No problem
5. Problems related to eating, sleeping, and body weight	Weight loss or gain Poor diet (heavy on carbohydrates) Sleep problems Skipping or postponing meals No problem
6. Physical and ocular discomforts	Musculoskeletal disorders and back pain Generalized fatigue, exhaustion Headache, migraines Stomach, skin, and lower limb disorders Problems with vision No discomfort
7. Important loss due to COVD-19, of family members, friends, colleagues, or coworkers	Direct family (father/mother, partner, son/daughter, brother/sister) Close relatives (uncles/aunts, grandparents, cousins, father/mother-in-law) Colleagues and coworkers (in the Health field) Close friends and acquaintances None
8. Other problem that currently affecting academic growth and professional training in the residency	Being away from my family/family load Distance between the residency and work Lack of academic material, internet service, and arrangements Work relationships, work environment, mistreatment Health and personal problems Pandemic, and fear of COVID Time, work overload, no rotation None

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Article

The Association between Post-Traumatic Stress Disorder and Psychological Distress among Primary School and Middle School Teachers during the COVID-19 Epidemic: A Moderated Mediation Analysis

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Abstract: Background: The outbreak of the coronavirus disease (COVID-19) and its rapid spread may have led to individuals developing post-traumatic stress disorder (PTSD) and psychological distress. Under this context, teachers merit more attention as a group with high levels of work stress. The purpose of this study was to verify the relationship between PTSD and psychological distress and to explore sleep problems as a possible mediator in the relationship between PTSD and psychological distress, as well as the moderator of internet gaming disorders (IGD) in the relationship between sleep problems and psychological distress. Methods: A total of 11,014 Chinese primary and middle school teachers participated in this study. The survey was conducted online between 25 May and 30 June 2020. Results: PTSD was shown to have both a direct and indirect effect on teachers' psychological distress. The indirect effect was mediated by sleep problems. IGD played a moderating role between sleep problems and psychological distress. Conclusions: During the COVID-19 pandemic, PTSD has been shown to have had a serious impact on the psychological stress of teachers, which was mediated by sleep problems. In addition, IGD raised the harm brought from sleep problems on teachers' mental health.

Keywords: post-traumatic stress disorder; psychological distress; sleep problems; internet gaming disorder; COVID-19

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1. Introduction

1.1. The Impact of COVID-19 on Teachers

The outbreak of the coronavirus disease (COVID-19) had many physical and psychological effects on people. With the large-scale spread of the pandemic, much attention has been given to the state of peoples' mental health [1–4]. Some of these studies have been done in consideration of post-traumatic stress disorder (PTSD) [4,5]. Studies have shown that the speed of the pandemic's spread, home isolation, contact with suspected infected individuals, the pain of bereavement, the stress of unemployment, and the uncertainty of the future can all cause people to feel miserable and make them more prone to PTSD [4,6]. PTSD is characterized by persistent and intrusive memories of traumatic events, high vigilance, avoidance of trauma-related cues, and negative changes in thinking and emotions [7]. PTSD causes harm to peoples' mental health. For example, studies have found that people with traumatic experiences, such as experiencing Severe Acute Respiratory Syndrome (SARS), the Ebola virus, earthquakes, or hurricanes, are more likely to experience psychological distress [8–11]. After the 1999 Marmara earthquake in Turkey and Hurricane Mitch in Nicaragua, studies found that people had high levels of comorbid

PTSD and depression (i.e., 67.5% and 79% for the PTSD and depression comorbid rates in both traumatic experiences) [10,11].

In addition to the impact of PTSD on psychological distress, sleep issues can be another variable that may contribute to psychological distress. During the outbreak of this pandemic, many destabilizing social effects led to increased sleep problems [12,13], and some studies have investigated the association between such sleep problems and psychological distress [12,14,15]. The results indicated that individuals with sleep problems were more likely to develop depression and anxiety than individuals with healthy sleep [12,14,15].

In the context of COVID-19, studies have investigated both the effects of PTSD and sleep problems on psychological distress, but no studies have taken all three details into account, which could lead to doubt regarding the effects of these two variables on mental illness within the pandemic context. This is because the diagnostic indicators of PTSD include items reflecting sleep problems [15], making it hard to avoid the confounding factor of sleep problems as part of the impact of PTSD on peoples' mental health unless both PTSD and sleep problems can be included in the same analysis model. Therefore, it is necessary to discuss these three variables at the same time, so that the influence of each variable on mental illness can be more accurately seen.

On the topic of mental health during the pandemic, internet gaming disorder (IGD) has also received considerable attention. IGD is an excessive and prolonged pattern of internet gaming that results in a range of cognitive and behavioral symptoms, including a gradual loss of control over gaming, tolerance, and withdrawal symptoms similar to those of substance use disorder [7]. The basic characteristic is constant and regular participation in computer games, especially group games, for many hours at a time [7]. It is reported that greater psychological distress increases the amount of time primary school students spend playing games at home [16]. In a recent survey, 23.7% of primary school students reported that their time spent playing games at home has increased, and the results show that depression, anxiety, and stress are significantly associated with IGD [16]. In another survey conducted during the pandemic, IGD was proven to be a strong predictor of psychological distress, and higher levels of IGD were associated with more depression, anxiety, and stress [17–19]. Among these results, IGD was treated as a dependent or an explanatory variable [16,19]. However, the association between IGD and psychological distress may not only exist in the direct correlation between the two, but IGD may also combine with other variables to jointly influence psychological distress. For example, some scholars have suggested that internet games can easily interfere with sleep [18]. As such, whether IGD exacerbates the effects of sleep problems on psychological distress requires further exploration.

Many studies have been done on the mental health status of various groups during the pandemic, including frontline medical staff, adolescents, and college students [1,20,21]. However, few studies have looked at the psychological status of primary and middle school teachers. After the outbreak of COVID-19 in December 2019, China immediately took a series of countermeasures, which included the closure of public entertainment places and educational institutions [22] and moving to adopt online teaching. Teaching in the virtual environment requires teachers to be proficient in different remote teaching tools and to change their teaching strategies, which undoubtedly poses a huge challenge to teachers [23–25]. Moreover, it has been shown that teachers experience increased pressure when they must use unfamiliar technologies to conduct online teaching [26]. Therefore, it is pertinent to conduct a large-scale investigation into the psychological distress of such a high-risk demographic.

1.2. Research Purpose and Hypothesis

During the pandemic's outbreak, teachers who were unprepared to adapt to these new circumstances were required to adopt online teaching methods which may have made them vulnerable to psychological distress [23,27–29]. As such, this study focused on this demographic to investigate the possible factors influencing their psychological distress. To

fully explain the underlying mechanism, a conceptual model was proposed (Figure 1). As shown in this model, we examined the association among teachers' PTSD (i.e., teachers at high risk of PTSD and normal individuals), psychological distress, sleep problems, and IGD. What follows are the relevant empirical works that have led us to hypothesize the model pathway.

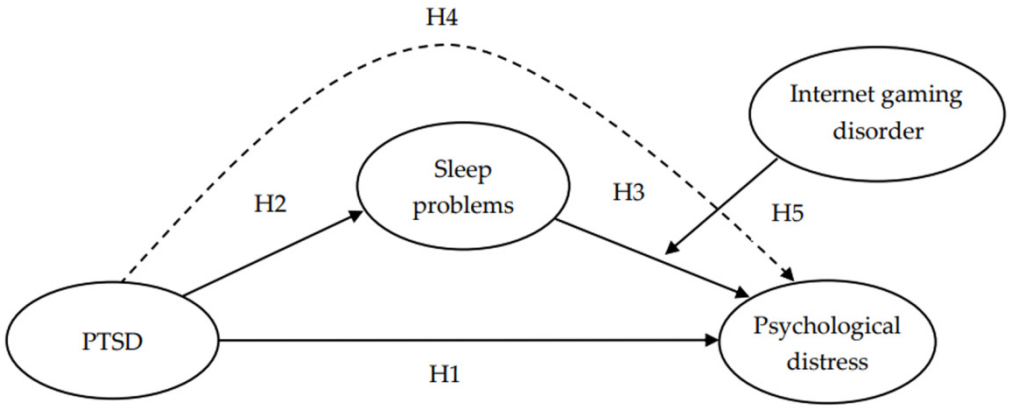

Figure 1. Research model and hypotheses. H4 is the mediating effect of sleep problems. (PTSD (Post-traumatic stress disorder) → Sleep problems → Psychological distress). The dashed line below H4 represents the indirect effect between PTSD and Psychological distress.

First, studies have shown that PTSD is significantly related with depression. One study from the United States showed that 24.2% of children with traumatic experiences showed depressive symptoms, and adolescents who had experienced a traumatic event were 2.6 times more likely to develop depression than those who had not [30]. In addition, studies have shown that PTSD is positively correlated with depression, anxiety, and stress [31]. Therefore, we hypothesized that PTSD is positively correlated with psychological distress (H1).

Numerous studies have shown that sleep problems are closely related to PTSD, and studies have shown that more than 50% of individuals with PTSD will report sleeping problems [32,33]. Sleep problems are also associated with depression, stress, anxiety, and other factors [12]. According to the 3P (predisposing, precipitating, and perpetuating factors) model of insomnia as proposed by Spielman and Glovinsky, sleep problems lead to an increase in peoples' existing stress levels [34]. Therefore, the following hypotheses were proposed:

H2. *PTSD is positively correlated with sleep problems.*

H3. *Sleep problems are positively correlated with psychological distress.*

Given that both PTSD and sleep problems are predictors of teachers' psychological distress and that PTSD may also influence sleep problems, it is reasonable to hypothesize that sleep problems mediate the relationship between PTSD and psychological distress (H4).

Studies indicate that psychological distress is closely related to the sleep status of individuals, and depressed individuals in particular will generally have a shorter reported sleep time [35,36]. In practice, however, not all people with sleep problems are equally troubled. Furthermore, individuals with the same level of sleep problems can also have different levels of mental health problems (such as anxiety levels, depression levels, stress levels), so there may be other important moderators between sleep problems and psychological distress. According to Davidson's emotional resilience theory, some individuals may produce positive or negative emotions too easily, which is detrimental to their physical and mental health [37]. The emotional experience of online gaming tends to be a roller coaster ride depending on whether the player is winning or losing in the game. During the COVID-19 pandemic, teachers not only have had to bear heavy schoolwork pressures, but they have also had to manage the general psychological pressures brought by the pan-

demic. With all the stress that has come due to all the changes, sleep for many has suffered. According to the self-regulation self-depletion model, when an individual's self-regulation resources are insufficient and the individual is in a state of self-depletion, this will lead to a decline in the individual's self-control, leading to impulses that are not conducive to the individual's wellbeing that appear in order to alleviate the depletion that the individual is suffering [38]. Insomnia is a typical manifestation of ego depletion [39,40]. Therefore, when an individual suffers from sleep problems, an individual with IGD may have positive or negative emotions brought about by internet or gaming addictions, aggravating the impact of sleep problems on their psychological distress. Therefore, this study hypothesized that online game addiction plays a moderating role in the effect of sleep problems on psychological distress (H5).

2. Materials and Methods

2.1. Participants and Procedure

An online survey was conducted using teachers from Jiangxi, Sichuan, and Shandong between 25 May and 30 June 2020, during the COVID-19 pandemic. The study was approved by the ethics committee of the Jiangxi Psychological Consultant Association (IRB ref: JXSXL-2020-J013). Informed consent was obtained from all individual participants included in the study. There were 11,014 teachers who participated in the investigation, with 3157 (28.7%) males and 7857 (71.3%) females. All teachers were from primary or middle schools (primary school teachers = 6921, 62.8%; middle school teachers = 4093, 37.2%). Among them, 10,566 (95.9%) worked at public schools and 448 (4.1%) at private schools. The range of teaching experience was from 1 year to 5 years (1 year = 2925, 26.6%; 2 years = 1888, 17.1%; 3 years = 1445, 13.1%; 4 years = 1187, 10.8%; 5 years = 3569, 32.4%).

2.2. Measures

In this study, the Chinese PTSD Checklist for Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (PCL-5) was used to evaluate teachers' PTSD in order to understand the teachers' situation during the COVID-19 pandemic. The 21-item Depression, Anxiety, and Stress Scale (DASS-21) was used to assess teachers' psychological distress; the 9-item Internet Gaming Disorder Scales-Short Form (IGDS-SF9) was used to assess the extent of teachers' IGD; one item was used to assess teachers' sleep problems. These instruments are described in detail below.

2.2.1. The Chinese Post-Traumatic Stress Disorder Checklist for DSM-5 (PCL-5)

The PCL-5 is one of the most widely used self-report measures in the DSM-5 for the assessment of PTSD [41]. The PCL-5 includes 20 items which are rated using a five-point Likert scale ranging from 0 (Not at all) to 4 (Extremely). In this study, teachers were divided into a high-risk PTSD group (score higher than 33) and a normal group according to the diagnostic criteria of DSM-5 [42,43] and based on the total score on the PCL-5. The Cronbach's α of the PCL-5 in this study was 0.95 for both groups of schoolteachers.

2.2.2. The Depression, Anxiety, Stress Scale-21 (DASS-21)

The DASS-21 is a shortened version of the Depression and Anxiety Stress Scale-42 developed by Lovibond and Lovibond [44]. It consists of three subscales that assess the extent of one's depression, anxiety, and stress. Seven items on each subscale are scored using a four-point Likert scale ranging from 0 (Did not apply to me at all) to 3 (Applied to me very much, or most of the time). Sample items are "I felt that life was meaningless" (depression); "I was aware of the action of my heart, without any physical exertion" (anxiety); and "I found it hard to wind down" (stress) [45]. The Cronbach's α of the three subscales in the current study were as follows: (i) the depression scale was 0.92 for both categories of schoolteachers; (ii) the anxiety scale was 0.91 for both categories of schoolteachers; (iii) the stress scale was 0.90 for primary school teachers and 0.91 for middle school teachers. To judge whether the participating schoolteachers had any mental illness, the DASS-21 scores

were multiplied by two and assessed using the following cutoff: (i) depression: less than 9 points is normal status, more than 10 is mental illness; (ii) anxiety: less than 7 points is normal status, more than 8 is mental illness; (iii) stress: less than 14 points is normal status, more than 15 is mental illness [46].

2.2.3. Sleep Problems

We used a single item to measure sleep problems, taken from the Chinese version of the Fear of COVID-19 Scale [47]: "I couldn't sleep well because I was worried about getting COVID-19." This measure was rated using a five-point scale ranging from 1 (Totally disagree) to 5 (Completely agree). The severity of the sleep problems was indicated by the item score, with higher scores indicating a higher level of sleep problems.

2.2.4. The Nine-Item Internet Gaming Disorder Scales-Short Form (IGDS-SF9)

The IGDS-SF9 is a short psychometric tool for the assessment of IGD which was developed by Pontes and Griffiths [48]. The IGDS-SF9 is a self-report instrument with items rated using a five-point Likert scale, ranging from 1 (Never) to 5 (Very often). After totaling all items to obtain one overall score, a higher score indicates a higher level of internet gaming disorder. A sample item is, "Do you systematically fail when trying to control or cease your gaming activity?" The IGDS-SF9 has a well-established unidimensional structure, and the Cronbach's α in this study was 0.95 for both categories of schoolteachers.

2.3. Data Analyses

In this study, SPSS 21 was used first to deal with descriptive statistics, and Pearson's correlation was used to explore correlations between variables. Next, we tested the research hypotheses about the mediating effect of sleep problems with Partial Least Squares Structural Equation Modeling (PLS-SEM) [49]. PLS-SEM can be used to examine data without distribution assumptions [50]. PLS can be divided into an outer model and inner model; the outer model can reflect the loading or weight of each indicator, showing the data's relationship with the model, and can be used to evaluate the construct validity of the model [50]. The outer model contains a formative indicator and a reactive indicator. All indicators used in this study were reactive indicators. The model was evaluated using the internal consistency reliability (Cronbach's α, threshold ≥ 0.7), composite reliability, convergent validity (AVE, threshold ≥ 0.5), and discriminant validity (HTMT, threshold ≤ 0.85) [49,51].

The linear relationship can be seen from the inner model (also called structural model) between constructs through the path coefficient (range from -1 to +1) and can be used to evaluate whether there is a significant difference between indicators by comparing it with zero. In this study, the hypotheses were tested with bootstrapping (n = 5000) and 95% confidence intervals (CI) [52,53]. We selected the coefficient of determination (R^2, with 0.67, 0.33, and 0.19 displaying substantial, moderate, or weak levels, respectively), and effect size (f^2, with 0.35, 0.15, and 0.02 displaying large, medium, or weak effects, respectively) to evaluate the endogenous constructs [54]. Given that there has been no common agreement of model fit criterion in PLS-SEM and that the SmartPLS manual recommends that researchers should be very cautious to report and use model fit in PLS-SEM [51,55], we did not report any indicators related to model fitting (e.g., SRMR, d_ULS, d_G, Chi-square, NFI). Finally, the mediating moderation model hypothesized in this study was also tested by PLS. PLS can be used to draw simple slope analyses of $\pm$ one *SD.*

3. Results

3.1. Descriptive Statistics and Pearson's Correlations

Table 1 shows the descriptive statistics including the means (standard deviations; *SD*) and Pearson's correlations (r) of each variable. According to the diagnostic criteria of the DSM-5 [42,43], a total of 978 participants were classified as the group with a high risk for PTSD, while the remaining participants made up the normal group (n = 10,036). As for psychological distress, 3100 suffered from psychological distress (28.14%), including

2901 (26.34%) having anxiety, 2273 (20.63%) having depression, and 1114 (10.11%) having stress. As expected, all variables showed a significant positive correlation with each variable ($p < 0.01$), among which the lowest correlation was with IGD and sleep problems ($r = 0.328$, $p < 0.01$), while PTSD had the highest correlation with psychological distress ($r = 0.610$, $p < 0.01$). The relationship between the variables supports the follow-up test of the research hypotheses.

Table 1. Descriptive statistics and Pearson's correlations of each study variable.

	M	*SD*	1	2	3	4
1. PTSD	13.139	12.090	1			
2. SP	1.82	0.692	0.402 **	1		
3. PD	15.091	20.191	0.610 **	0.419 **	1	
4. IGD	13.520	6.048	0.448 **	0.328 **	0.486 **	1

Notes. PTSD = Post-traumatic stress disorder; SP = Sleep problems; PD = Psychological distress; IGD = Internet gaming disorder. ** $p < 0.01$; PD is calculated by multiplying the DASS-21 score by 2.

3.2. Assessment of Reflective Outer Model

To test the relationship between PTSD, sleep problems, psychological distress, and IGD, the hypothetical model was established, and PLS was used to test it. Table 2 shows the outer model results, with the discriminant validity, composite reliability, Cronbach's α, and AVE values meeting the recommended criteria [49,56–58]. The HTMT values of all indicators, except when compared to themselves, were $\leq$0.85, indicating that the discriminant validity of each indicator was good. In addition, the composite reliability and Cronbach's α values were both more than the threshold value of 0.7, indicating that the model had good reliability.

Table 2. Assessment of the measurement model.

	HTMT				CR	Cronbach's α	AVE
	1	2	3	4			
1. PTSD	1.00					Not applicable	
2. SP	0.248	1.00				Not applicable	
3. PD	0.419	0.419	0.789		0.972	0.969	0.623
4. IGD	0.333	0.330	0.492	0.855	0.961	0.954	0.731

Notes. HTMT = Heterotrait-Monotrait Ratio; CR = Composite Reliability; Cronbach's α = Cronbach's Alpha; AVE = Average Variance Extracted.

3.3. Assessment of Inner Model

Tables 3–5 and Figure 2 show the bootstrapping results for the relationships between anxiety, stress, and depression. The results reveal that PTSD was significantly and positively correlated with psychological distress. Specifically, PTSD positively predicted anxiety ($f^2 = 0.201$), stress ($f^2 = 0.180$), and depression ($f^2 = 0.209$) with medium effects (H1). It also had a positive prediction on sleep problems ($f^2 = 0.248$) with medium effects (H2). Similarly, sleep problems also positively predicted anxiety ($f^2 = 0.212$), stress ($f^2 = 0.203$), and depression ($f^2 = 0.180$; H3). As for H4, when sleep problems were included as a mediator, the path coefficient for anxiety changed from 0.409 to 0.325, the path coefficient for stress changed from 0.390 to 0.308, and the path coefficient for depression changed from 0.416 to 0.340, all of which show that there were complementary and partial mediating effects in these three dimensions [51,59]. The R^2 values for the endogenous variables of anxiety, stress, and depression were 0.274 (small), 0.256 (small), and 0.261 (small), respectively. The average R^2 was 0.264.

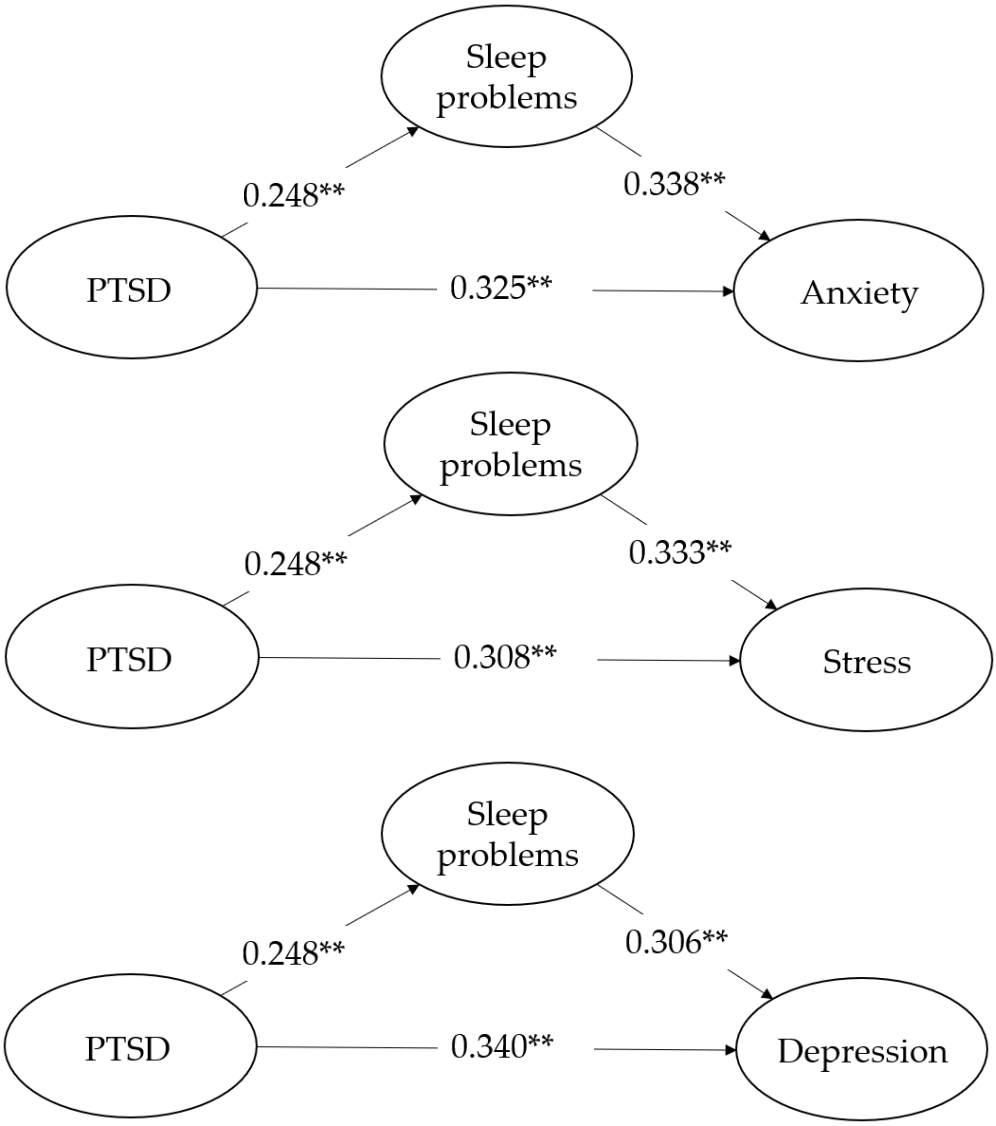

Figure 2. The PLS-SEM model with path coefficients and factor loading. Moderated mediation of IGD (Internet games disorder) is not included in the above models; ** $p < 0.01$. PTSD represents Post-traumatic stress disorder.

Table 3. Hypotheses testing for inner model results of anxiety.

Hypotheses	Effect		*SD*	*t*	*p*	95% CI
(H1) PTSD → Anxiety	Path Coeff.	0.409	0.012	33.408	<0.01	[0.385, 0.433]
(H2) PTSD → SP	Path Coeff.	0.248	0.011	23.088	<0.01	[0.226, 0.269]
(H3) SP → Anxiety	Path Coeff.	0.418	0.010	42.894	<0.01	[0.399, 0.437]
(H4) PTSD → SP → Anxiety	Path Coeff.	0.084	0.004	19.513	<0.01	[0.075, 0.092]
(H5) SP*IGD → Anxiety	Path Coeff.	0.057	0.012	4.889	<0.01	[0.034, 0.080]

Notes. The *t*-value should be greater than 1.96 (plus or minus) and the *p*-value should be less than 0.05 to be considered significant. The interval of 95% Confidence Intervals (CI) cannot contain zero. *SD* = Standard Deviation (STDEV).

Table 4. Hypotheses testing for inner model results of stress.

Hypotheses	Effect		*SD*	*t*	*p*	95% CI
(H1) PTSD → Stress	Path Coeff.	0.390	0.012	33.562	<0.01	[0.367, 0.413]
(H2) PTSD → SP	Path Coeff.	0.248	0.011	23.088	<0.01	[0.226, 0.269]
(H3) SP → Stress	Path Coeff.	0.410	0.010	43.130	<0.01	[0.392, 0.429]
(H4) PTSD → SP → Stress	Path Coeff.	0.082	0.004	19.470	<0.01	[0.074, 0.091]
(H5) SP*IGD → Stress	Path Coeff.	0.034	0.010	3.346	<0.01	[0.014, 0.054]

Notes. The *t*-value should be greater than 1.96 (plus or minus) and the *p*-value should be less than 0.05 to be considered significant. The interval of 95% Confidence Intervals (CI) cannot contain zero. *SD* = Standard Deviation (STDEV).

Table 5. Hypotheses testing for inner model results of depression.

Hypotheses	Effect		*SD*	*t*	*p*	95% CI
(H1) PTSD → Depression	Path Coeff.	0.416	0.012	34.226	<0.01	[0.392, 0.440]
(H2) PTSD → SP	Path Coeff.	0.248	0.011	23.088	<0.01	[0.226, 0.269]
(H3) SP → Depression	Path Coeff.	0.391	0.010	39.379	<0.01	[0.372, 0.410]
(H4) PTSD → SP → Depression	Path Coeff.	0.076	0.004	18.530	<0.01	[0.068, 0.084]
(H5) SP*IGD → Depression	Path Coeff.	0.058	0.011	5.093	<0.01	[0.035, 0.080]

Notes. The *t*-value should be greater than 1.96 (plus or minus) and the *p*-value should be less than 0.05 to be considered significant. The interval of 95% Confidence Intervals (CI) cannot contain zero. *SD* = Standard Deviation (STDEV).

In terms of moderation (H5), the results indicate that the moderating effects on anxiety (Path Coeff. = 0.057, $t = 4.889$, $p < 0.01$), stress (Path Coeff. = 0.034, $t = 3.346$, $p < 0.01$), and depression (Path Coeff. = 0.058, $t = 5.093$, $p < 0.01$) were significant (see Tables 3–5).

4. Discussion

As a public health emergency, the COVID-19 pandemic has had a huge impact on teachers. This study focused on teachers' psychological and physiological conditions and constructed a moderated medication model which proves that the mental health of teachers with PTSD will be affected by sleep problems and IGD.

In support of our first hypothesis, the path coefficient was significantly and positively correlated with PTSD and psychological distress. This result is the same as in previous studies looking at the relationship between PTSD and psychological distress [31]. Teachers are a group who can face high amounts of pressures [60,61], with regular exposure to students and parents even during the COVID-19 pandemic. In this context in particular, these teachers were under pressure not only when teaching their students, but also as they dealt with the psychological strain of the epidemic [62]. As a psychological disorder, PTSD is related to environmental stressors, which can lead to individuals becoming even more sensitive to psychological distress in the context of the COVID-19 pandemic [63].

Our results also proved Hypotheses 2 and 3 in that PTSD was also significantly and positively correlated with sleep problems, and with sleep problems positively correlated with psychological distress. One interesting finding is that sleep problems were most likely to cause anxiety, followed then by stress and depression in the three dimensions of psychological problems. As one of the most common negative psychological states, the first thing that sleep problems cause teachers is a sense of psychological irritability, and this feeling is the source of anxiety [64]. Many clinical studies have shown that sleep problems can predict the likelihood of developing future psychological distress, particularly anxiety [14,65,66]. For example, alterations in sleep may exacerbate generalized anxiety disorder [65]. As for depression, nighttime insomnia symptoms have also been shown to overlap with depression and anxiety symptoms [67]. Our research results support the

conclusion that PTSD can affect peoples' sleep problems, and that sleep problems can then lead to psychological distress.

The mediating effect of sleep problems in relation to PTSD and psychological distress was also examined (H4). PTSD is related to traumatic events. If someone died from COVID-19, the risk of their family members or relatives suffering from PTSD is greatly increased [4]. Similarly, the treatment of PTSD is often undermined by fragmented rapid eye movement (REM) sleep [68,69], so sleep problems and PTSD are closely related and move in the same direction. Poorer sleep is strongly associated with poorer psychological health [70–72]. Therefore, it could be suggested that when a teacher suffers from PTSD, the kinds of stresses that are placed on them are magnified, possibly affecting their sleep and, in turn, the teacher's psychological health.

Hypothesis 5, that IGD plays a moderating role in the relationship between sleep problems and psychological distress, was supported. These results were statistically significant, although the effect was not large. Regarding the relatively small moderating effect of IGD, it may be because most teachers have been very busy throughout the crisis [73–75] and didn't have much time to play games. However, for the few teachers with excessive internet gaming disorder, sleep problems are more damaging to their mental health. It appears that problematic internet behaviors among teachers should not be overlooked, even if their proportion is not high, since they can still negatively impact their psychological wellbeing over the long term.

5. Conclusions

This study found that during the COVID-19 pandemic, teachers, as a group, experiencing high psychological distress were more likely to report PTSD, and this PTSD may have caused teachers to experience increased depression, anxiety, and stress due to an increase in sleep problems. Experiencing severe sleep problems or stressful events increases teachers' likelihood to suffer from IGD, as does the internet becoming their primary means of being social with others or an accessible way to alleviate the pressures of the pandemic. In public health emergencies, teachers' mental health is of extreme importance given their role in society and involvement with younger generations. As such, further exploration is needed to understand and safeguard the mental health status of teachers.

6. Limitations

This study demonstrated the mediating effect of sleeping problems between PTSD and psychological distress, as well as the moderating effect of internet games distress between sleeping problems and psychological distress. There are several limitations of this study. The primary limitation of this study is the measure of PTSD. In line with other studies [76–78], we used the PCL-5 to measure symptoms of PTSD. However, some of the items in the PCL-5 measured the emotion of people exposed to trauma, while the negative emotions were also the essence in DASS-21, which was used as the indicator of psychological distress in this study. The overlap between PCL-5 and DASS-21 may affect the accurate association between PTSD and psychological distress, although the discriminant validity of these two latent variables was supported (see Table A1). Even though the measure of PCL-5 is a proxy variable of traumatic experience, future research could still consider reinvestigating the relationship between PTSD and psychological distress by including the data of pure traumatic experiences. Second, only one item was asked about sleep problems, so the measurement of sleep problems may be biased. Third, as the context of the COVID-19 pandemic is particularly unique, one must be cautious in terms of the findings' applicability, as the findings might not be transferable to normal situations. Therefore, future research should explore the mental health of teachers in a daily life context. Fourth, our data collection relied on internet and self-reported data gathering, and this could lead to bias. To avoid this situation, we standardized the data before analysis. Fifth, similar to the second limitation, the subjects of this study were mainly primary and middle school teachers. This model may not be applicable for high school or university teachers.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of Jiangxi Psychological Consultant Association (IRB ref of teachers: JXSXL2020-J013).

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

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the restriction by the institutional review board.

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Conflicts of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Appendix A

In Table A1, diagonal elements in bold are the square root of the averaged variance extracted. When these values were higher than the inter-latent factors' correlations (off-diagonal elements), the discriminant validity was a support for the respective latent variable.

Table A1. Discriminant validity of latent variables.

	PTSD	PD	IGD
PTSD	**0.865**		
PD	0.608	**0.789**	
IGD	0.516	0.508	**0.855**

Notes. Sleep problems were measured by a single item that caused averaged variance extracted (AVE) not to be calculated, so it is not shown in the above list.

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sustainability

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Review

Scientific Review and Annotated Bibliography of Teaching in Higher Education Academies on Online Learning: Adapting to the COVID-19 Pandemic

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Abstract: Since COVID-19 first appeared, e-learning has become more and more common. In order to understand gender disparities in e-learners' self-efficacy, satisfaction, motivation, attitude, and performance globally, this study will look at these variables. Many educational institutions have been forced to close due to the sudden COVID-19 outbreak, and many students have been forced to stay at home and take online courses. With the recent COVID-19 pandemic underway, there were challenges with STEM (Science Technology Engineering and Mathematics) modules and other teaching contents due to practical laboratory sessions and workshops required. Thus, the need to understand teaching style, online learning and its role in promoting a variety of desirable academic outcomes, such as increased achievement and decreased dropout rates, as well as various well-being and life outcomes, has advanced significantly. In this paper, the scientific review on teaching in Higher Education Academies (HEA) for online learning is presented with their frontiers towards sustainable education. The current work also gives an annotated bibliography that aims to consolidate and synthesise the literature on student engagement, online learning, social media, and teacher learning/training. Some conclusions and recommendations were also made on the study.

Keywords: teaching; higher education academy (HEA); learning; COVID-19; STEM; online learning; sustainability; systematic review; annotated bibliography; education; cultural difference; group

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1. Introduction

Since COVID-19 first appeared, e-learning has become more common [1–7]. In order to understand disparities in e-learners' self-efficacy, satisfaction, motivation, attitude, and performance globally, an annotated bibliography on related studies that looks at these variables is necessary. Many educational institutions have been forced to close due to the sudden COVID-19 outbreak, and many students have been forced to stay at home and take online courses [8–14]. With the COVID-19 epidemic underway, there were challenges with STEM (Science Technology Engineering and Mathematics) modules due to practical laboratory sessions and workshops required [15–20]. Without regard to their physical location, e-mentoring enables teachers to communicate with students via email, online chat, and bulletin boards. As a result, when students feel engaged in an activity, they are better able to develop their own knowledge. The need to have better teaching styles, teaching tools, and effective teachers globally that will continue to foster quality education is the bedrock of any Higher Education Academy (HEA). To ensure that learners can benefit from mentoring, it is crucial to comprehend learners' attitudes regarding online mentoring. Feedback can come from both the mentors and the students. Reflecting on student feedback and the use

of e-study as digital tools for teaching, such as e-boards, projectors, public address systems, and state-of-the-art lecture e-kits, are highly emphasized in Higher Education Institutions (HEI). Having these teaching aids, the student can download teaching notes as electronic files or use their mobile phones to record the lecture notes so they can be revised as their own files later.

One of the primary challenges that educational institutions and libraries face is the availability of annotated bibliographies that cover teaching methods in HEAs. Annotated bibliographies could be used to identify knowledge gaps, such as understanding student engagements by using studies on the lack of participation against high-level participation of students. However, some other annotated bibliographies present different levels of course-based teaching in English [21–27], but there is a gap for general teaching in HEAs. Also, there are other annotated bibliographies on different fields ranging from areas of teaching [28], virtual exchange [29], STEM teacher education [30,31], gender bias [32], digital library [33], plagiarism in engineering [34], online learning [35], technical education career [36], curriculum design [37], engaged learning [38], group works [39], business models [40,41], economics of education [42], scheduling [43], forecasting [44], algorithms [45], distance learning [46,47], sociology [48,49], greedy randomized adaptive search procedure (GRASP) optimisation [50], geological lineation [51], to health [52]. However, there is a need to sustain the quality of teaching in HEAs. To address this challenge, the authors outlined strategies for communicating the purpose and value of the discussion, setting clear expectations for responses, and designing a structure for the discussion. Another aspect of teaching is online learning, which has recently increased globally due to the COVID-19 pandemic [20,52]. Higher education institutions started using the internet as an alternate learning environment in addition to traditional teaching and learning methods in front of classes about 30 years ago [53]. For students and educators that actively participate in online courses, this type of environment continues to provide significant obstacles, thus, there is a need to include these themes in an annotated bibliography. Some studies reviewing best practices adapting to the COVID-19 pandemic in teaching also presented some lessons learnt [53–57]. The pandemic has availed us to have new perspectives, and lessons have been learnt by institutions as well as their teacher educators during COVID-19 [58–62]. Despite the enormous hurdles during the pandemic, there are positives that will endure over the long term. Due to COVID-19, our entire educational system and organisational structure had to transition to fully remote communication and online learning [63–67]. This means that all the teachers, instructors, and students have to understand that technological improvements need to urgently and significantly help address our sustainability challenges given how swiftly they have spread around the world. It is pertinent that the teachers understand student engagement and determine how learners feel about teaching. This could be adaptable, from having blended learning, online mentoring, to group learning studies. However, the latter is covered in another publication [67] of this annotated biography on teaching in HEAs.

In this paper, the scientific review with an annotated bibliography on teaching in HEAs covers themes on teaching and learning, presented with their frontiers towards sustainable education. Section 1 introduces the study and covers related studies on student assessments, teaching curriculum, and online learning, while Section 2 presents the methodology for the annotated bibliography. Section 3 presents the scientific literature review with scientometric review on teaching in HEAs and lessons from the COVID-19 pandemic. The current work, an annotated bibliography that aims to consolidate and to synthesise the literature on teaching style, is presented in Section 4. Section 5 presents the conclusions on the study. The study presents literature on learners' attitudes toward online learning to enable teachers to achieve better understanding of the students and it will serve as a reference guide for educators.

2. Materials and Methods

This section covers the materials and methods adopted for this annotated bibliography on the teaching style in Higher Education Academies (HEA). To obtain this data, the search was obtained from existing repositories from various institutions from annotated bibliographies and from the Scopus database. Scopus was selected because it has broader range of coverage, it is faster in indexing processes, and it has more recent publications on the literature search. Using the Scopus database, 88 documents were obtained and included in this annotated bibliography in this subject area. The search syntax used in Scopus was "teaching AND higher AND education AND academy AND online AND learning OR COVID-19", as shown in Figure 1 showing the methodology for obtaining the data used, and the search results from the Scopus database are shown in Figure 2.

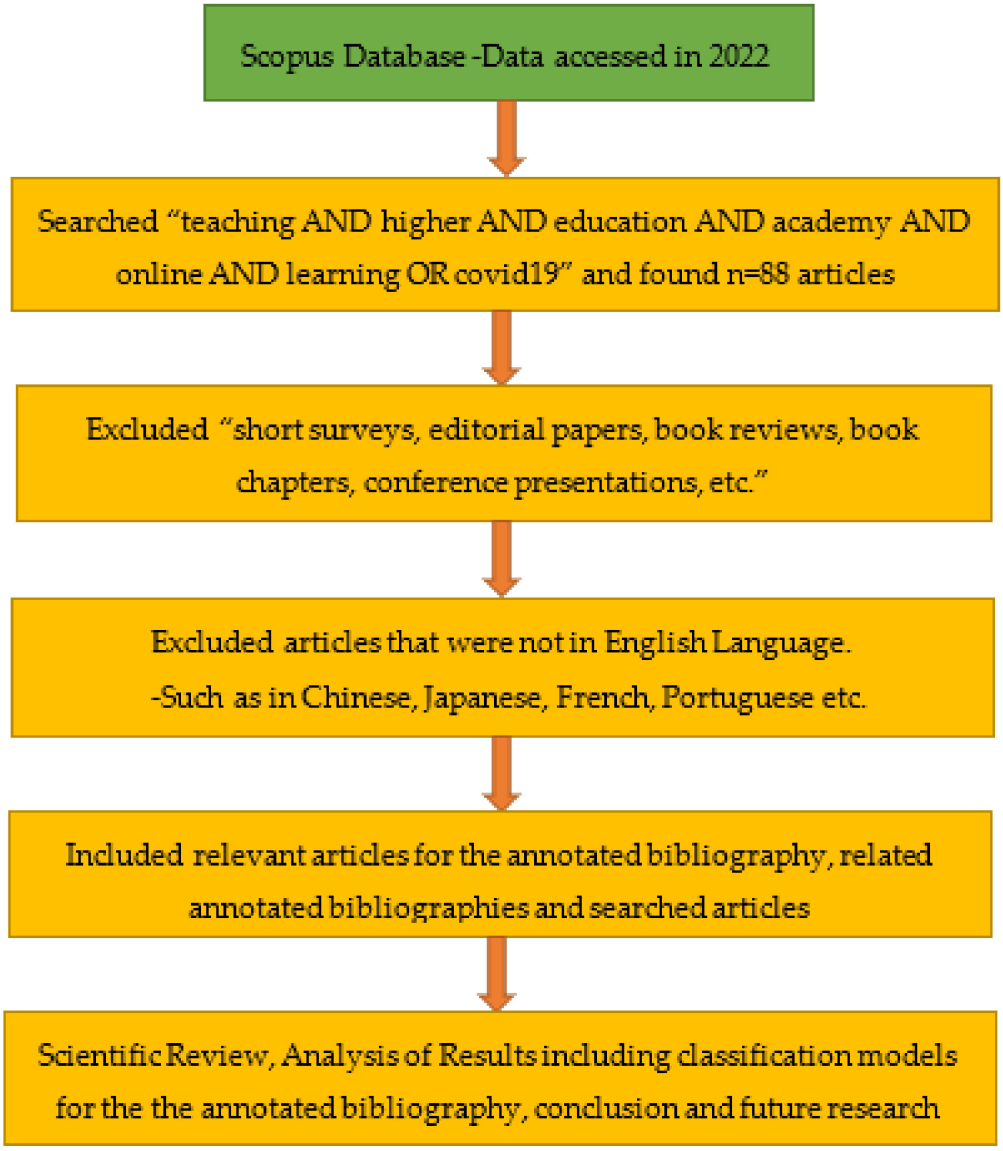

Figure 1. Methodology for the annotated bibliography on the search phrase "teaching AND higher AND education AND academy AND online AND learning OR COVID-19".

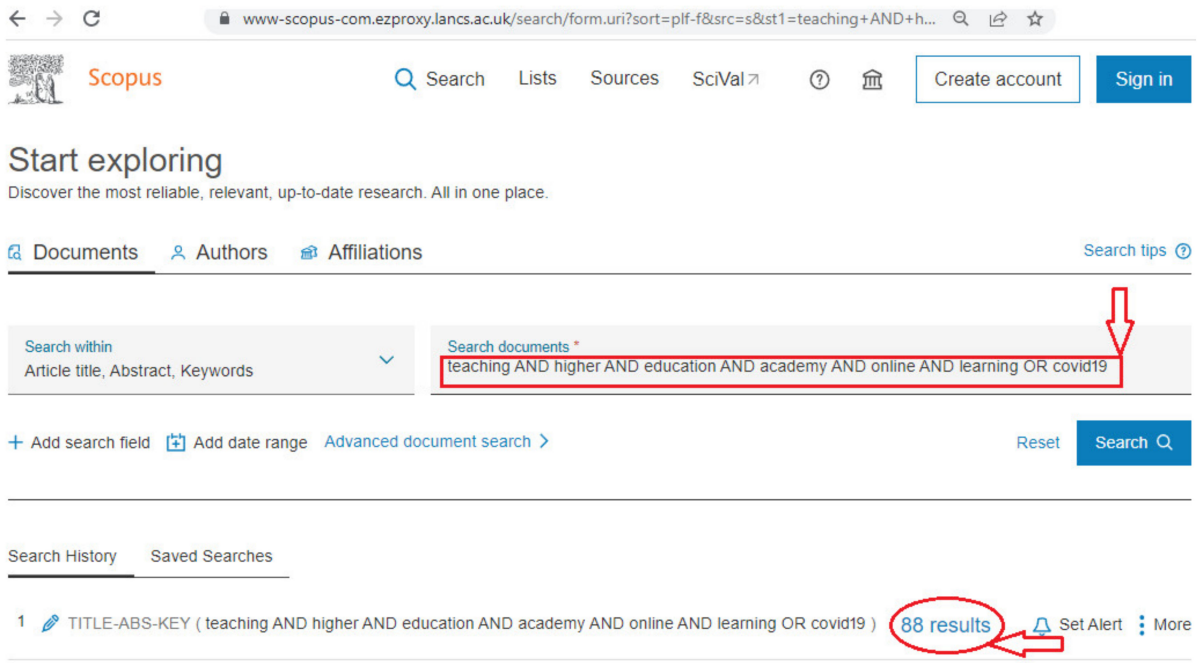

Figure 2. Scopus database supplied by Lancaster University UK showing the search phrase "teaching AND higher AND education AND academy AND online AND learning OR COVID-19" for the annotated bibliography on the meta-analysis of 88 publications.

3. Scientific Review and Scientometric Analysis on the Annotated Bibliography

In this section, the scientific review and scientometric analysis were conducted for the annotated bibliography on teaching in higher education academies based on the research themes. In this study, the research trends were investigated from the publication history, the publication classification, the subject area, the publication by country, journal range, the author keywords, and the publication by affiliations. To understand the research pattern on teaching in HEAs, data were retrieved from Scopus and are presented in the findings in Figures 3–10.

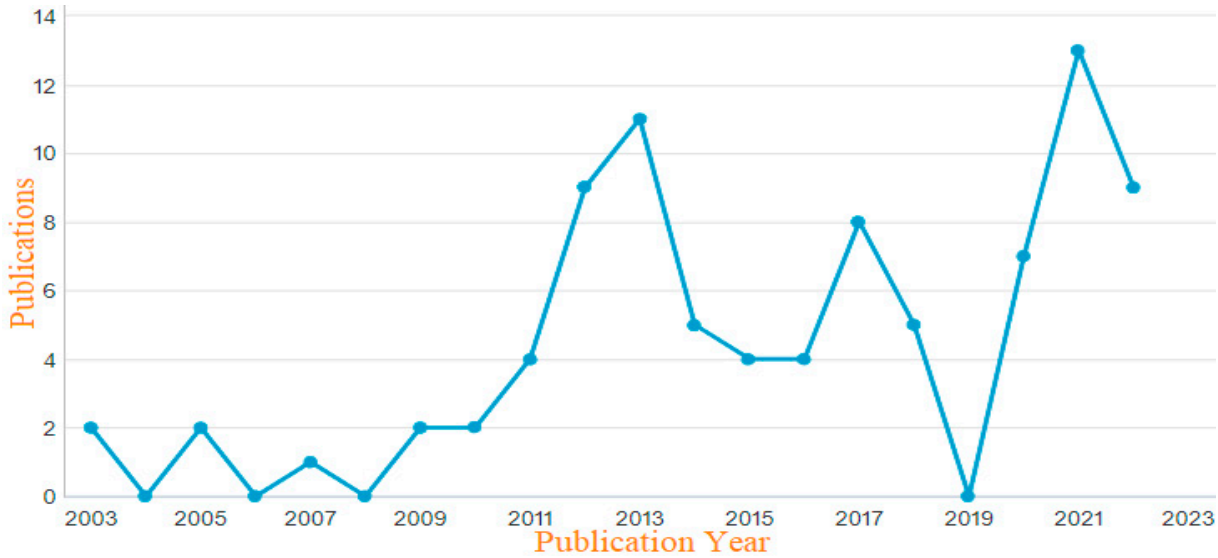

Figure 3. Results of publication records for the research on "teaching AND higher AND education AND academy AND online AND learning OR COVID-19" (data retrieved from Scopus database on 22 August 2022).

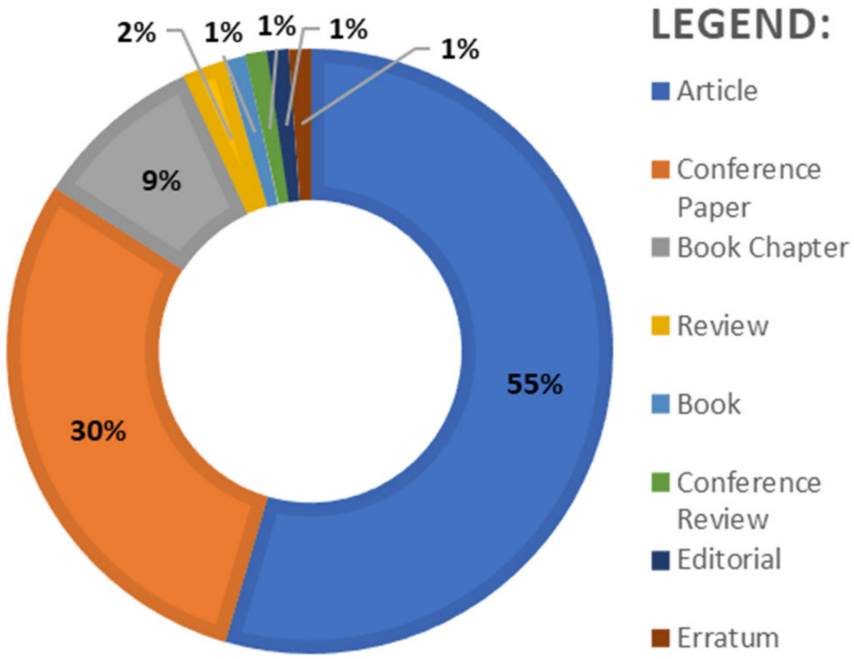

Figure 4. Results of publications by subject area for the research on "teaching AND higher AND education AND academy AND online AND learning OR COVID-19" (data retrieved from Scopus database on 22 August 2022).

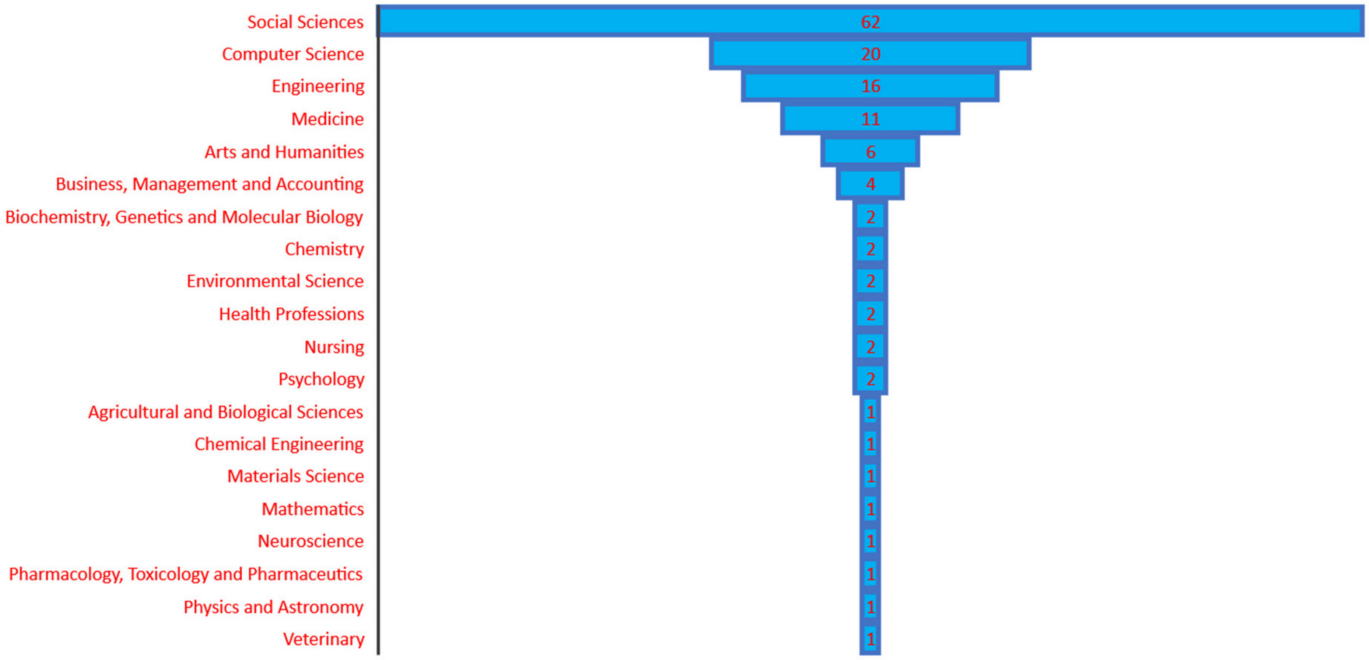

Figure 5. Results of publications by classification (or type) for the research on "teaching AND higher AND education AND academy AND online AND learning OR COVID-19" (data retrieved from Scopus database on 22 August 2022).

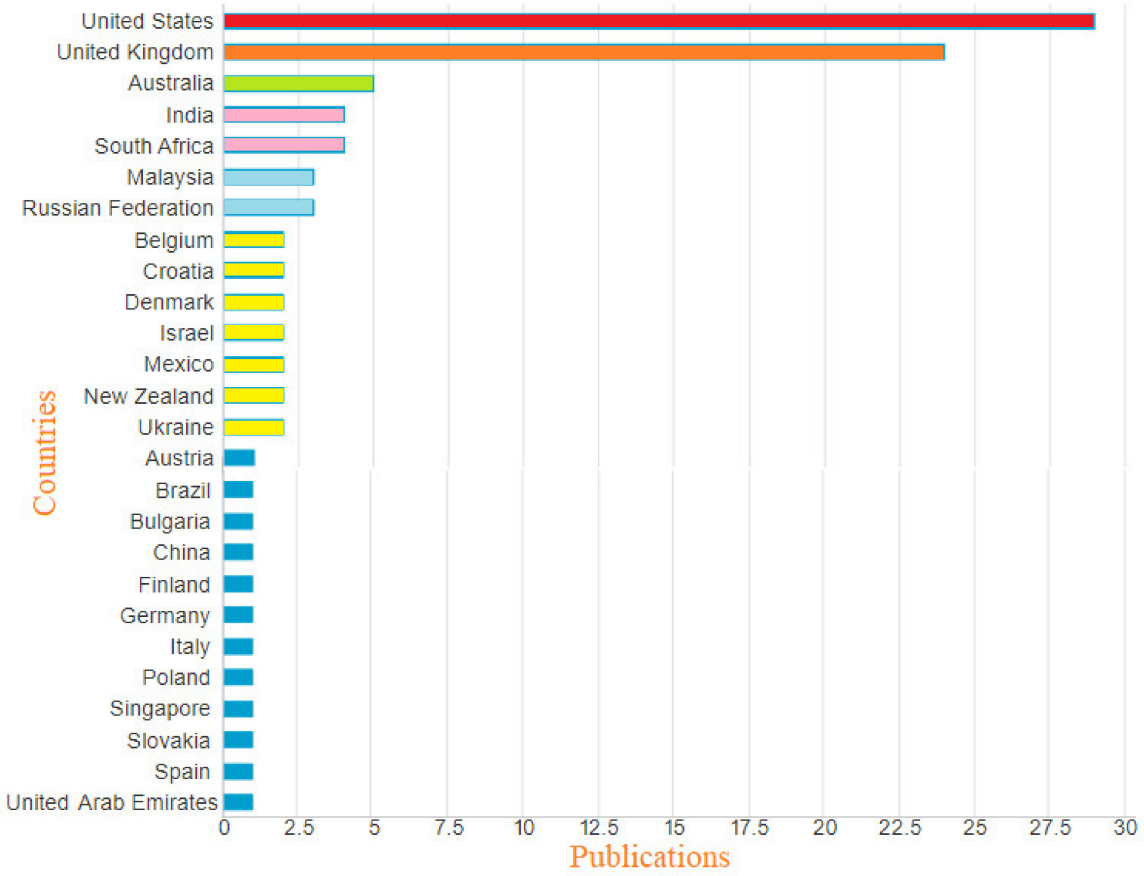

Figure 6. Results of publications by countries for the research on "teaching AND higher AND education AND academy AND online AND learning OR COVID-19" (data retrieved from Scopus database on 22 August 2022).

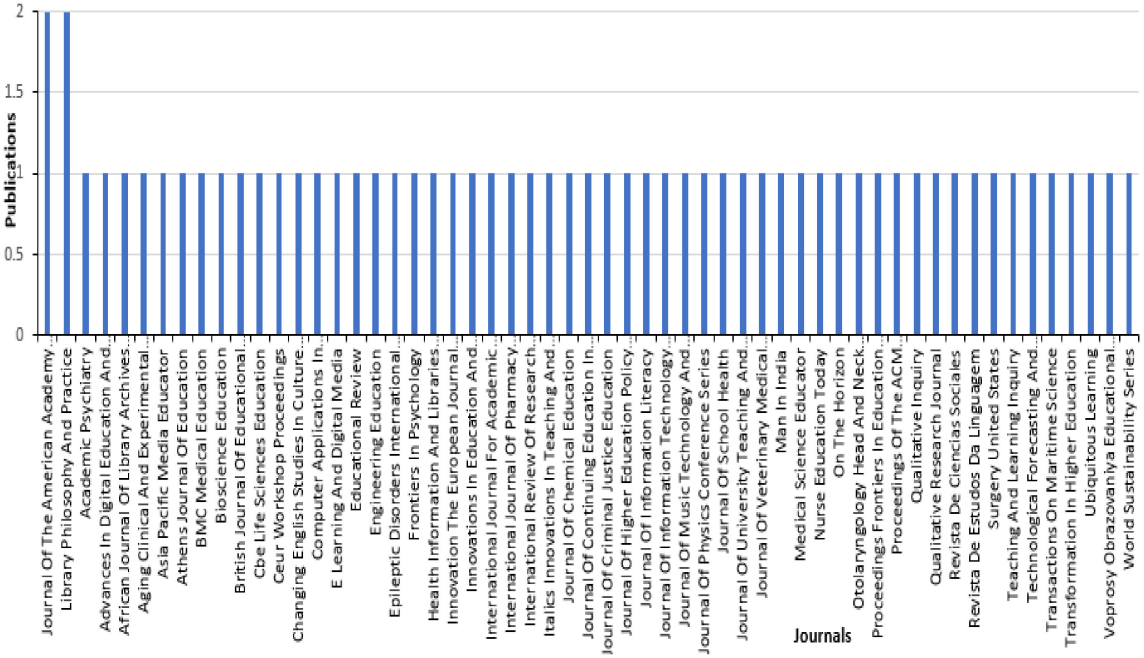

Figure 7. Results showing range of journal publications for the research on "teaching AND higher AND education AND academy AND online AND learning OR COVID-19" (data retrieved from Scopus database on 22 August 2022). See details in Supplementary Materials.

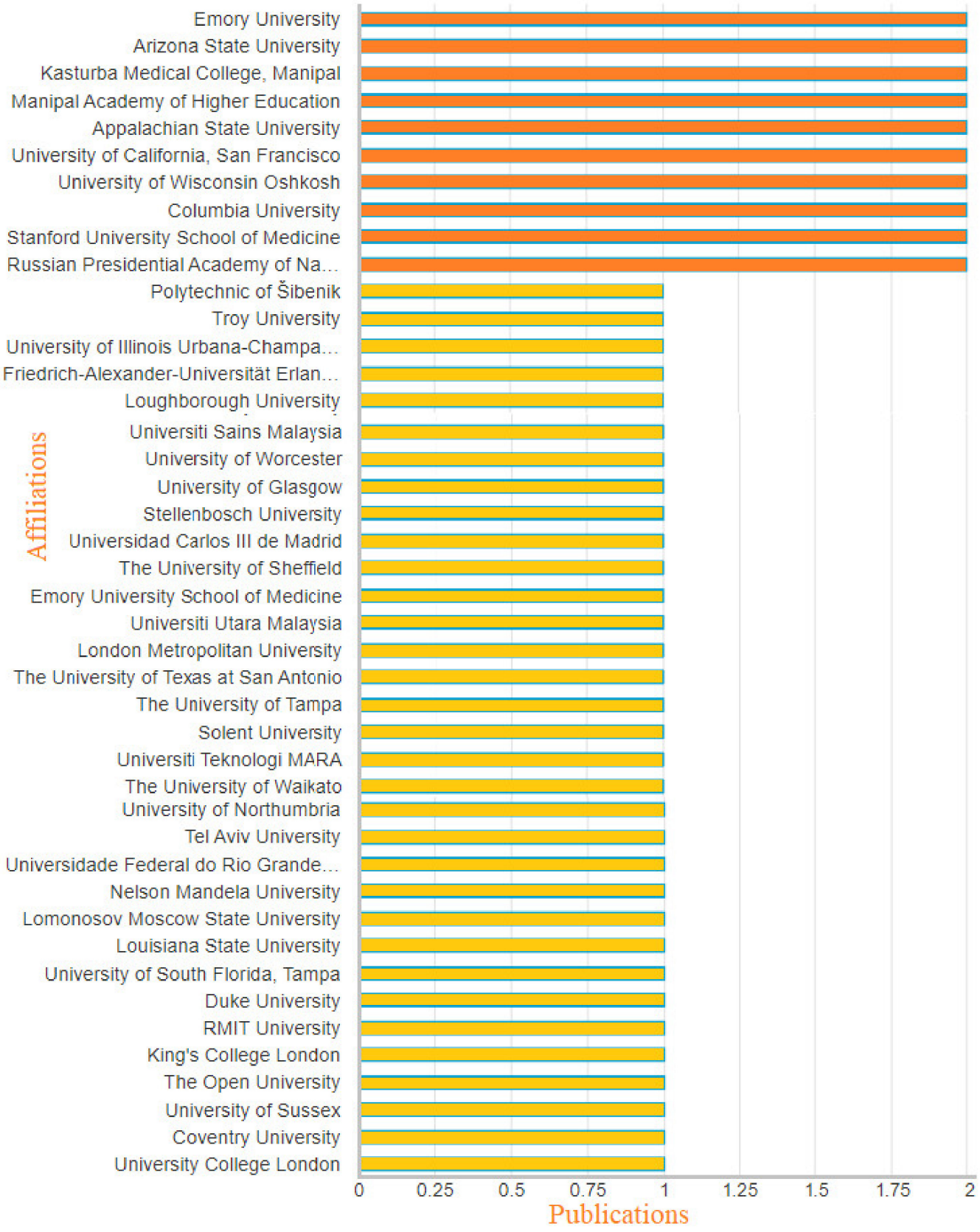

Figure 8. Results of publications by affiliation for the research on "teaching AND higher AND education AND academy AND online AND learning OR COVID-19" (data retrieved from Scopus database on 22 August 2022).

Figure 9. Word cloud for the author keywords research on "teaching AND higher AND education AND academy AND online AND learning OR COVID-19" using Voyant tools.

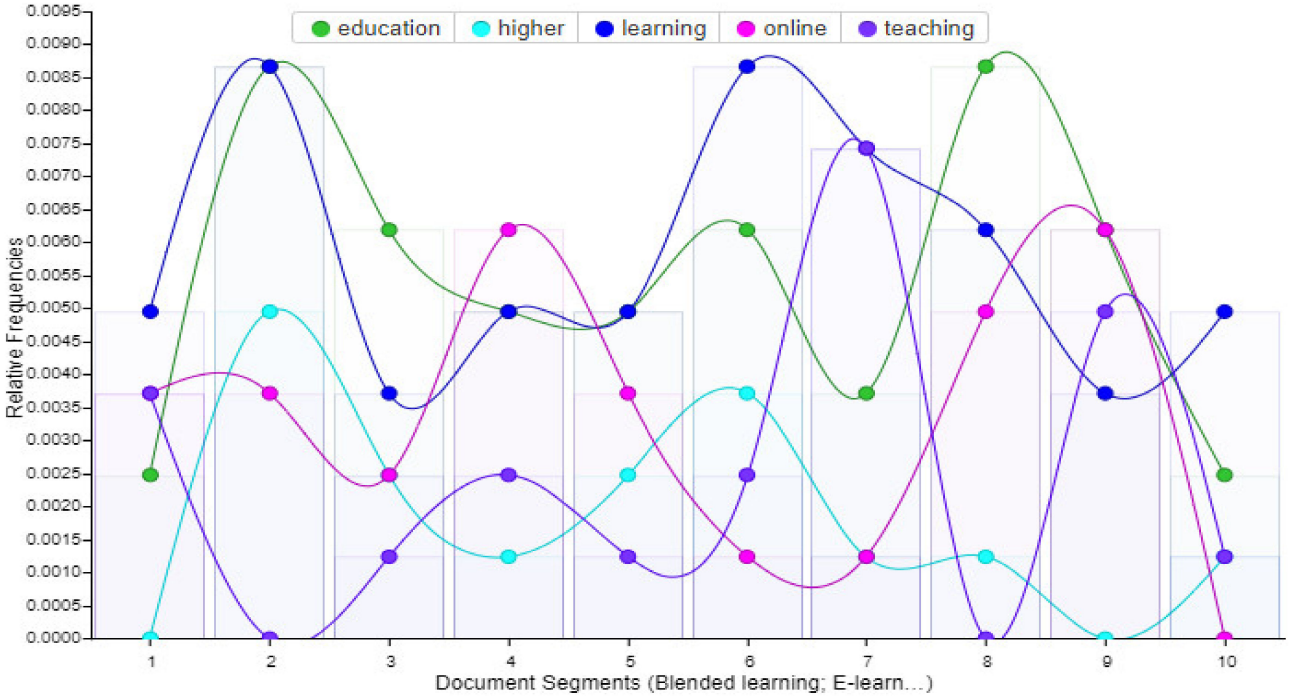

Figure 10. Results of relative frequency and trend from the most frequent author keywords generated using Voyant tools.

From Figure 3, it was observed that there were different shifts in this subject area as seen in the pattern of the publications from 2003 to 2022. The highest number of publications was 13 publications in 2021, followed by 11 publications in 2013, followed by 9 publications in 2012 and mid-2022, followed by 8 publications in 2017, followed by 7 publications in 2020. The highest occurrence by year was two publications, which appeared four times in 2003, 2005, 2009, and 2010. The second highest occurrence by year was four publications, which appeared three times in 2010, 2013, 2020, and 2021. It was observed that different global occurrences could have affected the research trends noticed in this subject area, such as the 2008 global economic recession, the 2016 drop in oil price, and the COVID-19 pandemic that hit the global world in 2020. It was observed that the publications did not increase around these times, but further evidence is required to support this pattern. With the increase in online learning, publications rose from 7 publications in 2020 to 13 publications in 2021, showing a sharp increase of 65% between both years.

From Figure 4, it was observed that the publications from the search were mostly journal papers or articles (55%), which covered 48 publications, followed by conference papers (30%), which covered 26 publications. It was then followed by book chapters (9%), which covered 8 publications, followed by reviews (2%) which covered 2 publications. There was also one publication that was a full book, one editorial, one erratum, and one conference review paper, which were each the least prevalent (1%). This shows that most publications on this subject area were available as articles or journal papers.

From Figure 5, it was observed that the subject area from the search with the highest publications was Social Sciences (45%) with 62 publications, followed by Computer Science (14%) with 20 publications, then by Engineering (12%) with 16 publications. It was followed by Medicine (8%) with 11 publications, followed by Arts and Humanities (4%) with 6 publications, followed by Business, Management, and Accounting (3%) with 4 publications. The next set each produced two publications—Health professions (1%), Chemistry (1%) Environmental Science (1%), Nursing (1%), and Psychology (1%)—followed by the last set, which produced one publication each—Materials Science, Neuroscience, Pharmacology, Mathematics, Physics, and Astronomy.

From Figure 6, it was observed that the country with the highest publications is the United States of America (U.S.A.) with 29 publications, followed by the United Kingdom (U.K.) with 24 publications. The next pair of publications was much lower as Australia had 5 publications, followed by the pair whereby each nation had four publications, India and South Africa, followed by the next set of publications whereby each nation had three publications, Malaysia and the Russian Federation. The next set of publications whereby each nation had two publications included Belgium, Croatia, Denmark, Israel, Mexico, New Zealand, and Ukraine. The smallest set of publications by country had one publication each (Austria, Brazil, Bulgaria, China, Finland, Germany, Italy, Poland, Singapore, Slovakia, Spain, and United Arab Emirates). However, there were five publications that were undefined from the Scopus data retrieved from this search. It was also observed that the U.S.A. and the U.K., which are both developed countries that make significant investments in educational research, are the study's top two countries.

Another aspect of the research trend is seen from the publications where these articles were published as given in Figure 7. Also, the range of publications in this subject area is spread across different areas, and the highest number of publications (two articles) in this area was published in the journals called *"Journal of the American Academy of Dermatology"* and *"Library Philosophy and Practice"*. The second set of publications had one article each, which include: *"Academic Psychiatry"*, *"Advances in Digital Education and Lifelong Learning"*, *"African Journal of Library Archives and Information Science"*, *"Aging Clinical and Experimental Research"*, *"Asia Pacific Media Educator"*, *"Athens Journal of Education"*, *"BMC Medical Education"*, *"Bioscience Education"*, *"British Journal of Educational Technology"*, *"Cbe Life Sciences Education"*, *"Ceur Workshop Proceedings"*, *"Changing English Studies in Culture and Education"*, *"Computer Applications in Engineering Education"*, *"E-Learning and Digital Media"*, *"Educational Review"*, *"Engineering Education"*, *"Epileptic Disorders International Epilepsy Journal with*

Videotape", "Frontiers in Psychology", "Health Information and Libraries Journal", "Innovation inthe European Journal of Social Science Research", "Innovations in Education and Teaching International", "International Journal for Academic Development", "International Journal of Pharmacy Practice", "International Review of Research in Open and Distance Learning", "Italics Innovations in Teaching and Learning in Information and Computer Sciences", "Journal of Chemical Education", "Journal of Continuing Education in Nursing", Journal of Criminal Justice Education", "Journal of Higher Education Policy and Management", Journal of Information Literacy", "Journal of Information Technology Education Research", "Journal of Music Technology and Education", "Journal of Physics Conference Series", "Journal of School Health", "Journal of University Teaching and Learning Practice", "Journal of Veterinary Medical Education", "Man in India", "Medical Science Educator", "Nurse Education Today", "On the Horizon", "Otolaryngology Head and Neck Surgery United States", "Proceedings Frontiers in Education Conference", "Proceedings of the ACM Conference on Computer Supported Cooperative Work", "Qualitative Inquiry", "Qualitative Research Journal", "Revista De Ciencias Sociales", "Revista De Estudos Da Linguagem", "Surgery United States", "Teaching and Learning Inquiry", "Technological Forecasting and Social Change", "Transactions on Maritime Science", "Transformation in Higher Education", "Ubiquitous Learning", "Voprosy Obrazovaniya Educational Studies Moscow", and "World Sustainability Series".

The next aspect looked at was the results of publications by affiliation for the research on "teaching AND higher AND education AND academy AND online AND learning OR COVID-19", as represented in Figure 8. It can be observed that the highest amount of publications by affiliation was two publications. These affiliations were "*Emory University", "Arizona State University", "Katurba Medical College", "Manipal Academy of Higher Education", "Appalachian State University", "University of California", "University of Wisconsin", "Columbia University", "Stanford University", and "Russian Presidential Academy of Economy and Public Administration*". It was followed by a set of affiliations that produced one publication, which included "*University of Illinois", "Loughborough University", "University of Northumbria", "University of Worchester", "Tel Aviv University", "University College London", "Trop University", "University of Sussex", "Duke University", "Louisiana State University", "Solent University", "Coventry University", "Kings College London", "The Open University", "University of Glasgow", "University of Tampa", "University of Sheffield", and "Nelson Mandela University*". These affiliations are from different locations, which shows that research on education with an emphasis on teaching in higher education academies is being conducted globally. However, the rates of production are not very high, which could imply low funding in this research area.

The last parameter looked at is the author keywords from the search using data retrieved from Scopus. It was identified that the most frequent keywords in the corpus for the word cloud using Voyant tools were *"learning (47)"; "education (44)"; "online (27)"; "teaching (20)"; "higher (15)"*. This can be identified in the word cloud depicted in Figure 9, which was developed using 808 words and 400 unique word forms. From the cirrus on Voyant tools, the word cloud was generated and identified to have a vocabulary density of 0.495, a readability index of 30.999, and an average word per sentence of 808.0. Using the most frequent words, a trend was identified as depicted in Figure 10, showing that learning is the keyword with the highest relative frequency.

4. Annotated Bibliography

In this section, the annotated bibliography on teaching in Higher Education Academies (HEA) is presented in this paper based on different frameworks of sustainable education. One of the key findings is the adjustments that were made with the intention of creating and promoting accessible education, involving the use of resources and tactics that were methodologically diverse during COVID-19. One of the most significant tools for school reform today in response to the recent COVID-19 pandemic is blended learning, which combines the advantages of face-to-face and technologically assisted learning. With blended learning, there are significantly more opportunities for teachers and students to comprehend how we send and receive information, engage with others in educational

settings, acquire knowledge, and evaluate what we have taught or learned. Tables 1–6 present different publications listed and classified based on different categories by themes.

Table 1. Some studies related to the literature review on teaching in HEAs.

Author	Year	Title	Summary	Ref.
Morss, K. and Murray, R.	2005	*Chapter 5: Your First Laboratory or Fieldwork Practicals*. In: Teaching at University: A Guide for Postgraduates and Researchers	The chapter gives guides on the first laboratory, fieldwork, and practicals for teaching at university.	[68]
Morss, K. and Murray, R.	2005	*Chapter 1, Theory and Practice*. In: Teaching at university: a guide for postgraduates and researchers	This chapter offers straightforward, applicable information in an approachable manner as a guide.	[69]
Forster, F., Hounsell, D. and Thompson, S.	1995	*Chapter 5: Demonstrating*. In: Tutoring and Demonstrating: A Handbook. University of Edinburgh.	This chapter highlights the role of a workshop tutor and lab demonstrator, and the need for student feedback.	[70]
Sachs, J. and Parsell, M.	2014	*Chapter 2: Collaborative Peer-Supported Review of Teaching*. In: Peer Review of Learning and Teaching in Higher Education	This chapter presents teaching development, inclusive teaching processes, and peer-supported strategy on teaching in higher education (HE).	[71]
Brookfield, D.S.	2006	*Chapter 4: What students value in teachers*. In: The skillful teacher: on technique, trust, and responsiveness in the classroom.	This chapter looks into the behaviours of a successful teacher, to have credibility, experience, skill, knowledge, conviction, and justification.	[72]
Strawson, H.	2012	*Chapter 4: Encouraging students to participate*. In: 53 Interesting Things to Do in Your Seminars and Tutorials	The chapter guides instructors and teachers on how to support students and encourage them.	[73]
Biggs, J. and Tang, C.	2011	*Chapter 1: Effective teaching and learning for today's universities*. In: Teaching for Quality learning at University.	This chapter examined some ways that teachers might influence a student's learning outcomes in HE and successful teaching in HE.	[74]
Ramsden, P.	2004	*Chapter 9: Teaching strategies for effective learning*. In: Learning to teach in Higher Education	This chapter looks at teaching methods in HE that enhance student learning for small groups, online learning, textbooks, and practical work.	[75]
van Kuijk, M.F., Deunk, M.I., Bosker, R.J. and Ritzema, E.S.	2015	Goals, data use, and instruction: The effect of a teacher professional development program on reading achievement.	This paper presents teaching involvement of teachers in a professional development programme to enhance the reading comprehension of students.	[76]
Zwart, R.C., Korthagen, F.A. and Attema-Noordewier, S.	2015	A strength-based approach to teacher professional development	The paper looks at professional development aimed at boosting the sentiments of self-efficacy, autonomy, and competence for teachers.	[77]
Ronfeldt, M., Farmer, S.O., McQueen, K. and Grissom, J.A.	2015	Teacher collaboration in instructional teams and student achievement	This paper examines the extent of collaboration between instructional teams to identify the types of cooperation and collaboration quality.	[78]
Zhu, H., Trowbridge, A., Taylor, K. and Laxman, D.	2021	Online Sharing Platform for Course Modules: Understanding Materials Use and Effectiveness	The paper examines the utilisation and efficacy of open access online course modules shared with academics and administrators from various institutions.	[79]
Shaw, M.	2013	"Open Education in Practice", Openness and Education	This chapter argues for the use of open education (OE) in practise, school-related materials and informally for the HE level.	[80]
Bell, M. and Farrier, S.	2007	Measuring success in e-learning-a multi-dimensional approach.	The study looked at the metric for achieving e-learning from the pick and mix approach.	[81]
Dunn, S.C.; Jasinski, D. and O'Connor, M.	2005	A process model for educonsulting.	The paper gives the educonsulting (EC) model for companies to collaborate and connect their investment in educational initiatives using their corporate strategies	[82]
Heard-Lauréote, K. and Buckley, C.	2021	"To be relied upon and trusted": The centrality of personal relationships to collaboration in HE, in a successful cross-team institutional change project.	The paper considers trust both as an opportunity and a necessity to alter how to operate in HE, trending from a conventional stance with prioritised roles and hierarchy towards competencies and skills.	[83]

Table 2. Some studies related to the online learning, e-learning, and blended learning.

Author	Year	Title	Summary	Ref.
Alam, G.M. and Parvin, M.	2021	Can online higher education be an active agent for change?—comparison of academic success and job-readiness before and during COVID-19.	The paper examines academic achievement and employability before and after COVID-19 for online education using technology-mediated education.	[84]
Dziuban, C., Picciano, A., Graham, C. and Moskal, P.	2017	*Conducting research in online and blended learning environments: New pedagogical frontiers*	This book can be useful for planning research in online and blended learning environments. It was discovered that few articles investigate evaluations of student participation, as well as this book based on Faculty Learning Community. This book may be useful for designing future research in such a scenario.	[85]
Kalashnikova, L. and Chorna, V.	2021	Effectiveness of distance and online education services in the context of the coronavirus pandemic: experience of empirical sociological research in Ukraine, Innovation	The paper examines the findings of three empirical sociological studies with search-related research conducted by randomly selecting Internet users for the study.	[86]
König, J., Jäger-Biela, D.J. and Glutsch, N.	2020	Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany	The paper looks at the adaptation to Online Teaching During COVID-19 School Closure, by Early Career Teachers for teacher education and Teacher Competence Implications (TCIs).	[87]
Adedoyin, O.B. and Soykan, E.	2020	Covid-19 pandemic and online learning: the challenges and opportunities	The paper examines online learning during the COVID-19 pandemic, which is different from emergency remote teaching because it is more sustainable, and gives hybrid instructional activities.	[88]
Urem, F., Jureković, D. and Ban, E.	2020	Online and in-class computer science teacher training-Oracle Academy program experiences	The article examines the experiences with online and in-person computer science teacher training from the Oracle Academy program, an information technology tool.	[89]
Babinčáková, M. and Bernard, P.	2020	Online Experimentation during COVID-19 Secondary School Closures: Teaching Methods and Student Perceptions.	The study discusses the closure of secondary schools during the COVID-19 pandemic with online tests using student attitudes and teaching approaches.	[90]
Tsegay, S.M., Ashraf, M.A., Perveen, S. and Zegergish, M.Z.	2022	Online Teaching during COVID-19 Pandemic: Teachers' Experiences from a Chinese University.	This study examines the COVID-19 pandemic experiences of Chinese university lecturers with a focus on the approaches used for instruction and learning as well as their advantages and drawbacks.	[91]
Chen, R.H.	2022	Effects of Deliberate Practice on Blended Learning Sustainability: A Community of Inquiry Perspective.	This study looked at how online learning communities and intentional practise are implemented in a mixed-learning environment to increase English as a Foreign Language (EFL) students' learning performance and engagement.	[92]
Peñarrubia-Lozano, C., Segura-Berges, M., Lizalde-Gil, M. and Bustamante, J.C.	2021	A Qualitative Analysis of Implementing E-Learning during the COVID-19 Lockdown	The goal of the study was to evaluate the practical implications of using this type of approach during the COVID-19 lockdown to offer cutting-edge knowledge about e-learning's suitability for institutions offering pre-university education to the scientific and educational communities.	[93]
Auf, T.A. and Hamdi, O.A.	2022	Adoption of Online Learning during the Covid19 Pandemic Lockdown by Universities in Garowe.	The research shows that universities in Garowe adopted online education as a crisis management strategy since administration, faculty, and students were not prepared and had no prior experience with this pedagogical learning platform.	[94]
Rodríguez, M.L. and Pulido-Montes, C.	2022	Use of Digital Resources in Higher Education during COVID-19: A Literature Review.	This study's goal is to look into the digital resources used in higher education institutions, with a focus on the types and usage patterns of those resources.	[95]

Table 2. *Cont.*

Author	Year	Title	Summary	Ref.
Kaqinari, T., Makarova, E., Audran, J., Döring, A.K., Göbel, K. and Kern, D.	2022	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.	This study aimed to explain disparities in the use of educational technology for teaching, institutional support, and individual variables among lecturers from institutions in (four) nations. The first COVID-19 lockdown's implementation of emergency remote teaching (ERT) necessitated a lot of university lecturers, however, not all of them had the same difficulties.	[96]
Picciano, A.G., Dziuban, C.D. and Graham, C.R.	2013	*Blended Learning: Research Perspectives. Vol. 2*	Blended Learning: Research Perspectives, Volume 2 addresses institutional issues, design and adoption issues, learning issues, and offers a thoughtful reflection on potential future trends and research in the field with plans and investments for significant increases in blended learning environments.	[97]

Table 3. Some studies related to the teachers' training, professional development, and teachers' satisfaction.

Author	Year	Title	Summary	Ref.
Lopes, C., Bernardes Ó., Gonçalves, M.J.A., Terra, A.L., da Silva, M.M., Tavares, C. and Valente, I.	2022	E-Learning Enhancement through Multidisciplinary Teams in Higher Education: Students, Teachers, and Librarians.	The COVID-19 challenge is extensive, complex, and rapidly evolving; it poses a threat to everyone's health as well as to the environment, the global economy, all cultural and societal norms, and our daily activities. It is crucial that the needs of students are ultimately and consistently met, and that they are supported effectively, both during the Coronavirus outbreak and any upcoming lockdowns.	[98]
Milić, M., Radić Hozo, E., Maulini, C., De Giorgio, A. and Kuvačić, G.	2022	What Is the Place of Physical Education among the Teaching Priorities of Primary School Teachers? An Empirical Study on Importance, Qualification and Perceived Teachers' Competence.	The paper aims to investigate teachers' attitudes about subjects in primary school, with a particular focus on physical education. Teachers typically have a focus and have a significant impact on how a subject is taught and how students perceive it.	[99]
Conradty, C. and Bogner, F.X.	2022	Education for Sustainable Development: How Seminar Design and Time Structure of Teacher Professional Development Affect Students' Motivation and Creativity.	The study used changes in students' motivation and inventiveness as markers to measure the effectiveness of Professional Development (PD) indirectly. A typical lecture with one feedback session and recurrent supervision sessions were the two PD approaches that were investigated.	[100]
Abel, V.R.; Tondeur, J. and Sang, G.	2022	Teacher Perceptions about ICT Integration into Classroom Instruction.	This study examined studies that examined teachers' perceptions of the ways in which technology is employed in the classroom. In order to better comprehend the variety of teacher attitudes regarding ICT integration in the classroom, it used the meta-ethnography method to trace, evaluate, and synthesise the data.	[101]

Table 3. *Cont.*

Author	Year	Title	Summary	Ref.
Kohout, J., Buršíková, D., Frank, J., Lukavský, J. and Masopust, P., et al.	2022	Predictors of the Effectiveness of Different Approaches to Pandemic Distance Learning.	The objective of this paper is discussing the development of an online screening tool to assist teachers in identifying students who may perform less well during distance learning and in choosing the best teaching strategy for the particular class.	[102]
Cooper, R., Fitzgerald, A., Loughran, J., Phillips, M. and Smith, K.	2020	Understanding teachers' professional learning needs: what does it mean to teachers and how can it be supported?	This paper explores the participants' perspectives on and expectations for their professional growth based on an in-depth PD research of some teachers in a school.	[103]
Akiba, M., Murata, A., Howard, C., Wilkinson, B. and Fabrega, J.	2019	Race to the Top and Lesson Study Implementation in Florida: District Policy and Leadership for Teacher Professional Development	The paper investigated teachers' PD and discovered that the district's requirements of lesson study, funding provision, and future sustainability plans were significantly and favourably associated with a wider implementation of lesson study within the district using mixed methods.	[104]
Desimone, L.M.	2009	Improving Impact Studies of Teachers' Professional Development: Toward Better Conceptualizations and Measures	In order to improve our conceptualization, measurements, and technique for researching the effects of teachers' PD on teachers and students, the author advises that we use contemporary research findings. She argues that there is empirical evidence for the use of a set of basic features and a shared conceptual framework in impact studies on professional growth.	[105]
Wayne, A.J., Yoon, K.S., Zhu, P., Cronen, S. and Garet, M.S.	2008	Experimenting With Teacher Professional Development: Motives and Methods	This article evaluates the state of PD research and suggests a specific course of action for future investigation. The possibility of PD having a beneficial effect on achievement when a programme is provided across a variety of conventional venues and when its delivery is dependent on trainers is not well understood.	[106]
Supovitz, J.A. andTurner, H.M.	2000	The effects of professional development on science teaching practices and classroom culture.	The paper is on PD that is centred on subject-matter knowledge, tied to specified performance requirements for students, and anchored in a systemic context has been established by reformers. It is built on intensive and prolonged training around actual tasks.	[107]
Yoon, K.S., Duncan, T., Lee, S.W.-Y., Scarloss, B. and Shapley, K.L.	2022	Reviewing the Evidence on How Teacher Professional Development Affects Student Achievement. Issues & Answers	The study gives findings on quick-response projects from important current issues in education that were carried out by the regional educational laboratories to improve students' achievement.	[108]

Table 4. Some studies related to student assessment and school curriculum.

Author	Year	Title	Summary	Ref.
Belova, N., Krause, M. and Siemens, C.	2022	*Students' Strategies When Dealing with Science-Based Information in Social Media—A Group Discussion Study.*	The paper is on scientific disinformation which is common because it is so simple to disseminate information via platforms such as social media. It is anticipated that teaching students to analyse information critically will improve their capacity to evaluate media and scientific content.	[109]
Nicol, D.J. and Macfarlane-Dick, D	2006	*Formative assessment and self-regulated learning: a model and seven principles of good feedback practice.*	The study shows how these procedures might help students become self-regulated learners and take control of their education, whereby the results from formative assessment and feedback studies are reinterpreted.	[110]
Watson, D. and Knight, G.L.	2012	*Continuous Formative Assessment and Feedback in an Enquiry-Based Laboratory Course.*	The study addresses continual formative assessment and feedback in an inquiry-based laboratory course. The authors of this research detail the successful implementation of an online experimental summary sheet, which allowed for ongoing student monitoring of a huge cohort of students working on a six-week inquiry-based laboratory project.	[111]
Gibbs, G. and Simpson, C.	2010	*Chapter 2: How assessment influences student learning.* In: Using assessment to support student learning.	This article explores the importance of providing constructive criticism and praise while assessing academic work. It emphasises the significance of evaluation and encouraging comments when marking coursework. Although some of the sampled students showed greater interest in their feedback than in their grades, illustrating the huge impact of feedback on learning, the utility of feedback was studied in this study.	[112]
Bloxham, S. and Boyd, P.	2007	*Chapter 6: Marking. In: Developing Effective Assessment in Higher Education: A Practical Guide.*	This chapter emphasises marking as a significant component of evaluation in higher education (HE). In any university or higher education institution (HEI), this is largely a crucial time. Assessments are used to evaluate students' aptitude for their assignments and aid in their progression to the subsequent class or level of study.	[113]
Morss, K. and Murray, R.	2005	*Chapter 6: Assessment of and Feedback to Students. In: Teaching at University: A Guide for Postgraduates and Researchers*	It provides a succinct reference to important pedagogical ideas, providing new teaching instructors, postgraduate researchers and associate lecturers in higher education with a solid foundation. It emphasises on the significance of evaluation and encouraging comments when marking coursework.	[114]
Ramsden, P.	2004	*Chapter 6: The nature of good teaching in higher education. In: Learning to Teach in Higher Education.*	This chapter is on the lessons for teaching and learning principles, which make it to be quite fascinating. The book's thorough examination of teaching and learning from the students' point of view at the outset allowed for the development of reasonable guidelines for doing so in higher education.	[115]
MacLellan, E.	2001	*Assessment for Learning: The differing perceptions of tutors and students*	This paper challenges the reader to consider how students and academic staff view assessment and evaluation in the context of higher education. They attempted to analyse many elements about the goal of assessment, the nature and difficulty of the tasks that were assessed, the scheduling of assessment, and the marking and reporting process.	[116]

Table 5. Some studies related to digital literacy and social media for education.

Author	Year	Title	Summary	Ref.
Steehler, A.J.; Pettitt-Schieber, B.; Studer, M.B.; Mahendran, G.; Pettitt, B.J.; and Henriquez, O.A.	2021	Implementation and Evaluation of a Virtual Elective in Otolaryngology in the Time of COVID-19.	The paper focuses on implementation and evaluation of virtual electives in a medical otolaryngology curriculum during the COVID-19 pandemic.	[117]
Li, M. and Yu, Z.	2022	Teachers' Satisfaction, Role, and Digital Literacy during the COVID-19 Pandemic	The COVID-19 pandemic has surprisingly affected the educational process worldwide, pressuring teachers and students to transmit via online teaching and learning format. The COVID-19 health crisis has posed challenges to teachers' professional roles, levels of career satisfaction, and digital literacy when compared to traditional face-to-face teaching methods.	[118]
Picciano, A.G.	2018	*Online Education: Foundations, Planning, and Pedagogy*	This book covers a thorough investigation of blended and fully online teaching platforms. Also, Online Education covers history, theory, research, planning, and practise. Critical insights into the implications for administration and teaching are required as colleges, universities, and schools around the world adopt large-scale technologies and traditional class models transition into seamless, digitally interactive environments.	[119]
Turner, K.H., Hicks, T., and Zucker, L.	2020	Connected reading: A framework for understanding how adolescents encounter, evaluate, and engage with texts in the digital age.	The study presents theories of reader response, online reading comprehension, and digital reading. In order to understand readers' interactions with digital texts through coming across, assessing, and engaging with them, the study suggests a framework of connected reading.	[120]
Loh, C.E. and Sun, B.	2019	"I'd still prefer to read the hard copy": Adolescents' print and digital reading habits.	The study examines adolescents' print and digital reading habits. It found that young people prefer print, but as they become older, they read more online. It argues that adolescent reading preferences and behaviour with physical books are reflected in their online reading patterns. It indicates that taking into account the print or technological medium matters for teen readers' motivation.	[121]
Kesson, H.	2020	Reading digital texts: Obstacles to using digital resources.	The paper investigates how 12th grade ELA students used Chromebooks to access a digital textbook and read it. It investigates the elements that influence or restrict how students engage with and respond to digital web-based texts, with the goal of dispelling longstanding myths about young people's affinity for digital tools. The study concludes that classroom routines, reading instruction and learning tools, and student views about school-based reading can all limit students' access to digital components of texts.	[122]
Kanniainen, L., Kiili, C., Tolvanen, A., Aro, M. and Leppänen, P.H.	2019	Literacy skills and online research and comprehension: Struggling readers face difficulties online.	The paper analyses the relationship between students' performance on online research and comprehension (ORC) tasks and their literacy abilities (reading fluency, written spelling, and reading comprehension), as well as nonverbal reasoning, prior knowledge, and gender.	[123]
Greenhow, C. and Chapman, A.	2020	Social distancing meet social media: Digital tools for connecting students, teachers, and citizens in an emergency.	The article argues that the unprecedented COVID-19 health crisis has put K–12 public education on the front lines of producing informed and engaged citizens and examines how social media integration into remote learning strategies can be beneficial.	[124]

Table 5. *Cont.*

Author	Year	Title	Summary	Ref.
Daley, S.G., Xu, Y., Proctor, C.P., Rappolt-Schlichtmann, G. and Goldowsky, B.	2020	Behavioral engagement among adolescents with reading difficulties: The role of active involvement in a universally designed digital literacy platform.	The paper investigates how adolescents use a digital literacy platform created with the Universal Design for Learning concept to engage in activities and understand what they are reading. This study examines their behavioural engagement with text-based activities to assist students with poor reading comprehension.	[125]
Elder, R.H.	2012	Developing tools for teaching chemical engineering unit operation design.	The paper presents tools for a synoptic course and improved student learning, for a chemical engineering unit operation design must be taught in a project-week setting to increase student knowledge of the resources available as IChemE design.	[126]
Comiskey, D., McCartan, K. and Nicholl, P.	2013	IBuilding for Success? IBooks as open educational resources in built environment education.	Open, online course technologies that may be utilised by professors and students to enhance e-learning have become more popular in recent years in the teaching and learning environment. In order to help students study the principles of the subject outside of the classroom, the Apple iPad iBooks project set out to create a reusable, media-rich Open Educational Resource (OER).	[127]
Craig, A.	2012	Chapter 7-The academy goes mobile: an overview of mobile applications in higher education. In: *Social Media for Academics: A Practical Guide.*	The chapter provides an overview of mobile applications in higher education. Together, social media platforms such as Twitter and Facebook and smartphone technology provide a setting that is not just conducive to dialogue but also conversation that is no longer bound by physical space since we connect to one another.	[128]

Table 6. Some studies related to student engagement and student motivation.

Author	Year	Title	Summary	Ref.
Mendini, M. and Peter, P.C.	2019	Research note: The role of smart versus traditional classrooms on students' engagement.	In this study, the use of smart technology in the classroom was contrasted with face-to-face instruction. The findings point to greater participation from students in groups and with the teacher in a classroom without technology.	[129]
Morley, C. and Ablett, P.	2017	Designing assessment to promote engagement among first year social work students.	In this study, first-year student participation is taken into account. It results in enhanced cooperation and teamwork among students when they are assessed on a group project (presentation). It considers group work evaluation as a means of encouraging engagement through collaborative effort.	[130]
Mandernach, B.J.	2015	Assessment of student engagement in higher education: A synthesis of literature and assessment tools.	This study considers student engagement for higher education students. It does evaluate students using teamwork and cooperation. Engagement is examined as a dynamic notion with cognitive, affective, and behavioural elements.	[131]
Martin, F. and Bollinger, D.U.	2018	Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment.	In this study, student engagement in online learning environments is taken into account. They discover that realistic assignments promote learner engagement with the subject, and that collaboration and conversations improve learner to learner engagement, whether viewed from the perspective of a community or inquiry (learner to instructor, learner to learner, and learner to content).	[132]

Table 6. *Cont.*

Author	Year	Title	Summary	Ref.
Muir, T., Dyment, J., Hopwood, B., Milthorpe, N., Stone, C. and Freeman, E.	2019	Chronicling engagement: students' experience of online learning over time.	Students are surveyed every week to find out what influences student involvement and what causes it to fluctuate, tracking students' participation over the length of the lesson rather than at one specific time.	[133]
Nagel, L., Blignaut, A.S. and Cronje, J.C.	2009	Read-only participants: A case for student communication in online classes.	The study makes the case that online discussion boards are crucial channels of communication for distance learning. This article also emphasises the drawbacks of online debates, namely the presence of readers solely.	[134]
Newton, D.W., LePine, J.A., Kim, J.K., Wellman, N. and Bush, J.T.	2020	Taking engagement to task: The nature and functioning of task engagement across transitions.	This paper looks at student engagement based on tasks. Instead of being a classroom-based study, this one is work-based. The level of involvement may vary from task to task, and there may be a spill-over effect where the level of participation in one activity may affect engagement in a subsequent task.	[135]
Ouyang, F. and Chang, Y.H.	2019	The relationships between social participatory roles and cognitive engagement levels in online discussions.	The study examines the connections between online conversation participation in social contexts and degrees of cognitive engagement. This multi-method investigation looked at students' involvement in asynchronous online debates. Interaction can become more meaningful when it is more socially engaged, and vice versa.	[136]
Pérez-López, R., Gurrea-Sarasa, R., Herrando, C., Martín-De Hoyos, M.J., Bordonaba-Juste, V. and Acerete, A.U.	2020	The generation of student engagement as a cognition-affect-behaviour process in a Twitter learning experience.	This study assesses the usage of Twitter as an online conversation medium in order to improve student engagement. Utilizing interactive and cooperative activities is advised in order to boost performance and engagement.	[137]
Salter, N and Conneely, M.	2015	Structured and unstructured discussion forums as tools for student engagement.	This study assesses the effectiveness of using discussion forums to boost student engagement. Students used the input more frequently in structured forums than in unstructured forums, which were perceived as being less engaging. It encourages more peer interaction in forums with less structure.	[138]
Skinner, E.	2009	Using community development theory to improve student engagement in online discussion: a case study.	The study discusses how community formation requires student participation. To improve engagement, students must express their own emotional and personal interests (i.e., they need to be personally invested to get something out of the class). Inquisitive students can help instructors choose subjects and questions.	[139]
Sweat, J., Jones, G., Han, S. and Wolfgram, S.M.	2013	How does high impact practice predict student engagement? A comparison of white and minority students.	By contrasting white and minority students, the study discusses how student participation is a requirement for creating community. It discusses how racial categories, such as service learning, undergraduate research, group projects, learning communities, sequence courses, and, in particular, having a close faculty mentor, affect student participation.	[140]
Taneja, A.	2014	Teaching tip: Enhancing student engagement: A group case study approach.	The paper discusses student participation as a teaching strategy. Group work is seen as a distinct learning objective. Case studies are used in the group to apply theoretical understanding to practical application.	[141]
Rodriguez, R.J. and Koubek, E.	2019	Unpacking high-impact instructional practices and student engagement in a preservice teacher preparation program.	The focus of the paper is student engagement for a preservice programme to enable teachers to prepare better. High-impact strategies for engagement and learning include collaborative assignments, applied learning, understanding different points of view, and constructive feedback on tasks.	[142]

5. Conclusions

In this paper, a scientific review and an annotated bibliography on teaching in Higher Education Academies (HEA) are presented with their frontiers towards sustainable education. Literature on teaching styles, student assessments, online learning, adaptation to the COVID-19 pandemic, and e-learning was presented. To also create a better understanding on the methodology, some related annotated bibliographies and scientific reviews were also presented. However, some aspects of teaching such as inclusive learning, reflective comments, reflective thinking, and reflective behaviours of teaching were not included in this paper. The scope of this paper is diverse as seen in the section titles for the main topics covered in this paper, however, it has been streamlined to enable readers to find the references easily. These collected literature examples with the summaries and some reflections help professors, educators, teachers, students, postgraduate researchers, laboratory demonstrators, teaching assistants, and workshop tutors to have a quick view of related literature in the subject area to improve their teaching skills and reflect better on their teaching methods. The literature used for the annotated bibliography shows that teachers' actions might influence students' learning activities. The limitations of the research include the database used, due to the use of only Scopus database and the choice of keywords, some relevant recent literature could be missed out from the batch. It should be noted that the Scopus database was selected because it has a broader range of coverage, it is faster in the index process, and it has more recent publications from the literature search [143–145].

The scientific review and scientometric analysis conducted were used to understand the research pattern in this area. It is evident that there are key indicators that affect the research pattern on teaching in HEAs. Based on the publication records from 2003 to mid-2022, it was observed that different global occurrences could have affected the research trends noticed in this subject area, such as the 2008 global economic recession, the 2016 drop in oil price, and the COVID19 pandemic that hit the global world in 2020.With the increase in online learning, publications with the highest publications were produced in the U.S.A. Also, it was evident that the U.S.A. and the U.K., are the top two developedcountries that make significant investments in educational research as shown in the study. Also, the study shows that the most publications on this subject area were available as articles or journal papers. Using the most frequent words, a trend was identified showing that learning is the keyword with the highest relative frequency. Therefore, future research can include an annotated biography on teaching in HEAs with themes such as student assessment, diversity, teaching pedagogy, and group learning included. Also, detailed scientific literature reviews can be conducted on teaching in HEAs using other search database.

Supplementary Materials: The supplementary data used in the study is uploaded herewith. The following supporting information can be downloaded at: Amaechi, Chiemela Victor (2022), "Data on Scientometrics of Teaching in HEA and adapting to COVID-19 (online learning)- Paper 1", *Mendeley Data*, V1, https://doi.org/10.17632/7mmwpvxtwr.1.

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"Sustainable or Unsustainable" in Higher Education Internationalization Development: Exploring the Post-Doctoral System in the Humanities and Social Sciences

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Abstract: The current reforms in the internationalization of the post-doctoral system in China's higher education institutions is implemented using both governmental and institutional policies, especially in the humanities and social sciences. These reforms are situated in evolving strategies for the internationalization of China's post-doctoral system. This study explored various stakeholder perspectives on this internationalization process; we analyzed 34 institutional post-doctoral recruitment documents and the transcripts from 36 interviews we conducted with academics, university senior administrators, and vice presidents. The findings suggest that internationalizing the post-doctoral system in the humanities and social sciences still faces challenges and difficulties: the postdocs' role ambiguity as "temporary researchers" without the "iron rice bowl"; non-guaranteed funding, which creates a "survival of the fittest" postdoc environment; quality versus quantity of work positioning "paper as the primary productivity"; and governance and management disorder being seen as "shifting from management to service". The internationalization of the post-doctoral system still embodies ambiguities and dilemmas. Suggestions are offered for future research in the last.

Keywords: post-doctoral researcher; China; post-doctoral system; world-class universities; higher education; internationalization

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1. Introduction

Since the concept of "sustainable development" was put forward in the 1990s, sustainable development, as a new development view, has attracted more and more attention from all over the world. As an important component of the higher education teaching process, post-doctoral education plays an important role in promoting the improvement in the overall quality of higher education in China. Therefore, we need to change the traditional thinking of higher education development, reshape the social function of higher education, and optimize the ecological environment of higher education to promote the development and progress of the reform of post-doctoral education in China. It is widely acknowledged that the post-doctoral system can be traced back to Johns Hopkins University in the United States in the 1770s, and that it was officially established after World War II [1]. In China, internationalizing the post-doctoral system is parallel to reforming it. Since the 1990s, the Chinese central government has systematically implemented a series of policies to internationalize or reform the post-doctoral system in China. In 1985, the State Council issued The National Development Document (No. 88) to launch China's post-doctoral system, which marks its establishment. The emergence of the post-doctoral system in China was firmly linked to the establishment of government programs for overseas students, which is directly related to attracting overseas students back to Mainland China. In 1985, the China Post-doctoral Science Foundation was established and has invested a total of RMB 2.71561 million over the past 30 years. The total amount of subventions has been increasing yearly. From 1985 to 2018, a total of 207,840 post-doctoral researchers were recruited; by the end of 2019, there were 66,511 postdocs in the Centers for Post-doctoral

Research [2]. From one post-doctoral candidate in 1986 to more than 1000 in 1995, it then took only another 14 years for that number to reach over 10,000. In 2015, the number of post-doctoral students in China reached its historical peak of 16,694, and it continues to increase steadily [3]. During the past decades, 88,023 postdocs in China have obtained academic achievement at the Center for Post-doctoral Researchers [4].

However, there are limited studies on exploring the current situation in the internationalization of the post-doctoral system in China's higher education institutions. Some previous research has indicated that the post-doctoral system has become a platform for the growth of high-level talent in China, many of whom have worked in China's research-oriented universities and national research institutes. They not only participate in important national research projects but have also made high-level research achievements in the fields of economics, science and technology, and national defense; this has become an important force in promoting China's scientific and technological innovation [5]. Prior to the present study, little evidence had been published about different stakeholders' perspectives and perceptions (e.g., post-doctoral researchers, co-advisors, and senior administrators) on internationalizing the post-doctoral system in China. Therefore, there is a gap in examining the stakeholders 'perceptions of the post-doctoral system in China. Along with this, this study explored the influence of post-doctoral policies in China in the context of pursuing a world-class university status. It drew on the analysis of 34 institutional post-doctoral recruitment documents and also of semi-structured interviews with 36 post-doctoral researchers and co-advisors in the humanities and social sciences and with institutional senior administrators. This study addressed two major research goals: (1) it examined the recruitment policies in China for post-doctoral researchers, and (2) investigated different stakeholders' (i.e., post-doctoral researchers in the humanities and social sciences, co-advisors, and senior administrators) perspectives and perceptions on internationalizing the post-doctoral system.

1.1. Three Phases of Post-Doctoral Recruitment Policies in China

Initial phase: 1985–1988: In 1985, the establishment of the Center for Post-Doctoral Studies was approved by the State Council, led by the State Science and Technology Commission, to form the national post-doctoral management committee for unifying the organization and coordination of national post-doctoral affairs. During the period 1985–1987, the Chinese central government successively promulgated a series of post-doctoral policies including the Notice on National Science and Technology Commission about the Application of Center for Pilot Post-doctoral studies, Several Issues on Establishing the Post-doctoral Scientific Research from the National Science and Technology Commission, Interim Provisions of Post-doctoral Researcher Management, and The Interim Provisions on Post-doctoral Fund Management. All of these documents promoted the recruitment policies by focusing mainly on the creation of post-doctoral training institutions, recruitment conditions and training requirements, student welfare and treatment, and/or on research funding [6,7].

***Developmental phase: 1988*:** In 1988, the Ministry of Personnel Affairs was assigned responsibility for post-doctoral policies to expand post-doctoral recruitment, disciplines, and countries. For example, in 1988, the Notice of the National Post-Doctoral Management Committee on Several Issues Concerning the Current Post-Doctoral Work was proposed to recruit self-funded post-doctoral students to expand enrollment autonomy. In 1992, The Ministry of Personnel, the National Post-Doctoral Management Committee on the Approval of Peking University, and 13 other units in the field of social sciences set up a Center for Post-Doctoral Studies, which was approved to recruit post-doctoral researchers in the social sciences. In 1998, The Ministry of Human Resources of the China Post-doctoral Management Committee proposed to undertake and implement the China–Korea young scientists exchange program, which marked the launch of China's official governmental post-doctoral exchange program for post-doctoral internationalization. Thus, regulating post-doctoral research funding is considered another major issue for guaranteeing post-doctoral research training [8,9].

***Boom phase: 1988–present*:** Since 2011, along with The National Medium- and Long-Term Talent Development outline (2010–2020), the Chinese central government has paid more attention to post-doctoral internationalization. For example, the Notice of the National Post-Doctoral Management Committee on Accepting African Researchers to Conduct Post-Doctoral Research in China was approved to allow African researchers to conduct their post-doctoral research in China's higher education institutions (HEIs). It also aims to apply the China–Africa science and technology partnership to recruit African post-doctoral researchers. The Notice on Mainland China–Hong Kong Joint Training Post-Doctoral Researchers was also proposed in 2011, which implemented the "Xing Jiang Scholar Plan" to support Chinese candidates "going abroad" to undertake post-doctoral studies. Both expansion and internationalization contribute to the deepening development of China's post-doctoral policies. In short, China's post-doctoral system has achieved much over the past decades but continues to face serious problems and concerns. For one thing, it is difficult to recruit excellent doctors to be postdocs. Furthermore, China's post-doctoral system reform lacks a comprehensive national strategy, and the system design lags the development of a market economy. Many post-doctoral fellows, moreover, have different attitudes toward the post-doctoral system, especially in the humanities and social sciences [10].

1.2. Stakeholders' Perspectives on and Perceptions of Internationalizing the Post-Doctoral System in China

Different stakeholders, especially post-doctoral fellows in the humanities and social sciences, hold different attitudes toward the internationalization of China's post-doctoral system. Some scholars have offered critical and negative perspectives on the current status of and issues around facilitating the post-doctoral system; these issues include academic identity, interpersonal communications, funding allocation, and management systems [11]. For example, the post-doctoral role conflict originates from the perspectives of theory, inducement, and adjustment. Chinese government should establish an attractive post-doctoral incentive mechanism. Shaping these communicative relations is essential to promote the conservational support for integrating ideas and approaches. We need to build a funding system that promotes the internationalization of China's post-doctoral education [12]. The current post-doctoral researchers are faced with tremendous challenges such as the ambiguous status of post-doctoral education, pressures on professional development, low salaries, and poor academic environments. The daily post-doctoral research expenses represented the basic funding required to ensure successful post-doctoral research and life, but current research grant funding is limited, especially in the humanities and social sciences [13].

Other scholars have offered positive perspectives on shaping China's post-doctoral system by advocating for world-class universities and the internationalization of higher education. For example, promoting world-class universities stimulates professional post-doctoral development in China [14]. Shaping post-doctoral internationalization is closely related to the construction of world-class universities in China [15]. We should set up post-doctoral training consciousness, build a post-doctoral research platform for international exchanges, create a relaxed academic environment, and improving the innovative competencies of post-doctoral fellowships to make them more international [16]. It is suggested that to internationalize the post-doctoral system in China, it will be necessary to implement policy optimization from "single-center governance" to "multi-center co-governance" through establishing policy objectives and priorities, strengthening policy supervision, and promoting the coordination and diversification of policy tools. It is suggested to set up a scientific assessment and evaluation of the post-doctoral system—an essential step in promoting the internationalization of China's post-doctoral system. They posit a need to build incentives and restriction mechanisms for post-doctoral education through the creation of a fair competition environment, evaluation system reform, and improvement in the quality of teachers' post-doctoral career planning and teacher training;

the goal is to comprehensively improve the post-doc quality and teachers' post-doctoral training of their critical thinking and idea [17]. Like China, other countries' post-doctoral systems raise similar questions with respect to their higher education systems, the role of post-doctoral fellows, institutional management, and academic employment. The higher education systems and the role of post-doctoral fellows play a pivotal role in influencing the perceptions and experiences of post-doctoral fellows. The federal government should implement bureaucratic reforms [18]. The dissatisfaction among post-doctoral researchers with the nature of their position and with their future employment prospect [19,20].

2. Methods

The aim of this study was to provide an in-depth understanding of the experiences with and perceptions of the post-doctoral researchers, co-advisors, and institutional administrators of the current post-doctoral system in China. The naturalistic and interpretive nature of our qualitative approach was able to tap into the personal insights and first-person perspectives of various stakeholders on China's current post-doctoral policies.

2.1. Background and Case Selection

Since 2017, the attainment of world-class status has been a goal for China's top universities as an integral part of their pivotal policy position to create internationally recognized exemplary HEIs. The sampled universities in this study have followed The Report of the 11th Five-Year Plan for the Construction of World-Class Universities to formulate a diversified schedule to get into the world-class league [21,22]. In light of this goal, the selected universities have devoted themselves to the internationalization of their post-doctoral recruitment and cultivation policies to raise the quality of their post-docs. To achieve this, various incremental efforts have been made toward implement institutional post-doctoral policies and reforms to achieve world-class academic goals. The predominant disciplines of these eight universities, moreover, are Comprehensive (3), Humanities and Social Sciences (3), and Science and Engineering (2). Over the past few decades, all of the selected universities have implemented various post-doctoral recruitment policies to attract post-doctoral researchers/fellows for the purpose of expanding their international academic exchanges.

This study concentrated on two data sources: (1) A total of 34 institutional post-doctoral recruitment documents and policies of world-class universities; and (2) 36 semi-structured interviews with selected post-doctoral researchers, co-advisors, and institutional administrators. Post-doctoral recruitment documents and post-doctoral outbound policies were collected from the official websites of 34 quasi-world-class Chinese universities; field visits were conducted at five universities from December 2018 to September 2019. Each field visit lasted over 60 min. The 34 universities were selected on the basis of criteria outlined in the Notice on the Promulgation of the List of World-Class Universities, and the Universities and Disciplines for the Construction of First-Class Disciplines, which were jointly issued by China's National Development and Reform Commission of the Ministry of Education and Finance in 2017 [23].

Semi-structured interviews were conducted from September 2016 to May 2017 at six universities, with 16 post-doctoral researchers (10 graduated from local universities and six from foreign universities), 11 co-advisors, five senior administrators, and four vice-presidential administrators in charge of scientific research. This study obtained an official approval letter from each of the selected universities. Each interview lasted approximately 35–45 min. In addition to the interviews, both the participant and non-participant observations were conducted; that is, we engaged in and observed some of the participants' academic activities across different departments. The interview questions included: "What is your attitude toward China's current post-doctoral system?"; "What are your concerns/worries regarding your post-doctoral life?"; and "Do you have any comments/recommendations on how to change this situation that you have suffered"?

Of the 34 selected universities, 14 were comprehensive research universities, 10 were humanities and social sciences, six were normal universities affiliated with the Ministry of Education, and four were sciences and engineering. Twelve of the selected universities were located in Northern China, 11 in Eastern China, three in Western China, and the other 11 in Central China. Post-doc interviewees majoring in the humanities and social sciences were recruited using "purposive sampling" and "snowball sampling" strategies. In sociology fields, snowball sampling refers to a non-probability sampling method, which includes purposive sampling. Researchers begin with a small population of known people and enlarge the sample by asking those initial interviewees to find others who would like to participate in the study. Thus, a sample "snowballs" into a larger sample throughout the study. We applied a snowball sampling technique to initially identify and locate post-doctoral fellows in the humanities and social sciences in the selected universities. Given the nature of this method, the resulting sample is not regarded as representative for statistical goals. However, it is an appropriate method for conducting an exploratory study with a specific and relatively small group, especially one that is difficult to identify and/or locate [24].

One senior administrator at each case university was interviewed. Each was involved in formulating institutional post-doctoral recruitment and incentive policies. The selected social sciences included Sociology, Economics, Political Science, and Psychology and the humanities comprised Arts, Literature, and History with Centers for Post-Doctoral Researchers.

2.2. Data Coding and Analysis

This study documented institutional post-doctoral recruitment and incentive policies; documentary evidence was collected including official publications, annual reports, and archival records related to the internationalization of the post-doctoral system. Data were coded in three stages: Open coding, followed by pattern coding to develop categories, and finally clustering, comparing, contrasting, building logical connections between codes, and generating themes. Additionally, all interview transcripts, observational field notes, and documents were comprehensively analyzed in response to the research questions. This study applies the semi-structured interviews with different participants. During the interviews, we paid significant attention to the challenges, problems, and suggestions on promoting the sustainable development of the current post-doctoral education system in China's higher education institutions. For the interview protocol and phases, we selected keywords identifying their post-doctoral education reform and policies including "post-doctoral funding information, resources and allocations", "post-doctoral academic publications and research work", "post-doctoral professional career development", and "post-doctoral management and policies". All these keywords are considered as the key phases for researchers to analyze the transcripts. For the coding and confidentiality, all of the participants' information such as their name, sex, job, and marital status were anonymized by researchers to protect the participants' ethnic information.

Along with the previous literature review and research questions, we developed coding categories: the post-doctoral system, academic identity, interpersonal communication, funding allocation, and management system; guided by these categories, we assessed the sampled universities' post-doctoral fellows' attitudes toward and perceptions of their current academic environment. We then collected and coded the sampled data followed by the coding categories to evaluate which level the transcript was associated with, whether they expressed the perceptions of interviewees, and what ideas they were showing. After this coding round, we analyzed and summarized the coded text.

3. Findings

On the basis of our documentary analysis, and interviews, it was found that in recent years, the sampled Chinese universities had implemented a series of positive institutional policies to recruit post-doctoral fellows. In response to the internationalization of the

post-doctoral system, a growing number of Chinese higher education institutions have formulated recruitment policies to promote higher quality post-doctoral researchers. However, there still existed a couple of challenges.

3.1. Role Ambiguity: "Temporary Researcher" without the "Iron Rice Bowl"

Academic identity determines the social, political, and economic status of post-doctoral communities. In China, post-docs are regarded as high-level innovative young talents, and when the post-doctoral system was established, the treatment standard of post-docs was equivalent to that of the university assistant professors. It is important to reasonably confirm the post-doctoral role, especially to give operational identification. The post-doctoral identity in developed countries is essentially that of a mobile contract researcher.

As a result of this fluidity, post-docs must consult with their institution at the end of their contract period to continue their post-doctoral work or to gain formal employment in the university faculty. This quasi-independent researcher role requires post-docs to adhere to their advisors' guidance to conduct their research. In other words, a post-doc is a category between a doctoral student and an independent researcher. YX, a 29-year-old female interviewee, is a post-doctoral researcher majoring in Education Policy, who graduated from one of the top Chinese universities in Beijing, who argued:

> "From my perspective, being in the role of a post-doc means conducting temporary research with the guidance of a co-advisor. The core task of being a post-doc is to follow the requirements and guidance to do various research projects. We also encountered lots of pressures and tensions compared with being doctoral students. The temporary, subjective role of being post-docs seems like "floating personnel", which causes us to not have the internal identity of being post-docs. Publishing papers such as in SSCI, CSSCI is considered as the key indicator for evaluating whether someone is a good post-doc or not. In addition, the quality and quantity of publications directly influence the likelihood of finding a good job in the coming days".

In addition, HKY, a 31-year-old male post-doctoral researcher, majoring in Chinese Language and Literature, who graduated from one of the normal Chinese universities in Shanghai, expressed a similar concern:

> "I am always confused by my embarrassing role of being a post-doc. Is being a post-doc being a student or being a teacher? I am not a formally recruited faculty member or a graduate student and sometimes, I feel at a loss. When my family asks me, "where are you working"? I cannot give a clear answer to explain my current status of being neither researcher nor student. In addition, working as a post-doc, I have undertaken a lot of challenging work, but it has neither been recognized nor received the benefits they think they deserve. They always fall into a dilemma".

Moreover, the increasingly competitive academic community presents post-doctoral researchers with serious pressure in their scientific research, employment, and life, which has had a physiological and psychological impact on their daily post-doctoral work. Some interviewees indicated that pursuing post-doctoral research is time consuming with many risks. LX, for example, a 29-year-old male post-doc, majoring in Education Policy, who graduated from a comprehensive foreign university, pointed out that,

> "The risk of job market saturation in academia is the big issue worldwide. Some post-doctoral researchers believe that more and more doctors now need to bear the risk of employment brought by time cost. I used to work in the Chinese Academy of Sciences, but now, it's hard to enter the field of study after I leave. I worry that, with the saturation of the job market, colleges and universities are increasingly demanding in their employment criteria, and many colleges and universities explicitly require applicants who have study abroad experience, not being post-doctoral experience. In addition, the risk of policy change is

> considered as another issue. I think the current policy changes too fast. At that time, when I chose to do in-service post-doctoral work, the policy propaganda had better treatment, but now it has not been fulfilled. Faculty post-doctoral work is constantly changing such as "to prepare", which worries us that we haven't found a fixed job yet. This kind of unsafe career prospect over time increases the current load of post-doctoral work".

Furthermore, some interviewees highlighted that, at present, the relationship between post-docs and their cooperative tutors in China is mainly a traditional teacher–student or superior–subordinate relationship, which does not benefit academic interactions between post-docs and tutors. The establishment should systematically promote equal relationships between post-docs and tutors and enhance mutual understanding and trust through cooperative guidance. Some PhD graduates must choose a post-doc role to meet their personal academic development goals or compromise passively with HEIs. Several interviewees also pointed out that the primary motivation for seeking post-doctoral status involves being elected to teach in the contracted universities and then finding a better position to improve the existing treatment. However, a post-doctoral researcher is always considered as a "temporary researcher" without the "iron rice bowl". This is the main reason many scholars hesitate to undertake post-doctoral work; most young scholars choose to undertake post-doctoral work because they do not have job opportunities that might sustain them temporarily. Most Chinese people have the idea of an "iron rice bowl" and their subconscious reveals a sense of insecurity, which can greatly reduce post-doctoral happiness.

3.2. Funding Not Guaranteed: "Survival of the Fittest"

Financial aid plays an important role in shaping the post-doctoral system. In China, the funding for post-doctoral research consists of four categories: daily expenses, scientific research expenses, housing benefits, and tutor or enterprise expenses. Daily expenses refer to recruit with the cost of living index; national research refers to post-doctoral scientific research funded by the China Post-Doctoral Science Foundation of China; housing benefits mainly refer to the provision of post-doctoral welfare housing; and tutor or enterprise expenses refer to the 1988 trial at the university of self-financing enterprise recruiting 1994 recruits post-doctoral and post-doctoral, tutor, university, or national requirements enterprise bears part of the funds.

In China, post-doctoral funding allocation is typically decentralized. For example, a post-doc should be able to apply for various types of funding, but currently, not every post-doc can obtain the basic funding they need as they are not fully funded by their institutions or by their co-advisors.

The decentralized funding policy has obvious disadvantages. In addition to receiving welfare housing, a post-doctoral researcher may face the dilemma of "keeping an empty room" without basic living expenses or receiving daily expenses without scientific research funding.

Aside from the research funding, there are many other economic pressures on post-doctoral researchers. In some universities or scientific research institutes, the post-doctoral salary is relatively low. Most post-doctoral researchers are approximately 30 years old or older and suffer from the pressure to make money to support their families. Such economic pressure often comes not from the fear that the money they earn cannot support their families, but from the social expectations regarding their own income and the psychological pressure associated with comparing their income to that of their peers. For example, XJY, a 33-year-old male post-doc, majoring in History, who graduated from a local comprehensive university, stated:

> "I think, the helplessness of not seeing future hope is more painful. As you know, during the post-doctoral period, we suffered from a low salary, and I did not have enough money to afford my family. If you can't see the future, you will lose interest, motivation, and even feel despair. The limited funding for post-doctoral research makes most of the young researchers fall into a state of

> confusion and struggle. A few years ago, post-doctoral students could get a position of associate professor directly in a good scientific research institute or university. Now, post-doctoral students have to go to a good scientific research institute or university to work, which is many times more difficult than before. After they go to a good scientific research institute or university, they rarely have the chance to attain associate professor directly. They still need to go from lecturer or assistant researcher, which starts with the title of "endure".

FJ, a 29-year-old female post-doc, majoring in Chinese Literature, who graduated from one of the humanities and social sciences-oriented universities, also claimed:

> "I am currently struggling with research funding. My advisor has not offered me research funding to conduct my study. It is not easy to apply to the national post-doctoral research foundation, which does not guarantee that I will receive the basic salary from my institution, and it couldn't afford my daily expenses. In addition, I need to rent an apartment, but on my current salary, it is difficult to cover my daily expenses".

3.3. Quality and Quantity Questioned: "Paper as the Primary Productivity"

Some interviewees argued that a post-doc's research capacity plays an important role in their selection as an excellent researcher. Post-doctoral centers in China are set up in some research universities or in key research institutions but have their own research value orientation and long-term accumulation of research culture, strong and sustained research funding as well as multi-disciplinary, multi-professional, comprehensive research platforms with the aim to promote the rapid growth of post-doctoral research. Reshaping the policies and mechanisms of centers of post-doctoral research is essential to expand the recruitment of high-level post-doctoral scholars. The establishment of post-doctoral centers should transform from incentive-dominated principles to a quality-based orientation. Encouraging the acquisition of high-quality post-doctoral researchers requires expanding the scale of recruitment and implementing national recruitment standards. Some interviewees argued that strictly implementing an exit mechanism for post-doctoral researchers is urgently needed. ZX, a senior administrator in a humanities and social sciences-oriented university, asserted:

> "I think the quality of post-doctoral researcher is key to promoting the development of world-class universities. Many post-docs do not have sufficient publications to find satisfying academic positions. Most world-class universities offer strict requirements for recruiting post-docs. However, some of them do not have clear standards or requirements for their research during the post-doctoral stage. The large-scale recruitment of post-doctoral researchers impeded the cultivation of quality post-docs".

In addition, a co-advisor who was currently working with two post-docs from a humanities and social sciences-oriented university also emphasized:

> "The quality of post-docs is generally not high, and some post-docs couldn't fulfill their research task. For example, some post-docs in the social sciences haven't published qualified articles in CSSCI journals or SSCI journals or applied for national- or provincial-level funding support. In addition, some co-advisors complain that some post-docs couldn't complete the required research workload and there existed an obvious tension between the advisors and post-docs. Generally, many co-advisors are not satisfied, to some extent they are disappointed with the academic competence and skills of the recruited post-docs".

We found, moreover, that the co-advisors' satisfaction with their post-docs also reflected a tension with respect to balancing quality and quantity. The occurrence and development of communication between the post-docs and their co-supervisors/advisors was essentially the generation and development process of communication rationality.

The rational development of intersubjective communication is an important factor in the enhancement of the post-docs' scientific innovation abilities in light of making important scientific discoveries. The development of communication rationality between postdocs and co-supervisors mainly aims at the production of advanced knowledge. Original innovation has become the value criterion for the development orientation of communication rationality between subjects and the evaluation standard for the development level of the communication paradigm. Communication paradigm optimization for post-docs and co-supervisors is imbedded in improvements in environmental support systems, and in improvements in the communication concepts and modes. Most interviewees also suggested that promoting the post-doctoral researchers' scientific innovation abilities, especially original innovation abilities, is considered as an important factor in the construction of the post-doctoral researchers' academic futures. Undoubtedly, an important avenue through which such scientific innovation abilities can be improved is communication with the co-supervisors/advisors.

3.4. Governance and Management Disorder: "Shifting from Management to Service"

Some interviewees argued that reducing the hierarchies in the Centers for Post-Doctoral Researchers and shifting their focus to "service" would be a way to form a new system of post-doctoral management. It is necessary to create a post-doctoral system of "nation–institution/entrepreneurs–mentors" with respect to the principles of power, responsibility, and benefit. National-level management focuses on nationwide post-doctoral management committees, whose main function is policy formulation for post-doctoral research in China. For example, the approval for the evaluation of centers for post-doctoral researchers and workstations, the release and approval of China's Science Foundation for Post-Doctoral Research, and the release of information and development data for China's post-doctoral recruitment. Institutional/enterprise management might include the university or enterprises with post-doctoral stations. Its main function is to release institutional post-doctoral recruitment policies and information, post-doctoral development data statistics, and the exchange of post-doctoral management and services. The supervisors' management permits post-doctoral supervisors to recruit their post-doctoral researchers, provide post-doctoral subsidized funds, and guide post-doctoral work. In other words, delegating authority to mentors and shaping the post-doctoral system in its discovery of more advanced talents is beneficial for promoting the functional influences of Centers for Post-Doctoral Researchers. A senior administrator from a world-class university explained:

> "I think the most important thing is to re-adjust the governance and management of post-docs. Currently, there is not a unified management system for post-docs at the institutional level. Constructing an effective faculty post-doctoral management system should include the post-docs in the management of the faculty. Its purpose is to adapt to the needs of school teaching and scientific research development, strengthen the construction and training of young talents, optimize the faculty structure, broaden the channels of post-doctoral training, and improve the quality of post-doctoral training. For example, we can divide post-docs into two types: one is faculty post-docs, another is ordinary post-docs. Faculty post-docs and the ordinary post-docs are different in training objectives, job requirements, and salary benefits. After ten years of exploration and practice, the policy for the faculty post-doctoral system in Chinese universities and colleges has made great achievements". [25]

The number of higher education institutions implementing faculty post-doctoral policies has been greatly increased, which has effectively promoted the reform of the teacher appointment system and activated creativity in post-doctoral policy. The policy of the faculty post-doctoral system is also faced with some new challenges such as unclear policy concept, irregular policy formulation, lack of guidance in the policy system, and the lack of monitoring in policy implementation. These problems urgently need to be answered from the theoretical and practical perspectives [26].

The post-doctoral system has the "dual attributes" of training and using talents. Post-doctoral experience is both human capital investment and capital investment. The important responsibilities of the management organization have shifted from management to service, providing the management for the post-docs' development needs.

4. Discussion

Along with the findings, the alternative discourses and practices are challenging the post-doctoral system, highlighting indigenous governance and management, and the need to comprehensively reshape the structure and post-doctoral system. In the internationalization of their post-doctoral system, and thus when assessing domestic knowledge production, Chinese universities should adopt international standards and norms from global world-class universities [27]. As the interviewees noted, Chinese post-docs are confined to international norms and employ international rules to promote the development of the post-doctoral system. This could result in the creation of an effective post-doctoral system in China, primarily in international terms, without adding a distinctive Chinese strand to the global academic conversation. Regardless, accounts of China "climbing the ladder" reveal a drive in the Chinese academic community to establish and promote an international post-doctoral system in a globalized world. The "ladder-climbing" approach could be conceptualized as an ascending process, starting from the level of introducing Chinese academic backgrounds, and progressing to more critical, sophisticated, and professional engagements for internationalizing the post-doctoral system [28–30].

In addition, compared with previous published works regarding the post-doctoral education system in China, this study offers a specific in-depth understanding of the stakeholders' attitudes toward the current post-doctoral system and management. The previous studies have concentrated more on analyzing the historical educational policies in the development of the post-doctoral system and reform in China's higher education system without considering individual and personal micro level opinions on how to advance current post-doctoral management intuitionally and nationally. Thus, this is also the unique contribution of this research to explore the emotional reflections on current post-doctoral education reform.

This study has several implications for Chinese universities, which continue to encounter tremendous tensions between international and domestic post-doctoral system management. As an important part of the national talent strategy, the post-doctoral system in China has incomparable advantages [31]. The reform of China's post-doctoral system should actively adapt to the needs of the market and to the demands of knowledge development. It is important to reasonably define—especially operationally—the post-doctoral position. Decentralized funding could be changed to full funding to construct a new post-doctoral funding system [32]. The Chinese central government should offer sufficient support in shaping the post-doctoral system to attain substantial achievements in policy formulation, personnel training, and funding allocation. All of these education reforms contribute to addressing the previously mentioned difficulties such as post-doctoral funding, recruitment scale development, and management system improvement. Using the post-doctoral system blueprint of education reform, it is necessary to take full advantage of the unique advantages of the post-doctoral system of national talent, from a top-level redesign through the proper positioning of post-doctoral identity to the dispersion of funding for full funding, from a reduction of unqualified postdocs and expansion of recruiting, to a lowered management center of gravity and a reduction of management measures such as reconstructing a new post-doctoral system [33]. One of the methodological limitations in this study was the snowball sampling technique, which could not identify or locate large samples in the humanities and social sciences in the selected universities [34,35]. The sampled interviewees, moreover, did not represent all of China's humanities and social sciences post-doctoral fellows. Our qualitative findings include only sample-based findings, and they may not be generalizable to all populations and contexts. Quantitative elements should be added to this study to investigate a broader selection of groups [36,37].

Additionally, future research should investigate more macro-level external post-doctoral systems, and the role of post-doctoral systems in China's HE system could be investigated from a comparative perspective in terms of contextual differences in cultural, political, economic, and geographical factors [38,39].

This study also offers both theoretical and practical implications of analyzing the post-doctoral education management and policy development in China's current higher education system [40]. For theoretical implications, social emotional theory and social cultural theory could be discussed in this theme for unpacking the individual real post-doctoral life and learning contexts [41–43]. For practical implication, this study offers a variety of effective strategies to address the current challenges and problems. Some specific results could inform future study to make a broader study on how to identify the stakeholders 'personal development when pursing post-doctoral education. In addition, during the pandemic period, the job-readiness plays a pivotal role for post-doctoral researchers to achieve more and more academic performance [44].

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COVID and ICT in Primary Education: Challenges Faced by Teachers in the Basque Country

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Abstract: This article focuses on the digital competency of primary school teachers in the Basque Country Autonomous Region (Spain) during the COVID-19 pandemic. The temporary closure of schools forced teachers to adapt face-to-face teaching-learning processes in order to operate remotely, making use of technology infrastructure and digital resources. While several educational policies have been developed with the aim of incorporating Information and Communication Technologies into schools, including the "Escuela 2.0" programme, research has shown that there is a lack of Information and Communication Technology training for teachers. The main objective of this study is to further understand the challenges faced by primary school teachers in adapting to remote teaching due to the COVID-19 during stay-at-home lockdown restrictions. An ad hoc quantitative questionnaire was used, which was validated in a trial by eight experts. A total of 1069 primary school teachers participated in the survey. The main results show the participants' emphasis on their effort to reorganise and redesign subjects and their willingness to make use of information and communication technology infrastructure and resources. However, a high percentage of teachers reported that either they lacked information and communication technology training or considered themselves self-taught in these skills, and expressed interest in lifelong learning programmes in Google Classroom, Google Sites and Google Meet applications, among others.

Keywords: digital competency; technological resources; online learning; primary education

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1. Introduction

The DeSeCo project [1] established eight key competencies for lifelong learning, with a special emphasis on digital competency (DC). Since February 2020, this competency has been given even greater importance due to the consequences arising from the pandemic. Spanish Decree 463/2020 [2] declared a state of emergency in order to manage the COVID-19 health crisis. Article 9 of this Decree established two lockdown measures specific to education and training: Ceasing face-to-face educational activities in all institutions at all stages, cycles, degrees, courses and levels of education, as well as of any educational and training activities taught in both public and private institutions; conducting educational activities remotely by using online teaching and learning tools, whenever possible.

The educational community was compelled to urgently implement their DC at a dizzying speed, adapting contents and methodologies to non-face-to-face teaching [3–5]. However, this pandemic has sometimes drawn attention to the lack of digital resources in schools, the competency-based learning model, and DC training for both teachers and pupils. This is particularly serious considering that the development of DC is stipulated and promoted in different educational laws [6–9], including Decree 236/2015, which established the Basic Education curriculum to be implemented in the Basque Country Autonomous Region (BCAR) [10].

The low level of teachers training in how to use ICT with pupils is an important factor [11] that was evidenced during the pandemic [4,12]. This situation becomes even

more challenging because there are no resources in place "to implement mandatory lifelong learning programmes" [13] (p. 20) to help improve it.

Therefore, the main objective of this study is to further understand the challenges faced by primary school teachers in adapting to remote teaching due to the COVID-19 stay-at-home lockdown restrictions.

In addition, in order to empower pupils and contribute to their development as successful citizens, teachers should also be empowered to do the same for their pupils [14]. Moreover, teachers should have appropriate training to contribute to the development of pupils' DC and teach them to make critical, creative and responsible use of ICT.

This paper is structured as follows: In Section 1 there is a literature review about the impact of COVID-19 on teaching-learning processes and the digital educational resources available to primary school teachers; Section 2 details the research objectives and hypotheses, the instrument used, and finally, the sample and data collection followed; Section 3 describes the results; the last section presents the discussion and main limitations and future research lines of the study.

1.1. The Impact of COVID-19 on Teaching-Learning Processes

According to the United Nations Educational, Scientific and Cultural Organization [15], at the end of March 2020, 166 countries around the world decreed the temporary closure of all their educational institutions and almost 1.5 billion students at all levels of education (82.8% of the world's total) stopped having face-to-face classes.

With a view to completing the academic year, the most striking change was converting a face-to-face setting into a digital learning environment. However, this adaptation did not simply mean digitising content, but required teachers to rethink their subjects, adjust pedagogical and didactic practices, and create dynamic materials that stimulated distance learning [16]. In this virtual scenario, teachers were required to have technological and pedagogical-digital knowledge in order to innovate, reflect and transform their teaching ideas, while they met curricular objectives [17].

Teachers' DC was particularly important in this situation. As Trujillo-Sáez et al. [18] concluded, this became "a prerequisite for pupils' learning and competency development in a distance learning context". Teachers were very often faced with the immediate challenge of developing competencies and skills that had not necessarily been part of their training. In addition, they were compelled to rethink their teaching practice without any specific theoretical or practical frameworks [19].

One of the first international studies on educational responses to COVID-19 [20], released in 2020, noted that the most challenging aspects of the educational response were the availability and management of technological infrastructure, addressing students' emotional health, and the right balance between digital and screen-free activities. In addition, a significant percentage of participants saw that the changes caused by the crisis brought about some unexpected positive educational outcomes, such as the introduction of technologies and other innovative solutions, and an increase in pupils' autonomy to manage their own learning.

As the ECLAC-UNESCO report [21] pointed out, in the face of current challenges, teachers in Latin America are faced with a lack of training and available resources while the time they have to spend preparing classes and monitoring their students, among other things, has also increased significantly. This report also highlighted the fact that, given educational inequalities and unequal access to curricular coverage, the learning achievement gap is expected to widen. The international study conducted by Cáceres-Muñoz et al. [22] also stressed that the COVID-19 health crisis is increasing educational inequality.

In the study performed in Spain by Trujillo-Sáez et al. [18], teachers emphasised the need to expand infrastructures (spaces and technological resources) and staff numbers, and noted that they have felt abandoned by the education authorities. They also expressed a desire to be trained in DC and teaching strategies in virtual contexts, as well as in active

methodologies, assessment systems, feedback, and monitoring of students beyond the academic sphere. In the same line, Sánchez-Cruzado et al. [4], found that teachers have a low self-perception of their digital skills, and underlined the importance of developing a training program for teachers to reach optimal levels of DC. Different studies in the Spanish context support these results [12,16,23].

In the Basque Country, Portillo et al. [24] explored the perceptions that teachers of all educational stages had of their performance in remote teaching during lockdown. The greatest difficulty reported by teachers was the shortfall in their digital skills training, which led them to perceive an increased workload and negative emotions. In addition, DC was poorer at lower educational levels, which are the most vulnerable group in online teaching environments.

1.2. Digital Educational Resources Available to Primary School Teachers

In Spain, educational policies aimed at incorporating ICT in schools began in the 1980s with the Atenea programme, among others, but it was not until the 2009–2010 academic year that they came to the fore with the "Escuela 2.0" programme. Its objectives were: To provide ICT resources for both teachers and pupils; to promote teacher training; to encourage the development and creation of digital materials; to offer values education for the responsible use of technology. The aim was to promote a '1-to-1 model' and to provide each teacher and pupil in the 5th and 6th years of primary education with a technological device. In addition, interactive whiteboards and Internet connection were installed in classrooms [25].

In 2012, the "Escuela 2.0" was discontinued and replaced with two technological projects: The 2015 Framework Agreement on School Connectivity, to provide ultra-fast Internet access in schools; the Digital Culture at School Plan, to design repositories of open educational content, digital textbooks, and connectivity in schools [26]. The education authorities in the Basque Country provided grants for the production of digital teaching materials (EIMA 2.0), the acquisition of digital devices, and the design of innovation projects for teaching-learning with digital resources ("Sare Hezkuntza Gelan") [27].

Resulting from the circumstances surrounding COVID-19, the 10th Additional Provision of Spanish Organic Law 3/2020 [9] established that the Ministry of Education and Vocational Training, in collaboration with the education administrations, will design a Contingency Plan model to ensure that learning activities continue to be offered and guarantee pupils the right to education under any circumstances. This plan includes the organisational and operational aspects of schools; liaising between governing and teaching coordination bodies; measures that facilitate communication with the educational community; participation of the different members of the educational community in mitigating and addressing the emergency situation; measures that guarantee DC is acquired by pupils and teachers, reducing the digital gaps in access and use as far as possible; provisions for reviewing the elements of the curriculum and the teaching programmes focused on the most competent aspects of the curriculum.

However, COVID-19 has also led to the closure of schools, creating multiple problems in teaching and learning. The fact is that non-university education institutions in Spain are designed for face-to-face rather than remote learning. The digital divide in Spanish households must also be taken into account. According to the latest report on ICT Equipment and Use in Households [28], 81.4% of households with at least one member aged 16 to 74 have some kind of computer and 95.4% of households have an Internet connection. According to the OECD [29], 61% of students in Spain in the highest-income households have three or more computers at home, while 44% of the lowest-income households have only one, and 14% have none. Therefore, it can be said that not all families have the same technological conditions. According to Rodicio-García et al. [30], one in three students, despite having technology at home, does not have the necessary resources. It was found that this perception is influenced by the size of the population where the individual lives and having the knowledge to be able to use the technology. The presence of technological

resources is not enough for the true integration of ICT in the classroom [31]. Faced with this situation, there have been many proposals and programmes for open educational portals and resources to help teachers, pupils, and families to keep up with the pace of the academic year and try to compensate for possible deficiencies in educational processes [32]. There are currently numerous Web 2.0 tools available to be applied in education, such as those used for information searching, communication, or the creation of materials [31]. Governments and institutions in different countries have also developed teaching guides with resources and materials [19,20].

2. Materials and Methods

The main objective of the study is to further understand the challenges faced by Basque primary school teachers from having been forced to adapt to remote learning due to the COVID-19 lockdown between March and June 2020.

In Table 1 the relationship between objectives and hypotheses is presented.

Table 1. Relationship between objectives and hypotheses.

Specific Objectives	Hypotheses
1. Analyse the impact of a range of social and working variables on the teachers' professional field during the pandemic.	H1.1 A range of social and working variables impact the teachers' professional field during the pandemic. H1.2 There are significant differences in the impact on the teachers' professional field with respect to the general context variables.
2. Analyse the digital infrastructure and resources that schools offer for distance learning.	H2.1 Schools generally provide teachers with a wide range of digital infrastructures and resources.
3. Explore the technological resources used by teachers for distance learning activities.	H3.1 Teachers use a wide range of digital infrastructures and resources for distance learning.
4. Analyse the differences in terms of digital infrastructure and resources with respect to the general context variables.	H4.1 There are significant differences in terms of digital infrastructure and resources provided by schools with respect to the general context variables. H4.2 There are significant differences in the teachers' use of digital resources with respect to the general context variables.
5. Analyse teacher training needs and interests in the face of the forced adaptation caused by the pandemic.	H5.1 A high number of teachers need ICT training. H5.2 Teachers show interest in having lifelong training in technological tools.

2.1. Instrument

First, a questionnaire was designed based on the research by [17,18,33–38]. Subsequently, 8 experts in education and ICT were asked to assess the suitability of the items, their clarity, and whether there was a need to add any further categories.

Based on the expert assessment, the questionnaire consisted of 7 dimensions: General context; psychological impact; psychological causes and consequences; technological infrastructure and resources; ICT uses; ICT training; interest in ICT. Questions 1–4, 7, 11, and 13 were multiple-choice (single-answer) responses; questions 5, 6, 14, and 16 were open-ended; question 15 was a ranking question; the remaining questions were on a Likert-type scale ranging from 0 to 10. It was not compulsory to answer every question.

Finally, a pilot study was conducted to examine the overall performance of the measuring instrument. Five primary school teachers with similar characteristics to the target population participated in this study. They corroborated the degree of understanding of the items in the instrument.

2.2. Sample and Data Collection

The sample of the study was comprised of Primary Education teachers from the Basque Country.

The questionnaire was hosted on Qualtrics, a web-based survey platform in the two official languages of the BCAR, Spanish and Basque platform. The estimated response

time was 15 min. The questionnaire was sent to schools on 7 January 2021 and, after two reminders, closed on 12 February 2021.

The final sample consisted of 1069 teachers, 8.9% of the total sample. The sample was considered to be representative, as the total number of primary school teachers in the Basque Country was 11,891 [39] in the 2018–2019 academic year. Table 2 shows the participation percentages and those related to context variables.

Table 2. Sample participants.

General Context Variables	Type	Total (N = 1069)		Questions on the Impact of Variables in Their Professional Field (N = 731)		Questions on the Type of Technological Resources Used for Distance Learning Activities (N = 692)	
		Absolute	%	Absolute	%	Absolute	%
Institution	Public	735	68.75	479	65.53	447	64.6
	Private or publicly funded private	334	31.24	252	34.47	245	35.4
Area	Bizkaia	589	55.09	407	55.68	386	55.78
	Gipuzkoa	316	29.56	241	32.97	202	29.19
	Araba	164	15.34	110	15.05	104	15.03
Socio-economic environment	Low income	154	14.40	106	14.5	99	14.31
	Middle-low income	489	45.74	323	44.19	308	44.51
	Middle-high income	406	37.97	284	38.85	268	38.73
	High income	20	1.87	18	2.462	17	2.457
School years taught	First stage	507	47.42	353	48.29	327	47.25
	Second stage	562	52.57	378	51.71	365	52.75
Gender	Woman	851	79.60	575	78.66	540	78.03
	Man	210	19.64	148	20.25	144	20.81
	Other	8	0.74	8	1.094	8	1.156
Age	21–30	190	17.77	123	16.83	117	16.91
	31–40	245	22.91	176	24.08	170	24.57
	41–50	287	26.84	205	28.04	194	28.03
	51–64	347	32.46	227	31.05	211	30.49
Years' teaching experience	0–10	342	31.99	234	32.01	226	32.66
	11–20	302	28.25	211	28.86	202	29.19
	21–30	230	21.51	150	20.52	140	20.23
	31 or more	195	18.24	136	18.6	124	17.91

3. Analysis and Results

The statistical package for the Social Sciences (SPSS, version 27, IBM, Armonk, NY, USA) was used for data analysis. A descriptive analysis and analysis of variance were performed in this study. The internal consistency of the questionnaire was determined using Cronbach's alpha coefficient. Nunnally [40] recommended a minimum level of 0.7 and Field [41] a level of 0.8 to be considered good. For this questionnaire, the total Cronbach's alpha coefficient of the instrument was 0.87, which showed adequate internal consistency reliability.

The two scales of the questionnaire used in this article measured the impact of certain variables on the teachers' professional environment and the type of technological resources they used for their distance learning activities. The Cronbach's alpha for each was 0.88 and 0.7, respectively. Therefore, they both achieved an adequate level of internal consistency.

The principal component factor analysis has been grouped in the same way as in the questionnaire; thus, the questionnaire met the validity criteria.

Table 3 shows the means and standard deviations of the evaluation scale in relation to the impact on the teachers' professional environment during lockdown. As can be seen, the variables that had the greatest impact were the reorganisation of work time and subject redesign, while the lack of support from the management team, failure of the VLEs, and lack of support from other teachers were the items that scored lowest.

Table 3. Impact on teachers' professional environment.

Variables	Mean	Std. Deviation
Remote work overload	8.66	2.778
Reorganisation of working time	8.95	2.235
Redesign of the subject taught	8.98	2.157
Lack of time for forced adaptation	8.63	2.469
Lack of ICT training (on the part of the teacher)	6.89	3.145
Lack of ICT training (on the part of families)	8.50	2.485
Lack of ICT training (on the part of pupils)	8.04	2.661
Lack of ICT resources for the teacher	6.88	3.131
Lack of ICT resources for families/pupils	8.04	2.680
Precarious technological resources	7.26	3.013
Excessive bureaucratic hurdles from schools	6.21	3.418
Lack of clear guidelines from the management team on how to proceed and other issues	5.29	3.280
Lack of support from the management team	3.98	3.267
Failure of VLEs	4.82	3.129
Unstable Internet connection (teacher)	5.24	3.415
Unstable Internet connection (pupil)	7.26	2.874
Lack of support from other teachers	4.27	3.247
Lack of interest from pupils	6.06	2.969
Lack of family involvement	5.72	2.926

No significant differences were found in terms of the type of school, the area in which the school was located, or the school years taught by teachers; however, there were significant differences in terms of gender, socio-economic environment of families, age, and years of experience.

In terms of the infrastructures and resources available for teachers during lockdown, of the total of 723 teachers who responded to this question, more than 95% stated that they had Wi-fi connection, technological devices, digital communication tools, and digital content creation tools available. Some 74.3% stated that they had VLEs and 65% peripheral devices they could use.

There were no significant differences by territory and gender in relation to the availability of infrastructures and technological resources; however, significant differences were identified in terms of the type of school, the socio-economic environment of the families, age, years of experience, and school years taught by teachers. These differences were found in the variables related to peripheral devices, VLEs, and digital content creation tools.

With regard to the type of technological resources used by teachers for their remote learning activities, as can be seen in Table 4, the most used were digital communication tools and data storage tools, with an average of 9.51 each, and the least used were social networking tools, with an average of 3.58.

Table 4. Technological resources used in distance learning activities.

Type of Technological Resource	Mean	Std. Deviation
Information search tools	9.45	2.006
VLE	7.40	3.837
Digital communication tools	9.51	2.159
Digital content creation tools	8.13	3.096
Social media tools	3.58	3.422
Data storage tools	9.51	2.292
Others	6.28	3.606

No significant differences were perceived with respect to the type of school or the area in which it was located. The socio-economic environment of the families showed significant differences in the use of VLEs. As for age, there were again significant differences in the use of VLEs and digital content creation tools. In both cases, use decreased as the teacher's age increased. The same applies to the item on digital content creation tools and teachers' years of experience; with more years of experience, the less these tools were used.

Finally, there are also significant differences in terms of the school years taught in the use of VLEs, digital content creation tools and other possible technological resources used. In all three cases, their use was higher in the second stage.

In response to the question of whether teachers had ICT training before the pandemic, Table 5 shows the data for the different independent variables considered.

Table 5. Pre-pandemic ICT training.

Variables	Typology	Yes	No	Self-Taught
Institution	Public	31.07%	10.36%	24.30%
	Private or publicly funded private	19.44%	4.09%	10.74%
Area	Bizkaia	29.16%	6.39%	18.54%
	Gipuzkoa	14.58%	5.37%	10.23%
	Álava	6.78%	2.69%	6.27%
Socio-economic environment	Low	7.54%	1.79%	5.75%
	Medium Low	21.74%	7.16%	15.47%
	Upper intermediate	19.82%	5.12%	13.17%
	High	1.41%	0.38%	0.64%
School years taught	1st stage	21.10%	8.06%	17.39%
	2nd stage	29.41%	6.39%	17.65%
Gender	Woman	37.98%	12.28%	27.75%
	Man	12.02%	1.92%	6.91%
	Other	0.51%	0.26%	0.38%
Age	21–30	7.29%	1.66%	8.57%
	31–40	9.46%	4.73%	10.36%
	41–50	14.96%	5.50%	7.54%
	51–64	18.80%	2.56%	8.57%
Years' teaching experience	0–10	12.92%	4.73%	15.73%
	11–20	13.43%	6.14%	9.85%
	21–30	13.17%	1.66%	5.24%
	31 or more	11.00%	1.92%	4.22%
	Total	50.51%	14.45%	35.04%

Furthermore, when the answers given by teachers to this question were related to the availability of infrastructures and resources, as shown in Table 6, around 97% of the participants had Wi-fi connection and technological devices, around 96% had digital communication tools, around 85% had digital content creation tools, 75% had VLEs, and more than 67% had peripheral devices.

Finally, the types of pre-pandemic IT training that teachers reported they had were: Google Classroom, Google Drive, Google Suite, Microsoft Office, Google Sites, blog, Google Meet, Gmail, and Microsoft Word. The areas they would be most interested in having training on were, first: Editing and creation of digital material, classroom, site, blog, and liveworksheets. This was followed by VLEs, digital communication tools, social media, data storage, and digital content creation.

To sum up, the hypotheses H1.1., H2.1., H3.1. and H5.2. are confirmed, while H1.2, H4.1., H4.2. and H5.1 are partially confirmed.

Table 6. Infrastructure, resources, and previous training.

Infrastructure and Resources	Previous Training	Yes	No	Self-Taught
Wi-Fi connection	Yes	49.74%	13.17%	34.14%
	No	0.77%	0.90%	0.64%
	NA/NK	0.00%	0.38%	0.26%
Technological devices	Yes	49.74%	13.30%	33.63%
	No	0.77%	0.90%	1.02%
	NA/NK	0.00%	0.26%	0.38%
Peripheral devices	Yes	36.45%	7.03%	23.79%
	No	13.68%	7.03%	10.36%
	NA/NK	0.38%	0.38%	0.90%
VLEs	Yes	40.79%	8.57%	25.70%
	No	8.57%	4.99%	8.44%
	NA/NK	1.15%	0.90%	0.90%
Digital communication tools	Yes	49.49%	13.17%	33.12%
	No	0.77%	1.02%	1.15%
	NA/NK	0.26%	0.26%	0.77%
Digital content creation tools	Yes	45.14%	9.97%	29.41%
	No	4.48%	3.32%	4.48%
	NA/NK	0.90%	1.15%	1.15%

4. Discussion

In recent times, educational authorities and institutions have made great strides in promoting DC training for teachers and providing ICT resources, especially from the 2009–2010 academic year onwards. However, although this study shows that 50% of teachers have had ICT training (a lower percentage in state schools), the educational institutions should continue to promote it [13] to ensure that 100% of teachers are properly trained in DC and are not left to fend for themselves. As López-Meneses and Fernández-Cerero [11] have stated, there is still much to be done. The participants in this study expressed interest in continuing their training in digital resources, with Google Classroom, Google Sites, and blogs being their highest-ranked preferences, as Álvarez stated [42]. In fact, as this author referred, the edition and creation of digital content and security were pointed out as weak points during confinement. The present study highlights the need for teachers to be trained in these aspects, among others.

Contrary to the claims by Portillo et al. [24], teachers' lack of ICT training was not perceived by the participants in this study as one of the main difficulties when carrying out their professional roles. However, the lack of clear guidelines or support from the management team, the failure of VLEs, their unstable personal Internet connection, and the lack of solidarity from other teachers were mentioned as the main limitations. Moreover, the schools where families belonged to lower-income socioeconomic environments lacked DC, with less than 10% of their teachers having been trained in ICT. This is one of the digital gaps that should be addressed.

In relation to age, the percentage of teachers with pre-pandemic ICT training increased with age. This suggests there may be a shortfall in ICT training in the degree for Primary Education, as pointed out by Silva et al. [43] and Fernández-Cruz and Fernández-Díaz [44]. Yet, younger teachers had a more positive perception of their lack of training than other teachers. This may be due to the fact that they are more accustomed to the use of ICT, as they belong to the generation of digital natives.

Moreover, given the fact that ordinary school learning is face-to-face, it is not surprising that the pandemic has presented teachers with a major challenge [18,19]. In fact, this study has shown that primary school teachers in the BCAR have been overloaded with work due to the need to redesign and reorganise subjects, as shown by previous studies [16,17]. In this line, studies such as those by Álvarez-Núñez et al. [45] and Hortigüela-Alcalá et al. [46]

highlight among the most relevant difficulties perceived by teachers in primary schools some of the conclusions derived from the present study. Among them, the following stand out: The digital gap between students from different social contexts; difficulties of VLEs when dealing with a large number of participations in a limited period of time; lack of support from the educational administration; lack of support and coordination of the center team and its teaching staff.

Following the recommendations of García-de-Paz and Santana Bonilla [47] and the results obtained in this study, it is necessary to reflect on the participation of the teaching coordination teams in the decision-making process of policies that concern the integration of new learning contexts in educational proposals, among others.

In relation to the availability and management of technological infrastructures, the participants, contrary to some of the conclusions of the study carried out by Reimers and Schleicher [20], did not consider this to be one of the aspects that had the greatest impact or hindered their teaching. Additionally, in contrast to the report by ECLAC-UNESCO [21], the participating teachers claimed to have been provided with a range of ICT infrastructure and resources during lockdown. Nearly all of them had access to Wi-fi connection, technological devices, communication tools, and content creation tools. Our study clearly shows access to digital resources by teachers but does not address the quality of their use. Future research should continue to analyse the different types of digital gaps [48,49] (access, use, training, generational) and their implications for the development of DC [47]. In this line, in the context of the BCAR, a decree has recently been published for teachers to certify their level of digital competence [50].

It is also worth noting that in schools where families had a high-income socio-economic environment, the impact on the professional environment of some variables (lack of ICT training for teachers, families, and pupils; lack of ICT resources for teachers, families, and pupils; precarious technological resources; excessive bureaucratic obstacles from schools; pupils' unstable Internet connections; lack of interest of pupils and lack of involvement of families) was lower than in the rest of the schools where families came from to a low, medium-low and medium-high socio-economic environment.

The technological resources that were most often used by the teaching staff for their remote teaching activities during lockdown were digital communication tools, data storage tools, and information search tools; the least used were social media tools. After all, these have been the communication channels between teachers, families, and pupils.

The availability of digital content creation tools was lower among teachers in the second stage, despite the "Eskola 2.0" project, which is certainly surprising. However, this was not the case for the availability of VLEs, which was greater in the 2nd stage; at this stage greater use was made not only of VLEs (even though their availability was lower) but also of tools for creating digital content and other technological resources. We believe this is because the use of these platforms increases as we move up the educational ladder.

However, a large digital gap could still be seen when considering the socio-economic environment variable. The higher the income, the greater the availability of these resources and the greater the use of VLEs during the pandemic. This was also found for the variable of state-funded public schools and private schools.

The use of these virtual environments decreased as teachers' age and years of experience increased. This brings us back to the fact that younger teachers may be more familiar with the use of ICT because they belong to generation Z [44].

One of the limitations of this study is that only the situation of Primary Education teachers in the BCAR was analysed. It would be interesting to replicate the study with teachers from all the Spanish autonomous regions and all education levels, from primary education to university. As mentioned above, another possible line of research for the short term would be to analyse whether teacher DC is being further developed in the current post-pandemic era. Unfortunately, we are facing a situation of uncertainty from which educational institutions and professionals should emerge stronger and better prepared for the future in order to train true 21st century citizens. Further studies should deepen ways

to implement changes at different levels, such as the curriculum, pedagogy, institutional practices, and policies.

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Resilience and Academic Dropout in Ecuadorian University Students during COVID-19

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Abstract: The pandemic caused by COVID-19 has had a global impact that has affected all areas of people's lives. However, people have different capacities to adapt and cope with the adversities and traumatic events that may have occurred during the pandemic with different levels of resilience. One collective affected by this global crisis was university students, who had to face an unprecedented academic situation, resulting in some abandoning their studies. This study aims to analyse whether the resilience of the students could be related to academic dropout. To carry out this research, we assessed the resilience of 1676 university students from 11 universities in Ecuador. To do so, a committee of experts from the Ecuadorian Association of Social Work Education Centres and 11 Ecuadorian universities designed a questionnaire and sent it to the entire sample. Subsequently, we compared the levels of resilience between university students who withdrew from university during the COVID-19 pandemic with those who continued their studies by using a multivariate analysis. The results showed that there were statistically significant differences in all variables analysed. The students who obtained the highest scores were those who continued their studies, and those students who dropped out obtained the lowest scores. In summary, we found that school dropout among Ecuadorian university students during the COVID-19 pandemic was due to low levels of resilience. Therefore, increasing student resilience could improve university retention rates and, in turn, academic performance and future life prospects.

Keywords: resilience; academic dropout; higher education; SARS-CoV-2; pandemic

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1. Introduction

COVID-19 manifested as atypical cases of pneumonia in China and on 11 February 2020, the WHO considered the illness to be caused by a novel coronavirus [1]. On 11 March 2020, the WHO confirmed that the outbreak was a global pandemic. The virus in question has likely caused the most impact and damage internationally in recent decades [2].

COVID-19 drastically changed people's lives, and also had global economic, social and political consequences. Such repercussions drastically affected the living conditions of citizens, generating uncertainty, fear, massive disruptions and economic recessions that reorganised the economy's offer and demand [3]. Regarding the impact of the crisis, other authors have studied conditions that cause distress, mental disorders, and unemployment, which can lead to suicide in many cases [4]. Another factor that affected mental health due to COVID-19 was parents having to work remotely as their workload doubled and new strategies were required to school their children [5,6]. For Pietromonaco et al. [7], the pandemic increased stress levels, affecting couples' relationships and their individual vulnerabilities, such as insecurity and depression. Furthermore, it has been noted that significant affective, ethical and spiritual values implying emotional bonds hold a binding

meaning for elements that are implicit to resilience [8]; as a consequence, and despite mobility and clustering restrictions, the pandemic in some countries increased religious practice and addiction to internet use [9,10], as well as smoking and alcohol abuse and their possible link to SARS-CoV-2 [11].

Education was not spared from the impact of the crisis and it was one of the sectors most affected by the pandemic [3]. The world's education systems did not foresee systematic actions to mitigate the closure of education facilities, disrupting the education of over one billion learners. This affected learners, teachers, parents and other education-related actors [12]. Authors like Hanushek and Woessman (2020) have connected the impact of learning losses to a lasting economic impact, where the loss of a third of one academic year caused by COVID-19 will affect the students' income by approximately 2–4% during their working life. The magnitude of these social and economic consequences have been compared to economic crises, environmental disasters, revolutions and terrorist attacks, with the main difference being the considerable risk for public health requiring direct family attention [13].

According to a UNESCO publication (n.d.) [14], some of the harmful effects of school closures due to COVID-19 include learning disruption, malnutrition, digital inequality, greater pressure on schools and social isolation. The World Bank [15] analysed how unemployment and a lack of earnings will be a predominant factor for dropouts, causing more poverty and higher inequality. However, for Schleicher [16], the most affected students will be those who do not have access to digital learning resources and lack the resilience elements required to learn. According to Herrman et al. [17], resilience is a positive attitude towards the ability to maintain or regain mental health in the face of adversity. Resilience can transform life in times of adversity and, although it can be present in other aspects of life, it is during unanticipated times that it can develop with more impetus [18]. For Forés and Grané [19], resilience is strictly related to the ability that an individual has to cope in a situation and change it despite conditions that are detrimental to his or her development.

While this crisis required an immediate response, the impact of COVID-19 hit many households in Ecuador, particularly the most vulnerable. At the onset of the pandemic—early 2020—26,336 COVID-19 cases and 1063 deaths were recorded in Ecuador, deaths that were mainly concentrated in a single city (Guayaquil) [20]. For a relatively small country, this figure caused a national state of alarm [21]. Bonilla and Guachamín [22] reported on the reality in Ecuador and indicated that only 37.23% of households had a computer, which was lower in rural areas and deprived neighbourhoods (23.27%). During the first half of 2020, employment dropped by 11.1 %, placing employment at 52.8%, as an additional 643,420 people became unemployed. Of this group, young people aged between 15 and 24 years were the most affected (25.8% reduction), many of whom were students [23]. Furthermore, access to the health system, which was historically believed to be inefficient, was weakened even more, increasing health inequalities, mainly in rural areas [24]. During the first year of the pandemic, Ecuador was ranked eleventh in South America for COVID-19 testing (13,835 tests per million inhabitants), only ahead of Guyana and Suriname. An additional 27,000 deaths were reported compared with the three years before the pandemic [25].

Social and environmental sustainability play an important role in the resilience factors identified in the research. The COVID-19 pandemic deconstructed imposed social and environmental practices and rescued practices recognised for their own cultural identity and worldview. The pandemic was like a laboratory for de-imagining education from the perspective of family and environmental social sustainability [26]. As a consequence, during the health crisis, the family strengthened sustainable development practices through the recovery of memory, such as ancestral health, and the use of medicinal plants to mitigate the effects of COVID-19 or to recover family health in the face of the demand for care in public hospitals; it also recovered, in households, the need to create family gardens,

community practices of exchange, intergenerational integration, community work and bartering, which form the basis of the "Sumak Kawsay" [27,28].

In this context, one consequence of the pandemic among the Ecuadorian university population was academic dropout. Tinto [29] described academic dropout as being the process that interrelates academia with the students' social backgrounds in which different dynamics and conditions interact, including ethnic group, gender, lived experiences, academic achievements, family support and economic status. The paper also indicated that each of these factors will also enhance performance and the impact on those remaining in education. Authors like Greenland and Moore [30] who based their work on Tinto's [29] theory suggested that dropout or withdrawal was based on the student's level of commitment and their motivation influenced by friends and social groups that support learning. They further indicated employment as a predominant factor in withdrawal, as well as family and social interrelations. Resilience is related to factors such as dispositional optimism, i.e., the optimism that makes achieving goals and high efficiency possible [31]. To this end, Intriago et al. [32] stated that resilience is characterised by the human condition of being able to push for a goal in the face of defeat, and that "protective factors" will play a fundamental defensive role in goals being achieved. In keeping with these factors, they mentioned that high self-efficacy rates generate a greater ability to face adversity [33,34]. For Pereyra Girardi et al. [35], the self-efficacy construct can have several variables, including a protective factor, whereas Bandura et al. [36] indicated that self-efficacy is directly related to how a person behaves when facing a potentially stressful situation and is what gives human beings the impetus to achieve their goals by applying their skills and abilities, providing the motivation required to reach a goal [37].

1.1. Literature Review

There are studies on resilience that use existing methods and instruments. Levels of individual resilience, according to Jew et al. [38], are measured in three dimensions: optimism, skill acquisition and risk taking. For Doll et al. [39] resilience is measured using interpersonal relationships across four categories: frequency of social interaction, ability to resolve minor disagreements, frequency of prosocial behaviours and ability to resolve conflicts. Authors such as Hjemdal et al. [40] considered an individual's abilities to adapt when faced with new risky situations, defining the "resilient self" through a 14-item instrument. Other authors such as Wagnild and Young [41], developed a resilience scale based on self-acceptance and personal competence in five dimensions: perseverance, self-confidence, meaning in life, philosophy of life and equanimity. For students, Perry and Bard [42] developed a scale called Resilience Assessment for Exceptional Students (RAES), in which they identified 3 domains of resilience with 11 factors and 54 items. These domains were: knowledge of exceptionality; planning for needs; and alternative thinking for exceptional problem solving. Aspects of resilience such as commitment, burnout and its opposite, engagement, were applied to university students in Spain, Portugal and the Netherlands [43,44]. There are other instruments developed for students, such as the one proposed by Maslach and Jackson [45] that includes three categories: emotional exhaustion, cynicism and low efficacy. Warren and Hale [46] conducted a study of resilience and academic beliefs in students at a public university in the southeastern United States, using a brief resilience scale (BRS). The BRS is a five-item self-report measure developed by Smith et al. [47] that assesses resilience to stress. In Latin America, Salgado [48], developed an instrument to assess five resilience factors, self-esteem, empathy, autonomy, humour and creativity, that responded to Peru's own reality. In Mexico, Valadez [49] assessed the so-called "Mexican Scale", 43 items arranged in four categories: (social competences, family support, social support and structure), whereas Palomar and Gómez [50] developed a measurement scale of 25 items grouped in five dimensions.

As can be deduced from the previous paragraph, the existing resilience instruments take into account the specific reality of the subjects under investigation, and there is no model that is generally used by the scientific community. For this reason, no methods

and instruments were found that were developed and applied under this "new" reality of a global pandemic, nor did they include specific realities, such as the cosmovision of Ecuador's indigenous peoples and ethnic groups [51].

The Ecuadorian people has a great variety of indigenous ethnicities, peoples and nationalities (14 nationalities and 18 peoples). In this sense, according to Hurtado [52] in his book "Las Costumbres de Los Ecuatorianos" (The Customs of Ecuadorians), personal and family relationships are part of cultural and social relationships; however, these relationships in indigenous communities, Afro-descendants and minority ethnic groups, can be affected by discrimination and communication [53,54]. Family relationships and violence may also affect the personal relationships of students in the coastal region [55].

The existence of various nationalities, ethnic groups and peoples should not be seen as a hegemonic condition that implies superiority of one over another. For Boaventura de Sousa [56], plurinationality is a recognition of the country, which implies respect for its social and cultural rights. However, the culture of these peoples, which is part of their identity, is at risk and influenced by dominant groups and external agents [57]. According to Davalos [58], peoples and nationalities feel that their territory and culture are becoming vulnerable; therefore, they live in constant socio-cultural risk. On the other hand, not only is socio-cultural risk present but, due to natural phenomena, the population also "lives" in constant risk. Its territory is part of the Pacific Ring of Fire and is therefore exposed to constant earthquakes [59], as well as periodic flooding due to high rainfall caused by the influence of the El Niño warm current [60]. Faced with these realities, authors such as Anzola [61] and Páramo [62] consider resilience as a protection factor for people, especially indigenous students in conditions of poverty [63].

1.2. Hypotheses and Objectives

Studying the living conditions and academic dropout of university students became a priority for social work schools at 11 universities in Ecuador. For students, these conditions could generate traumatic situations, which were strictly related to the threat to life and the threat to collective and individual health and how they cope or overcome a crisis, individually or collectively. If they were not able to overcome said crisis, there would be an increasing unmet need, where the following factors should be considered: ethnic group, gender, education level, age, socio-economic and employment situation, etc. [64,65]. In this scenario of unprecedented socio-educational transformation not foreseen by the government, educational institutions or the students themselves, online support networks were created. For Aranda and Pando [66], these transformations arose within the framework of social interrelations and were related to caring and protecting others using support networks. Meanwhile, for Hernández et al. [67] they were informal support networks where identity strengthening is also built upon.

The objective of this study is to analyse if there are significant differences in the resilience of students who continued their studies and those who withdrew from university due to the effects caused by the COVID-19 pandemic in Ecuador.

This study aims to answer questions such as: What resilience factors do university students have because of COVID-19? Does the level of resilience affect university dropout? Is there a difference in the family relationships of those students who drop out because of COVID-19 and those who do not?

This paper is structured as follows: This section reviewed the literature on the health crisis caused by COVID-19 and offered a general overview of the situation and how it affected the population in Ecuador, especially the impact it had on education and academic dropout, which is the main objective of this study. The second section describes the method used for the study and specifies the participants in the sample, the instruments, procedures and the data design and analysis. The third section presents the results obtained from the statistical analysis comparing sample groups of students who continued their studies or withdrew from university. Lastly, the fourth section includes the main conclusions and discusses a possible future study.

2. Method

2.1. Participants

Ecuador has 71 universities (632,541 students), of which 11 universities have a degree in social work. The total number of social work students in the 11 universities is 3775, of which 1695 students participated in this study. These 11 universities are as follows: Central University of Ecuador, Ambato Technical University, National University of Loja, Cuenca University, Catholic University of Cuenca, Civil University Eloy Alfaro de Manabí, Manabí Technical University, Luis Vargas Torres University, Machala Technical University, Milagro State University and Santa Elena Peninsula State University.

As shown in Table 1, the average age of the participants was 22 years, and their ages ranged from 18 to 47 years.

Table 1. Descriptive statistics for participants' age by gender.

Gender	N	Min Age	Max Age	Age Avg.	Age Std. Dev.
Female	1111	18	46	22.25	2.977
Male	584	18	47	21.83	3.263
Total	1695	18	47	22.10	3.084

2.2. Instruments

The global pandemic caused by COVID-19 has created a new social problem scenario for which there is no evidence of methods and instruments that specifically measure resilience in this type of context. Under this new reality, experts from the 11 Ecuadorian universities (sociologists, psychologists, social workers and anthropologists) developed a measurement instrument with four factors/categories and resilience items during the pandemic (period of maximum impact) taking into account the realities, socio-cultural and family realities from the worldview of the peoples and communities of Ecuador [51,68].

We designed a social resilience assessment questionnaire (Table 2) using the Delphi method to find out how the participants coped during the COVID-19 health crisis. The research instrument included 29 items grouped in four categories of semantic units of resilience: interpersonal resources, family resources, sociocultural resources and coping with the risk situation.

To this end, we asked participants to answer the questions in Table 1, stating to what degree the statements described them by selecting one of the following four options from a Likert-type scale ranging from 4 to 1: always, almost always, almost never, never.

The questionnaire was approved by ten professionals based on the expert judgement method. Following the expert judgement, the Aiken's V coefficient was 0.96 and Cronbach's alpha was 0.80 for the whole scale.

2.3. Procedure

We conducted this study in response to 11 Ecuadorian universities deciding to take part in a study within the context of the COVID-19 health crisis. All universities offer degrees in social work and are members of the Ecuadorian Association of Social Work Education Centres (ANUATSE is its acronym in Spanish). The study was based on the principles of voluntary group participation. After the Association announced a student support project (called "COVID-19 support network") to its members, the heads of the degrees in social work agreed to be part of the study to consider the social problem of university students under this "new" reality throughout Ecuador.

The study started with ANUATSE formally communicating with authorities from the participating universities and the Council for Higher Education (the Council for Higher Education (CES) is an Ecuadorian institution that plans, regulates and coordinates the higher education system, and connects the different education actors with society to guarantee citizens a quality education and boost growth in the country [69]). Certification of the research project and informed consent (ethical considerations) for the application of the

survey was issued by ANUATSE, and the research was carried out with the endorsement of the CES.

Table 2. Resilience questionnaire.

1.	I apologise when I feel like I've made a mistake
2.	I share my problems with my friends
3.	I think one needs to tell the truth and be respectful to have friends
4.	I feel proud of the person I am
5.	When something difficult happens in my life, I get over it quickly
6.	It's important for me to have people that support me during difficult times of life
7.	If another person bothers me, I ask them to change the way they behave towards me
8.	I feel uncomfortable when people tell me about sad situations
9.	If someone asks me for help, I listen to them
10.	I find it hard to put myself in someone else's place when they're telling me about something that happened to them
11.	I feel like I receive support from my family when I have problems and/or needs
12.	Among my family and the people I live with, we talk and share our problems
13.	My family and the people I live with accept and support my decision to pursue new activities
14.	My family and the people I live with express their affection and respond to my emotions, such as anger, sadness and love
15.	My family and the people I live with spend time together in different parts of the house
16.	In my neighbourhood or community, we are prepared to face any type of situation
17.	The people in my neighbourhood or community are supportive of one another when there is a need
18.	In my academic preparation, I have received training about skills and strategies on how to face this situation
19.	I trust the educational institutions' responses to propose strategies to deal with the emergency situation
20.	The state institutions in my neighbourhood or community care about the well-being of my family or my neighbours
21.	I feel like state institutions respond to the needs of my neighbourhood or community
22.	The measures currently adopted by the State improve my family's quality of life
23.	Feeling like I belong in the place where I live allows me to develop emotional bonds of identity to face this crisis
24.	As citizens, strengthening national identity is important to face a crisis situation
25.	Customs and traditions are important resources to make us stronger during difficult times
26.	I didn't believe that the situation would reach the magnitude it has
27.	I try to take something positive from the country's situation
28.	I try to not think about the country's situation so as not to worry
29.	I feel defenceless and unable to do anything to change the situation

We then confirmed the data protection protocol, ensuring that participants had given their informed consent and that the data would be used appropriately. A database was created on the Eloy Alfaro de Manabí University's (ULEAM) virtual platform. Due to confidentiality and data protection, access to this database is restricted except for researchers from the participating universities. The method was developed by the Central University of Ecuador (UCE), and all participating universities created the analysis and instrument design.

The research was carried out in two stages: firstly, it was planned to survey university students and, secondly, the community in general. These surveys were carried out with the collaboration of students in the final stages of their social work degree courses. The students were mostly at home due to the suspension of face-to-face classes, but because connectivity in rural areas does not have total coverage [70], it was not known whether or all students had telephone or internet connectivity [71]. However, to use the research instrument, we considered the socio-economic conditions of each province (there are 24 provinces in Ecuador), a map and geo-referencing of each actor. We conducted the questionnaire from May 2020 until September 2021 via telephone calls (mobile or landline) or by sending a questionnaire link via email. The phone calls and student emails were carried out by students who were studying social work, a total of 220 students. Before starting the questionnaire, we informed the participants that they were participating voluntarily and asked them to consent to their data being recorded via the tool Kobo Collect.

2.4. Data Analysis and Design

To obtain the students' profiles, we assessed the students' resilience level during the COVID-19 pandemic.

We later conducted a statistical analysis in which we compared the resilience profiles of students who continued their studies and those who withdrew from university during the pandemic. We compared the groups using the general linear model (GLM) in the SPSS statistics package (version 24) along with a multivariate analysis of variance (MANOVA) and an analysis of variance (ANOVA), which is the procedure commonly used to analyse profiles. The approach to repeated measures designs offers several advantages over the traditional univariate approach. It does not make the assumption of sphericity that is so rarely met by psychophysiological data or in the behavioural sciences in general [72]. In said analysis, we used resilience variables as within-subject variables and the student groups (those who continued and those who withdrew) as between-subject variables. A t-analysis was used when it was necessary to analyse variable-by-variable behaviour.

3. Results

The result from the evaluation of assumptions of this analysis using Box's M test showed that there was homogeneity in the variance-covariance matrices (F = 1.525 and $p = 0.123$) being considered equivalent groups for the study. However, Mauchly's sphericity test did not show sphericity for the matrix of dependent variables (DVs) (W = 0.753, $\chi^2 = 480{,}899$, gl = 5 and $p = 0.000$).

Since the matrix shape of the dependent variables was not spherical, the degrees of freedom for the intra-subject tests were corrected for the effects of "flatness" (resilience effect) and parallelism of profiles (effect of interaction resilience * withdrawal from university COVID), with the epsilon correction values calculated in accordance with Greenhouse–Geisser procedures $\varepsilon = 0.853$, Huynh–Feldt $\varepsilon = 0.854$, and lower bound $\varepsilon = 0.333$. The result of the intra-subject effect analysis with the corrected degrees of freedom showed that the profiles were not flat but they were parallel. The variations in the DVs were significant for all statistics in the flatness tests (F = 354,980; p =0.000 and η^2 partial = 0.173). These profiles are displayed in graph form in Figure 1. The variations in the resilience variables for each group in all statistics corresponding to the parallelism test were not significant (F = 2123; $p > 0.05$ and η^2 partial = 0.001).

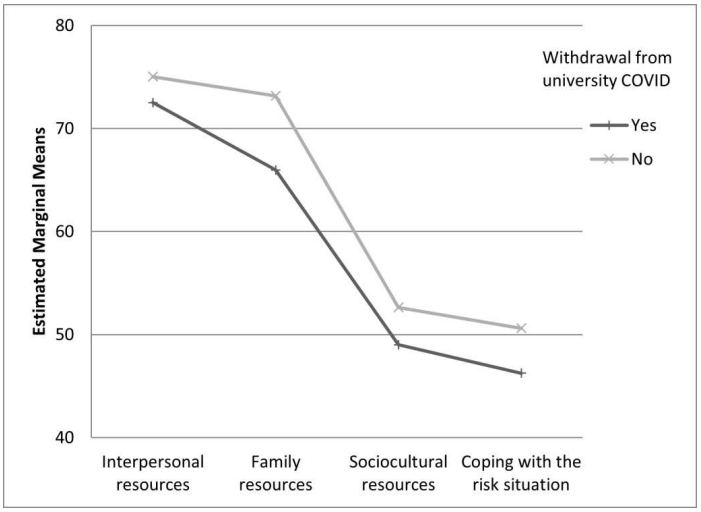

Figure 1. Resilience profiles of students who withdrew from university and those who continued their studies.

To analyse if there were significant differences in the resilience level of students who withdrew from university during the pandemic compared to those who did not, we conducted a level test (see Table 3). The results showed that the average resilience of one

group differed from the other (F = 20,150; p = 0.000; η^2 partial = 0.012); however, the effect size showed that the two groups were not so far apart.

Table 3. Test of inter-subjects effects.

Source	gl	F	*p*	η^2 Partial	Obs. Power [a]
Intersection	1	15,156.523	0.000	0.900	1.000
Withdrawal from university COVID	1	20.150	0.000	0.012	0.994
Error	1693	(59.493)			

[a] computed using alpha = 0.05.

Lastly, we conducted a t-test for difference of means to determine which variables showed differences between the two groups of students (Table 4). The results showed that there were significant differences in all variables (interpersonal resources, family resources, sociocultural resources and coping with the risk situation).

Table 4. *t*-test of independent samples of students who withdrew from university and those who continued their studies.

Variable	Difference of Means	T	Sig.
Interpersonal resources	−2.5	−2.497	0.000
Family resources	−7.2	−3.685	0.000
Sociocultural resources	−3.6	−2.274	0.000
Coping with the risk situation	−4.4	−2.991	0.000

4. Discussion

This research led us to identify that those university students who withdrew from education during the COVID-19 pandemic were less resilient. Resilience included significant differences in all the factors we studied (interpersonal, family, sociocultural and coping with the risk).

Of all the resilience factors we analysed, the main difference was found in the variables related to family resources (−7.2 points). These differences could be related to worldview (the age-old view of the relationship between humankind and our natural surroundings) [73] as well as the social and cultural values typical of Latin American families, which together form a protective factor for its members. Culturally, most university students are influenced by their cultural traditions and live with their families until they complete their academic studies, or even later, in some cases. Based on this, we can assume that family resources will have an important repercussion on the students' daily lives.

The next most significant resilience factor was "coping with the risk situation" (the difference between student groups was −4.4 points). This factor requires students having access to effective protective factors for them to continue their university studies and are dependent on the lack or limitation of effective protective mechanisms that may expose them to withdrawal or affect their academic performance.

The resilience differences concerning sociocultural resources among the students who continued their university studies compared to those who withdrew were also significant (−3.6 points). Even though at a community level, strategies are developed to cope as a response to the need for health services, food, housing and working conditions in the population, these responses do not seem to have been enough to alleviate the situation that university students had to face during COVID-19.

Lastly, the interpersonal resource variable showed a significant difference between the two student groups (−2.5 points). These differences could be due to the initial lockdown situation experienced by families in Ecuador, and later, by the social distancing measures put in place due to the pandemic, such as the need for online classes, which gave way to other ways of interacting with others, (which were not new for the students, however). In this sense, the analysis suggests that general resilience strategies should be developed

for the public, but with a greater emphasis on the resilience of students' family resources. Although we identified family resources as an important protective factor for university students, this factor requires care, family monitoring, prevention, support and comprehensive coping strategies. According to Zambrano et al. [74], family members suffered the effects of the health crisis and were left unprotected, so older adults had to go out to look for work while students abandoned their studies due to lack of resources.

The study shows certain limitations with respect to the techniques used. Since these techniques depended on technology (telephony and internet), and this in turn depended on the economic level of the students, there was a bias in access to the study. Students living in rural areas who did not have these services could not be interviewed. Another limitation was the lack of personal information that the universities had about their students (home addresses, telephone numbers and mailing addresses). Moreover, the main weakness was due to the extreme situation created by COVID-19 in which the research itself was carried out, since the social work students who carried out the surveys were going through situations of risk and family affectation, to which were also added the mobility restriction measures. This meant that the data could not be collected in situ, and the opportunity to collect qualitative information based on direct observation and dialogue (in-depth data) was lost. However, despite these limitations, the strength of the research lies in the large amount of data collected, high student participation, the inclusion of diverse regions and cultures, and the integration of academically dispersed social work programmes.

5. Conclusions

COVID-19 is a social phenomenon that has led to devastating consequences on global, regional and local scales. We analysed the impact of resilience on university students in Ecuador during this new scenario. However, there are studies linking the pandemic and the right to education, its impact on schooling and state obligations, as well as the closure of education facilities in Latin America [75].

In summary, we found that academic dropout in Ecuadorian university students during the COVID-19 pandemic was due to low resilience levels. To this end, calling for new legislation considering the ethics and politics that would benefit university students should be made a priority. Trying to increase students' resilience could improve university retention rates, and in turn, their academic performance and future life prospects.

To improve resilience capacities in the interest of academic improvement, student welfare departments should implement an online care system as an initial action because, as Vargas [76] mentions, the increase in family violence caused by the pressure of a lack of employment can influence negative aspects in students, such as alcohol consumption, smoking and unauthorised drug use.

In the future, we plan to study the COVID-19-related resilience factors that could affect academic performance to a greater or lesser extent and examine how these factors evolve following the pandemic. We will also analyse other social factors that could cause academic dropout, such as domestic violence, the use of psychotropic substances, the use of alcohol and unemployment caused by COVID-19.

We also plan to conduct further studies aimed at developing participation and planning strategies for higher education public policy to improve the overall health of students and their return to university. Although these policies are medium- and long-term, emerging assessments for students at risk in the short term could facilitate learning in conditions of equality that produce, as mentioned by Camargo-Velastegui et al. [77], a formative education, autonomy and self-regulation of students as well as the commitment of a teacher as an empowering agent. In this sense, we also hope that this further study will encourage authorities to create social policies or recommendations to minimise the impact of future pandemics or other serious crises.

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Challenges of the Coronavirus Pandemic as an Opportunity for Sustainable Digital Learning in Vocational Education and Training (VET)

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Abstract: In addition to restrictions in training companies, vocational schools were also closed due to the coronavirus pandemic in Germany. After the unexpected first lockdown, it was the challenge of all those involved to draw lessons from the emergent weaknesses in the system and to prepare for further school closures. These preparations primarily involved shifting to digital learning platforms. This article uses a simple and easy to understand research design and focuses from a practical point of view on the results of a quantitative online survey conducted by the University of Applied Labour Studies Mannheim among 143 apprentices in southern Germany on the differences between the first and second school closures with regard to live communication with teachers, attention to apprentice concerns by the vocational school, access to digital devices, and the use of these devices. The results of the survey show that, according to the apprentices' assessments, the vocational schools were able to improve live communication as well as better attend to the apprentices' concerns between lockdowns. In addition, the apprentices were able to improve their own digital devices and competencies and, to a large extent, make up for deficits. They were better able to use digital devices and software during the second school closure compared to the first. Gender differences were observed. However, despite significant improvements, there is still a need to modernize and innovate, which should be considered in future digital developments at schools.

Keywords: apprenticeship; digitization; distance learning; school development

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1. Introduction

In addition to the immediate health consequences, the coronavirus pandemic also triggered social and economic consequences due to the measures implemented to contain the virus. The closure of cultural and recreational facilities and businesses was accompanied by the closure of general as well as vocational schools and other educational institutions. In both the first temporary and unexpected school closure in Germany in spring 2020 and the second closure in December of the same year, students and apprentices were faced with the challenge of learning on their own from home and, if offered, participating in online classes.

This online learning required technical competence among teachers and access to digital equipment such as a computer, a laptop, or a tablet, and a sufficient Internet connection. Prior to the pandemic, this extensive digital equipment was not necessary for successful participation in face-to-face classes. After the start of the pandemic, digital devices were much needed but often not available to those in need, which included students and teachers, and which highlighted inequalities in access to digital equipment [1]. In the literature, it has generally been argued that longer periods without schooling, differences in digital equipment, and a lack of digital competencies have had an important role with regard to educational inequalities and that these were reinforced during the coronavirus pandemic not only in Germany [2] but also worldwide [3]. However, during the time

between those two closures, measures such as financial support for the digitization of the educational system in Germany were taken to improve the access to digital equipment and to prepare for additional school closures [4].

As the coronavirus pandemic continued with a second school closure lasting several months, the question arose as to what extent the apprentices as well as the German vocational schools have been able to overcome the challenges posed by the first school closure.

There are now numerous studies on pandemic-related school closures in general education schools. However, there has been little research focused specifically on apprenticeships, and few studies have focused on digital learning and school development. Studies with a similar focus as this article, but limited to the initial school closure in Germany, notably include the study by the German Federation of Trade Unions [5] on apprenticeship during the coronavirus pandemic, and a study by Biebeler and Schreiber [6].

The objective of this study, therefore, was to provide initial insights into how the organization of online learning has changed and the extent to which learning in vocational schools can benefit in the long term from the changes brought about by the coronavirus pandemic. Primary data in the project "Successful Start into Apprenticeship" (Erfolgreicher Start in die Berufsausbildung, EStarA) by the University of Applied Labor Studies (HdBA) at the Mannheim Campus were analyzed. The data retrospectively referred to the assessment of apprentices in southern Germany on their learning situation during the first and second school closures.

In this article, we first outline the theoretical background of the study on the basis of pivotal considerations regarding the requirements of digital learning as well as the equipment required and the use of digital devices and learning media. This is followed by a description of the data and data collection, including the special features that were considered when interviewing young people, as well as a presentation of the method of analysis used in this exploratory study. A report of the results is followed by a concluding discussion with practical implications. Finally, the limitations of the study are reported.

2. Theoretical Background and Current State of Research

2.1. The German Vocational Educational System

To understand the special situation of apprentices and their increased burden during the pandemic, the role of vocational education and training in the secondary sector of the German educational system is first to be described. After nine years of compulsory general education, young people in Germany can start vocational education and training even without a formal school-leaving qualification, either full-time at a school or as part of a dual apprenticeship in combination with employment in a company. This paper focuses exclusively on dual apprenticeships, which represent a complex system combining two learning spaces: the learning of theoretical knowledge at a vocational school and the learning of job-related knowledge at the workplace in a training company, which is highly functional [7]. This special form of vocational education and training enables context-related learning of relevant professional knowledge through hands-on experience. Theoretically explored learning content is applied directly in everyday professional life at the training companies, which promotes the learning process. In addition, the apprentices gain valuable practical work experience during their apprenticeship. Compared to full-time school-based training, in which practical content is only included in short internships, dual vocational education and training thus enables a complex, comprehensive learning process.

In an international comparison, Germany is one of the countries with the highest proportion of dual vocational education and training. This combination of theoretical and practical knowledge supports the transition into the labor market [8,9] because in Germany, apprenticeships are usually attended directly after graduation from general education schools. This aspect is of great importance for young people's career paths.

However, the low average age at which apprentices enter the program should also be seen as a challenge. Apprentices often still live in their parents' household and can only rely on their work and learning experiences from general education school when it comes

to structuring their learning process. Vocational education, however, requires learning theoretical knowledge that is directly linked to the occupation, which is why systematic support takes place in vocational schools that focus on specific occupational areas.

Furthermore, the apprentices as well as the companies are supervised by so-called chambers. One example of this is the Chamber of Handicrafts. On the one hand, it advises companies in the handicrafts sector, which, along with the industrial sector, has the highest number of apprentices in Germany [7], and on the other hand, it also supports the apprentices (e.g., exam preparation).

2.2. Learning Space and Support

Designing a personal learning space and creating the technical conditions are especially important for learning success during school closures. This is due to the fundamental changes to the learning framework: both the personal (through social distancing) and spatial dimensions (school vs. home) as well as material resources (technology), which are important determinants of the learning space [10], were affected by the pandemic-related restrictions. This was highlighted in a report by the European Commission's Joint Research Center following the first school closure, based on qualitative interviews with 105 students and their parents from 10 member states (Austria, Croatia, Denmark, France, Italy, Norway, Portugal, Romania, Slovenia and Spain). The report pointed to the difficulties students face in terms of learning space, which could be inadequate under restricted living conditions, as well as insufficient digital equipment or the lack of personal interaction [11]. Similar findings were presented in Indonesia, where teachers reported problems with Internet access and student support at the onset of school closures, despite available digital devices and online learning platforms [12,13].

Prior to the coronavirus pandemic, most learning for apprentices had taken place at a set location at a scheduled time and had not required special equipment. The vocational school had served as a learning space most of the time, but it was no longer available during the school closures.

Using data from the socioeconomic panel, a study in Germany showed that learning success was strongly dependent on the learning environment at home [14]. This was also confirmed by Helm et al. [15], who reported in an international meta-review that students from socially deprived and educationally disadvantaged families had experienced lower learning success during the pandemic. It was in this context that school-based support was an important determinant of successful learning during the coronavirus pandemic. A study from the U.S. shows how important non-academic support is in addition to learning support [16]. This illustrates the relevance of a contact person for students. The great importance of a viable educational relationship during school closures has been supported from different perspectives. From the perspective of parents as well as teachers and students themselves, frequent and continuous communication has a high impact on distance learning and a positive effect on learning success [17–19].

2.3. Digital Learning

In this article, "digital learning" refers to distance learning supported by technological means as occurred during the coronavirus pandemic and the resulting school closures.

There is not yet a clearly defined and distinct term in the research literature for this pandemic type of learning, which is why other forms of digital-based learning are initially used to define the concept for this paper. In this regard, Helm et al. [15] drew on similar existing concepts used in the German educational system such as homeschooling (i.e., parents adopt the role of teacher) and distance learning (i.e., responsibility remains with an organization, but learning takes place on one's own and independent of location) as well as homework practices, on which the domestic environment has a strong influence. Particularly important determinants for understanding digital learning in this coronavirus pandemic context, therefore, are the spatial flexibility provided, a transfer of responsibility, and the domestic environment.

Digital learning generally allows for additional informal learning, which offers a high degree of flexibility and individuality as compared to solely formal learning, since it is not bound to an institution and thus provides numerous advantages for the design of the learning situation [20]. These advantages are also quite relevant for vocational education and training [21]. Comprehensive meta-studies [22] have also shown that online learners perform even better than when in traditional face-to-face settings The analysis of 45 international studies comparing face-to-face learning with blended learning on the one hand and face-to-face learning with mere online teaching on the other hand shows that blended learning in particular leads to significantly better learning outcomes than face-to-face learning. A Japanese study shows that online learning can reduce the negative effects of pandemic school closures [23]. Nevertheless, international research show that disparities in technical access and in the use of technical devices need to be addressed to avoid the remote learning paradox where students who suffer the most from learning losses cannot participate in online instruction due to limited internet access [24]. Therefore, in online learning, good planning and institutional support structures are particularly important for success [25]. At the same time, the challenge to transmit and capture emotions via online platforms should be taken into account when it comes to digital learning [26].

Digital learning requires adequate technical equipment and digital competency, but social inequalities have been be observed [27,28]. Helm et al. [15] reported that a higher socioeconomic background increased the quality of technical equipment and digital literacy.

In addition to digital literacy (i.e., individual computer skills), self-management and time management (i.e., self-regulated learning) have also been shown to be essential requirements for successful distance learning [29]. Approximately one-third of students have difficulties with self-organization in distance education [15].

In this regard, a study from China also indicates that self-efficacy in using remote learning during the coronavirus pandemic supports academic performance, underlining the relevance of using digital tools for successful learning [30].

However, deficits in digital competences can be observed in the international literature among both students and teachers [31–35].

From a teacher's perspectives, students' lack of expertise, in addition to their lack of independence, challenges their abilities to participate in online learning activities [36]. In this context, maintaining communication with teachers who support students in their self-organization may be all the more important.

Gender differences in the field of digital learning have yet to be adequately investigated. Nevertheless, there have been indications that these differences exist and have had an influence on learning in distance education. For example, previous studies have shown that young males had higher digital literacy ratings than young females [37]. However, contrary to expectations, a recent study by Korlat et al. [38] from Austria showed no difference between genders in children in terms of their competency assessments regarding digital learning. This result was explained by the overall higher academic competency assessment of young women. For the intrinsic motivation in digital learning, a higher value among young females was observed [38]. These results were particularly relevant with regard to the development of gender inequality over the course of the coronavirus pandemic.

2.4. Digitization in the Course of the Coronavirus Pandemic

Dual vocational education and training in Germany is characterized by a particularly high proportion of subject-specific content that is closely linked to practical knowledge, and is therefore strongly affected by challenges in online implementation [34]. Digitization has already been cited in a 2018 study as the most important topic for the future-oriented design of vocational education and training [39]. Nevertheless, German general education schools were not prepared digitally for the pandemic-related school closures. There was a lack of equipment, teachers were on their own when it came to distance learning practices, and for the most part, communication was via e-mail [36]. Similar findings on the first

school closures were also reported by studies focusing on dual vocational education and training [5,6].

Before the coronavirus pandemic, the use of digital content by vocational schools was limited.

A survey of teachers at vocational schools in Switzerland showed gaps in the supply of digital devices and technological deficiencies, but at the same time, they viewed distance learning as an opportunity for their own digital education [40]. A German survey among teachers after the first school closure also indicates the need for qualification in ICT, which already existed before the coronavirus pandemic [41]. These findings are supported by a Spanish study that shows that parents and students as well as teachers already had a need for further training in digital literacy before the pandemic and that this need was intensified by the pandemic, as was the digital divide [42]. In a comparison between Germany, Austria, and Switzerland with regard to teachers' digital competency and digital equipment, the results of the school barometer showed that teachers in Germany rated both their competence and their equipment lower than teachers in neighboring countries [43]. The results of a survey among teachers in Italy [44] as well as a report about the situation in Latin America [45] and Indonesia [46] underline the necessity of teachers' digital skills and pedagogical knowledge in online settings.

At the beginning of the coronavirus pandemic, it also became apparent that not only the vocational schools but also the training companies [47] had made little use of the opportunities for digital learning and had rarely enabled people to work from home [6]. Although the disruption to apprentices in the workplace varies by occupation, it is clear that reduced social contact and less informal on-site learning have a negative impact on the apprentices' motivation [48].

Overall, digitization was low in the context of vocational training before and at the beginning of the pandemic, which was why the lockdowns further complicated the teaching of vocational training content. At the same time, this situation highlighted the importance of a functioning digital learning environment and the urgent need for action.

2.5. School Closures during the Coronavirus Pandemic

Distance learning in the first school closure in spring 2020 had to be implemented without any time for preparation. The lack of structure for online teaching required independent learning by apprentices, who had different ways of organizing their learning; while some coped well with the unexpected learning shift, others did not. These differences resulted from, among other things, the high heterogeneity among apprentice programs. Standardized concepts for distance learning did not exist and, depending on the vocational school, the proportion of analog or digital content varied [49,50]. Initially, self-organization played a key role for participation in digital distance learning, which requires high motivation and technical interest [51]. Teachers reported that self-organization, in particular, was one of the greatest challenges alongside the digital requirements [52]. However, a study from Greece shows that interactive digital activities such as online quizzes increase motivation in digital learning during the coronavirus pandemic [53].

In this context, close school support with regularly provided tasks promoted students' independent learning: a study in Germany based on data from approximately 900 students at general education schools showed that students' time spent on learning increased with the frequency of tasks assigned [17]. This finding was also supported by an analysis of the National Educational Panel in Germany, in which children's academic performance was strongly related to parents' perceived satisfaction with the care their children received from schools [54]. Another study illustrated that teachers' support, by being available to students and providing feedback, also directly influences student satisfaction [18]. This is also evident in the international research literature. Han et al. report from a Chinese survey of about 270,000 students at vocational schools that technical preparation of instruction together with comprehensive support are the most important prerequisites for successful online learning [55]. Consequently, although regular support and feedback that promotes

learning require a great deal of effort on the part of teachers, it is worth the effort in terms of motivation and self-organization in distance learning [19].

An analysis of the school barometer by Huber [56] showed a high variance in the response behavior of the surveyed teachers regarding the technical equipment of the schools for the first school closure. These findings, particularly at the beginning of the coronavirus pandemic, indicated the need for a large proportion of schools to modernize.

The differences in technical equipment can also be observed among teachers, depending on their affinity and prior knowledge of digital learning, which was perceived by both the teachers themselves and the students [56]. A study from Jordan [32] showed negative attitudes of vocational school teachers towards the use of digital learning formats. For students Helm et al. [15] report that approximately three-quarters had sufficient digital devices at home to cope with distance learning, although they assumed that students with insufficient technical equipment may have also been under-reported. At the same time, Huber [56] points out that, even if it only applied to a small proportion of overall students, inadequate equipment was the greatest handicap to participating in online instruction.

A study by Züchner and Jäkel [29] indicated that before school closures due to the coronavirus pandemic, 60% of students were able to use a computer and approximately half (52.6%) were able to use Microsoft Office programs and do research on the Internet (54.4%). Nearly 30% were able to work with a learning platform. In the representative JIMplus 2020 study, 80% of respondents reported having a personal computer or laptop; 29% a tablet; and 82% at least a smartphone for completing school tasks during the first school closure. Headsets (15%) and webcams (6%), however, had rarely been used, supporting the study's other finding that 16% of students had participated in videoconferences and that 11% had contact with teachers by phone. A fixed weekly class schedule was available to 6% of students. Most students received assignments via email [57].

Digital devices were not provided in the initial lockdown in Germany and had to be purchased at the student's own expense, leading to inequalities based on socioeconomic status [1] due to the simultaneous closure of public resources such as libraries [58]. Additional problems with participation in online classes arose from insufficient Internet capacity with many people working or being educated at home, especially in rural areas [59].

Gender differences were also observed, as males may be more likely to use computers at home [60] and reported better overall technical equipment with regard to online learning during the pandemic in an exploratory study by the HdBA during the first school closure in spring 2020 in southern Germany [41]. The study also showed for this particular target group that apprentices felt inadequately supported by their vocational schools and that their concerns were not satisfactorily addressed. Classes were often not held via live media and the technical equipment as well as the Internet connection were not sufficient, and females were found to have disadvantages [61].

Overall, existing inequalities had been further exacerbated by the first school closure at the onset of the pandemic. The first school closure was unexpected, whereas the second school closure from winter 2020 to April 2021 was anticipated due to the development of the coronavirus pandemic. Klein [62] argued that the first school closure exposed German schools' poor IT equipment and digital competence deficiencies and should have served as an opportunity for improvements. The IT competencies of teachers were also essential for the success of distance learning [29].

The period between summer and fall 2020 was used, at least in part, to prepare schools and students for future school closures.

The German Federal Government has invested a total of 600 million EUR to fund the expansion of IT infrastructure and also five billion euros for a special funding project for digitization in schools [4].

Nevertheless, due to the federal structure, there was no standardized regulation in Germany. At the conferences of the ministers of education and cultural affairs, many attendees insisted that face-to-face teaching had the highest priority despite growing concerns regarding the spreading coronavirus pandemic. Ultimately, the schools were

directed to close nationwide by the winter break period in 2020. As the Organization for Economic Cooperation and Development (OECD) [63] noted, although school closures were widespread globally until the second quarter of 2021, the situation had improved significantly compared to 2020. In this context, distance learning occurred in a hybrid form, combining synchronous digital learning units with asynchronous content provisions. A survey of vocational teachers from Indonesia indicates a strong preference for synchronous online classes or the use of video-based content for learning, but these methods also have the greatest challenges and require the most effort [64].

A survey of parents in Germany by Wößmann et al. [65] on the second school closure showed improvements in the activities of schools and teachers, as compared to the first school closure, particularly in online teaching and personal contact between students and teachers. During the second school closure, the use of learning platforms was possible for most students without issues and equipment with suitable hardware and a sufficient Internet connection was available for a large proportion of students. Furthermore, students were able to improve their digital skills so they could follow lessons in an online format.

Overall, there was a notable improvement in the structures of distance learning. At the same time, the phase between the first and second school closures was not sufficiently used to smooth the transition from face-to-face to online instruction for all types of students and schools. The changes perceived by apprentices between the first and second school closures are examined in more detail in the following analysis.

3. Data and Methods

3.1. Survey Design and Data Collection

Almost two-thirds of apprentices in Germany are under 20 years of age at the start of their vocational training and have a lower or intermediate secondary school leaving certificate [66]. Therefore, apprentices usually start training after nine years of school at approximately 16 years of age. This study was based on primary data from the EStarA project of the University of Applied Labor Studies in Germany. Our survey design made it possible to meet the special requirements when surveying our target group of apprentices. In order to achieve high data quality when interviewing adolescents, context effects should be avoided [67–69]; therefore, our survey was conducted in cooperation with selected chambers of handicrafts and chambers of commerce and industry in the counseling centers as a computer-assisted self-interview (CASI). The questions were also aligned with the adolescents' personal experience [67]. The online questionnaire allowed for graphical visualization of rating scales to further enhance response behavior among adolescents [70–73] and to increase digital natives' willingness to participate [74].

3.2. Respondents

The respondents were apprentices in vocational education and training (VET) in southern Germany. Since only apprentices from selected cooperating chambers were able to participate, the sample could not be considered representative for Germany. In addition to a privacy statement from the HdBA with a reference to the data protection officer, participants received display cleaners for their smartphones as incentives.

A total of 143 apprentices participated in the survey, which was conducted from October 2021 to January 2022. After a list-wise case exclusion based on the variables relevant for this study, 114 participants remained, 103 males (age: 17–44, mean: 20.8, SD: 3.7) and 11 females (age: 17–24, mean: 19.3, SD: 1.9). Despite the high age range, skewness (male: 3.4, female: 1.7) shows that most survey participants are young. A third gender-identification option was excluded from the analysis due to the low case number of 5 and inconsistent values. The low proportion of female respondents was likely due to the male-dominated occupational fields of the participating chambers and did not correspond to the proportion of females in dual vocational education and training in Germany.

According to the distribution in the Vocational Education and Training report [66], the majority of participants in the present study had a lower secondary school certificate at a

minimum age of 15, covering nine school years (n = 41, 36%) or an intermediate secondary school certificate usually at the age of 16, covering ten school years (n = 55, 48.2%). A university entrance qualification which comprises 12 or 13 school years and corresponds to a regular age of 18 to 19 was held by 18 participants (15.8%).

Of the participants, 48 (male: 41, female: 7) were in their third year of apprenticeship, 35 males in their fourth, 27 (male: 23, female: 4) in their second, and only 4 males in their first year. This distribution across the training years was due to the fact that, at the time of the survey, most of the participants were attending examination preparation courses for the completion of their apprenticeship at the chambers.

3.3. Measures

We evaluated retrospective apprentices' assessments of the support of the vocational school ("My concerns were taken seriously by the school during the first/second school closure.") and the use of live communication by the teachers ("The teachers used live communication (e.g., live chat) to communicate with the apprentices during the first/second school closure."). We also examined digital devices ("I had sufficient computer/laptop/tablet at home during the first/second school closure") and the use of digital devices ("I coped well with the technical requirements for online instruction during the first/second school closure").

In each case, two different items within a block of questions were used to assess differences between the first and second school closures. The quasi-metric rating scale ranged from 1 = "does not apply", 2 = "does rather not apply", 3 = "partly/partly", 4 = "rather applies" to 5 = "applies". The scales used for the relevant items can be found in the Appendix A in both the original German version and translated into English.

3.4. Analysis Method

To explore the extent to which the situation in vocational schools changed over the course of the pandemic, the information provided by apprentices at the two points in time of the first and second school closures was evaluated in pairs. The following research questions were examined:

1. From the apprentices' point of view, did the attentiveness of the vocational school improve between the first and second school closure?
2. Did live communication improve from the apprentices' perspectives?
3. Did the equipment with digital devices improve among the apprentices?
4. Did the apprentices' assessments of their own digital competence improve?
5. Were there gender differences?

Firstly, descriptive statistics and distribution measures (mean, standard deviation—SD, quartiles, median, outliers) were analyzed, which were also presented graphically using boxplots. Since we wanted to consider differences between females and males in terms of their digital equipment and competencies, these variables were also presented and grouped by gender. Secondly, one-tailed paired t-tests were used to analyze whether there were statistically significant improvements in vocational schools between the first and second school closures. In this regard, the analyzed variables were checked for their normal distribution.

4. Results

Table 1 summarizes the mean differences between the first and second school closures.

Figure 1 shows the differences in the ratings of the organization of the vocational school between the two school closures. The apprentices had to indicate to what extend the statements "My concerns were taken seriously by the school during the first/second school closure" applied on a scale as described above. They rated the attentiveness to their concerns by the vocational school in the first school closure at an average of 2.5 with a standard deviation of 1.2 scale points. The rating for the second school closure showed an improvement to a mean of 2.8 (SD = 1.2). However, a higher variability in the distribution

was observed. For the first school closure, at least a quarter of the respondents indicated that their concerns were not satisfactorily addressed. The second school closure shows a shift in the distribution to the upper range of the scale through the median and quartile boundaries. The *t*-test results showed that the mean differences were statistically significant at the 1% level. Therefore, the vocational schools' attention to apprentice concerns statistically improved significantly between the first and second pandemic-related school closures, with the effect sizes using Cohen's d [75] indicating a medium effect (0.3).

Table 1. Differences between first and second school closures.

Items	Mean	SD	pΔ *t*-Test	Cohen's d
Attentiveness of vocational school				
First school closure	2.544	1.153	<0.001	0.339
Second school closure	2.807	1.226		
Live communication	3.289	1.419		
First school closure			<0.001	0.447
Second school closure	3.904	1.190		
Digital devices	3.868	1.386		
First school closure			0.005	0.246
Second school closure	4.088	1.266		
Digital competence	3.325	1.436		
First school closure			<0.001	0.503
Second school closure	3.789	1.265		

pΔ shows the significance of a one-tailed paired *t*-test (first/second, $n = 114$).

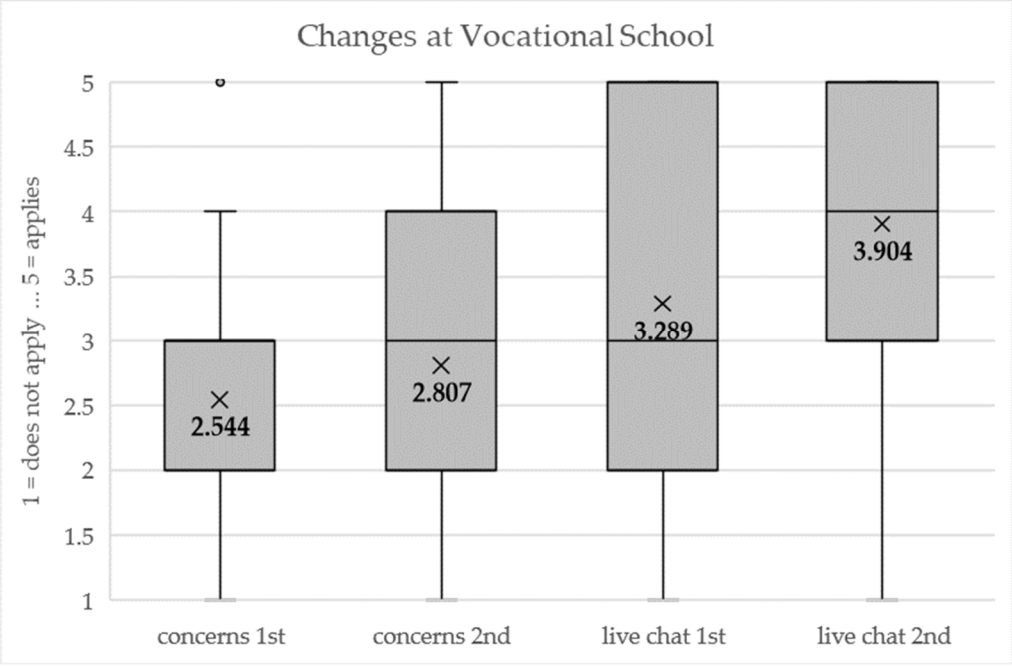

Figure 1. Changes at vocational school.

The same pattern was observed for live communication by the school as for the first variable examined. Here, the mean score for the first school closure was 3.289 (SD = 1.419), and for the second school closure was 3.9 (SD = 1.2). Furthermore, the median rose from a value of 3 to 4 and the variability of the assessments also reduced overall. The results of the *t*-test showed that the improved mean differences were statistically significant at the 99% level, with the effect size using Cohen's d indicating a medium-to-strong effect (0.4).

With regard to digital equipment, an improvement was likewise observed. The mean value for the first school closure was 3.9 (SD = 1.4). For the second school closure, the mean value was 4.1 (SD = 1.3). Accordingly, the digital equipment of the apprentices statistically improved significantly ($p < 0.005$) by 0.2 scale points in the second school closure, with Cohen's d showing a weak effect size (0.2).

The digital equipment of male apprentices changed only slightly from the first to the second school closure (Figure 2). The situation for female apprentices was more differentiated, with higher variability in the first school closure. When interpreting the results, it must be noted that the case number of women is very small. Due to the small number of female apprentices (m: 103, f: 11), the gender differences were not analyzed using a *t*-test. However, the mean value for the second school closure increased to 4.1 while the variability was reduced. We attributed these results to female apprentices being provided with better access to digital devices during the second school closure than at the beginning of the coronavirus pandemic.

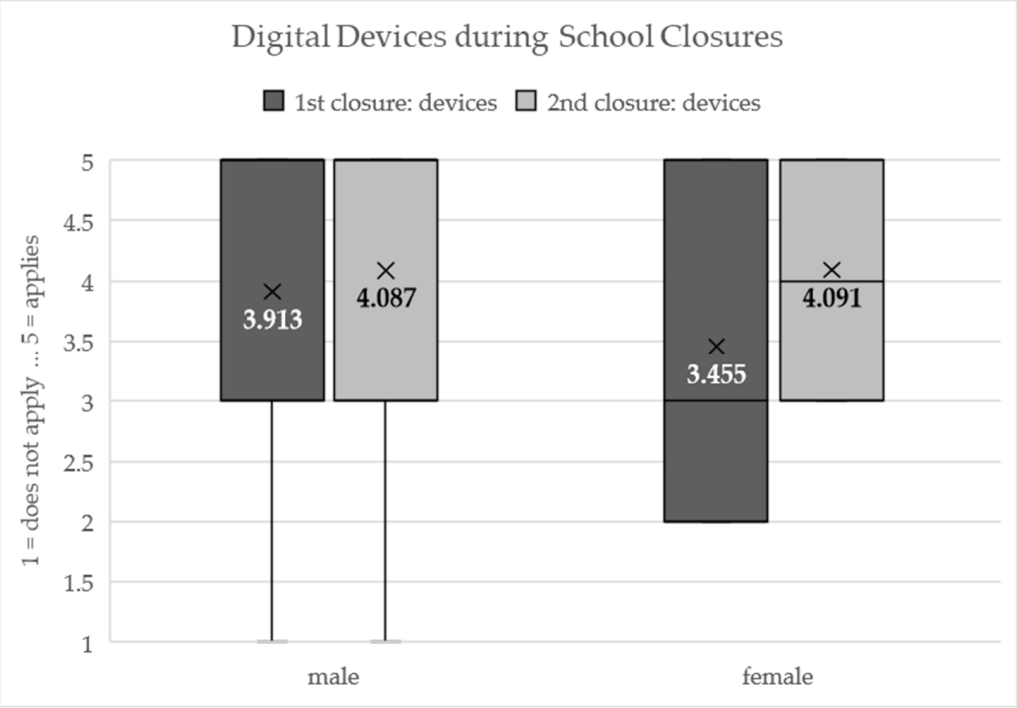

Figure 2. Digital devices during school closures by gender.

Again, for both genders, the score for "coping with digital devices" improved from a mean of 3.3 (SD = 1.4) for the first school closure to a mean of 3.8 for the second school closure (SD = 1.3). The apprentices' use of digital devices statistically improved significantly ($p < 0.001$) by 0.5 scale points in the second school closure. Cohen's d showed a strong effect size (0.5).

Coping with digital devices showed a mean value of 3.340 for male apprentices at the first school closure (Figure 3). This variable also showed an improved assessment for the second school closure with a mean value of 3.7. Variability also decreased. The median was unchanged at 4. Consequently, male apprentices' coping with digital devices improved between the first and second school closures. For female apprentices, the mean increased much more noticeably from 3.2 to 4.2, and the variability also decreased. The median also increased from 3 to 4. Overall, it was concluded that coping with digital devices for female apprentices had improved significantly.

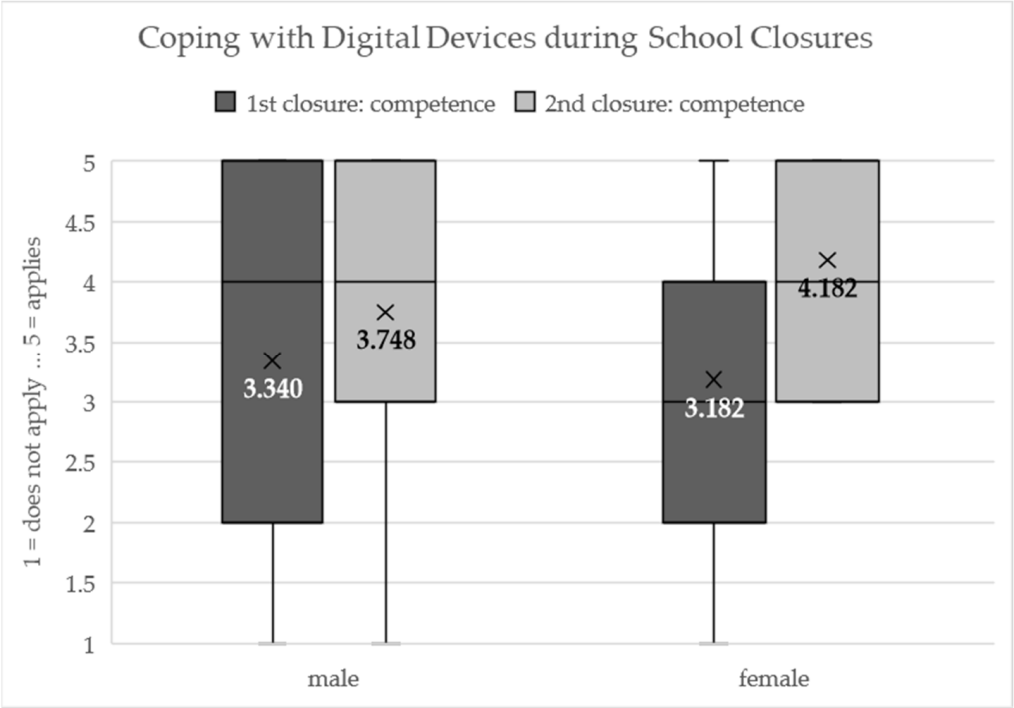

Figure 3. Coping with digital devices during school closures by gender.

5. Conclusions

5.1. Summary

The results of the survey showed statistically significant improvements in all areas in the before and after comparison between the two school closures. Both attentiveness of vocational school and live communication were rated better by survey participants for the second school closure. This suggested that appropriate measures were implemented by the schools of the surveyed students in summer 2020 to improve communication between those teachers and those students in preparation for the second school closure. For students, both their access to digital equipment and their assessments of their own digital competence improved significantly. Here, we can postulate that students may have used the time between the school closures to better adjust to a second distance learning period. The improved communication with the schools was perceived positively by the apprentices, which confirmed the results from previous studies that reported positive effects from improved communication on students' learning experiences [17–19].

The results of the comparison between the first and second school closures show that the female surveyed apprentices were poorly equipped with digital devices, especially at the beginning of the coronavirus pandemic, and show deficits in terms of their digital technical competence. A comparison between women and men is not possible without any doubt due to the unequal ratio of the number of participants (11 women, 103 men).

However, female apprentices appeared to have remedied this deficiency by the second school closure. In the present study, we assumed that males were more likely to use personal computers in their free time [60] and were, therefore, better equipped with technology than females at the onset of the coronavirus pandemic. At the same time, at least for the second school closure, the results of Korlat et al. [38] were supported: Both the digital equipment and the assessments on coping with digital devices in females in the context of digital learning were equal to the assessments of men. Here, we concluded that the overall higher intrinsic school motivation [76,77] as well as the higher motivation in digital learning environments shown in other studies [78,79] led to a digital catch-up process for female apprentices after the first school closure.

5.2. Discussion

5.2.1. Practical Implications

Although the results of this study showed a clear improvement with regard to digitization in dual vocational education and training, further effort is needed. There is no ideal situation, especially when there is still a great deal of heterogeneity in the types of equipment and the access to digital devices. In addition, although the apprentice assessments improved, much progress can still be achieved. A key prerequisite for reducing educational inequality, which has been exacerbated during the coronavirus pandemic, is that all students should have equal access to digital devices and be empowered to work with them [36]. With regard to the gender differences discussed in the research literature, it should be emphasized that access to digital devices is important for the realization of equal opportunities [1,58,60]. Even though gender differences cannot be reliably demonstrated due to the small convenience sample in this paper, the results nevertheless show hints that confirm the recommendations for action to reduce gender inequalities for sustainable education.

The implementation of live communication must also be further improved, and all students should have access, as these are essential to ensure that students can participate in lessons regardless of their location. In this context, beyond the mere transfer of information, it is also important to consider the motivational and emotional aspects as well as students' living situations in order to promote sustainable learning [26,56]. As the coronavirus pandemic caused a sudden interruption of the usual school and work routine of the apprentices and changed the communication channels as well as the roles of all actors in VET, there has to be a strategy for support beside the learning content [24]. The results of this paper have exemplified that communication between vocational schools and apprentices has made progress. Nevertheless, there is further potential for improvement.

Züchner and Jäkel [29] summarized that learning activities are supported by exchanges with teachers and classmates as well as family members. Apprentices must be empowered to use digital media to learn in a self-organized way. Teaching these digital competencies will be a key task for vocational schools in the coming years. In addition, it must be kept in mind that self-organized learning is associated with a decrease in social interactions and that particularly vulnerable groups, such as apprentices with non-German mother tongues, fear a deterioration in academic performance [61]. Consequently, in order to teach the learning content to as many apprentices as possible despite distance learning, personal contact with teachers is essential, especially when problems and concerns arise [36].

Based on the findings of the school barometer in Germany, Austria, and Switzerland, Huber [56] concluded that a comprehensive digitization initiative would be necessary during pandemic-related restrictions for sustainable school and personnel development, whereby the competencies of the teaching staff should be promoted in the long term in order to create a differentiated teaching and learning provision. In particular, he emphasized the complex interplay between innovation, sustainability, and optimization (ISO strategy), which are essential for successful development.

Eickelmann [80] emphasized four relevant objectives of successful digital learning: the use of digital media, the support of subject-specific learning, new forms of teaching, and the promotion of digital literacy. New technologies must be developed to make learning successful in the long term. To employ digitization for educational purposes during the coronavirus pandemic [36], vocational schools should further expand their current use of digital tools to support learning and motivation such as interactive elements e.g., like online-quizzes [53] or apps and learning-videos [28] that can be used flexibly in both space and time. This was underlined by the policy recommendations of the European Commission's Joint Research Center report, which emphasized digital upskilling, innovative pedagogical approaches, and equal access to digital devices for all students [11]. These recommendations are vital to avoid by all means the afore mentioned remote learning paradox [24] and to stop the increased educational disparities caused by the school closures and sudden introduction of digital lessons. However, target-oriented concepts should be developed to counteract

issues caused by competing hardware and software products and to thus ensure successful educational processes based on pedagogical and didactic premises [56]. Based on the need to impart digital competences to apprentices, further training courses for teachers and company training staff will be particularly relevant in the future, as they have not been sufficiently offered or attended in recent years [32,35,81,82].

In dual vocational education and training, training companies are an important source of information for apprentices, in addition to vocational schools. The use of digital media as part of vocational training varies greatly and depends on the sector. Although some companies have introduced digital media during the coronavirus pandemic [6], there is still much progress to achieve in order to provide apprentices with optimized digital support during the coronavirus pandemic and beyond.

5.2.2. Limitations and Future Research

The present study has some methodological problems, which is why it should be considered an exploratory survey. The selective sampling due to the cooperation with only a few chambers resulted in a participant population that was not fully representative. Furthermore, due to the selection of respondents by the chambers, the sample had a low proportion of women, which skewed the results. This affected the significance of the *t*-tests, and inferential statistics were not unconditionally possible. Therefore, only descriptive statistics with mean differences could be reported. A third variable control to reduce unobserved heterogeneity was not possible due to the small number of cases. Consequently, a robust hypothesis test was also not possible. As a result, no inference can be drawn about individuals outside the sample. The results can only be interpreted as a case study and considered as a reference point for future studies.

Since this was a retrospective query of the first and second school closures and not based on longitudinal data, memory bias was likely an issue for respondents [83].

Future research should strive for a representative survey of apprentices in order to obtain more robust data. Ideally, collecting panel data that documented the development of schools on a longitudinal basis should be considered. This would allow for more complex analyses since, as already discussed, numerous factors are relevant for the success of digital development.

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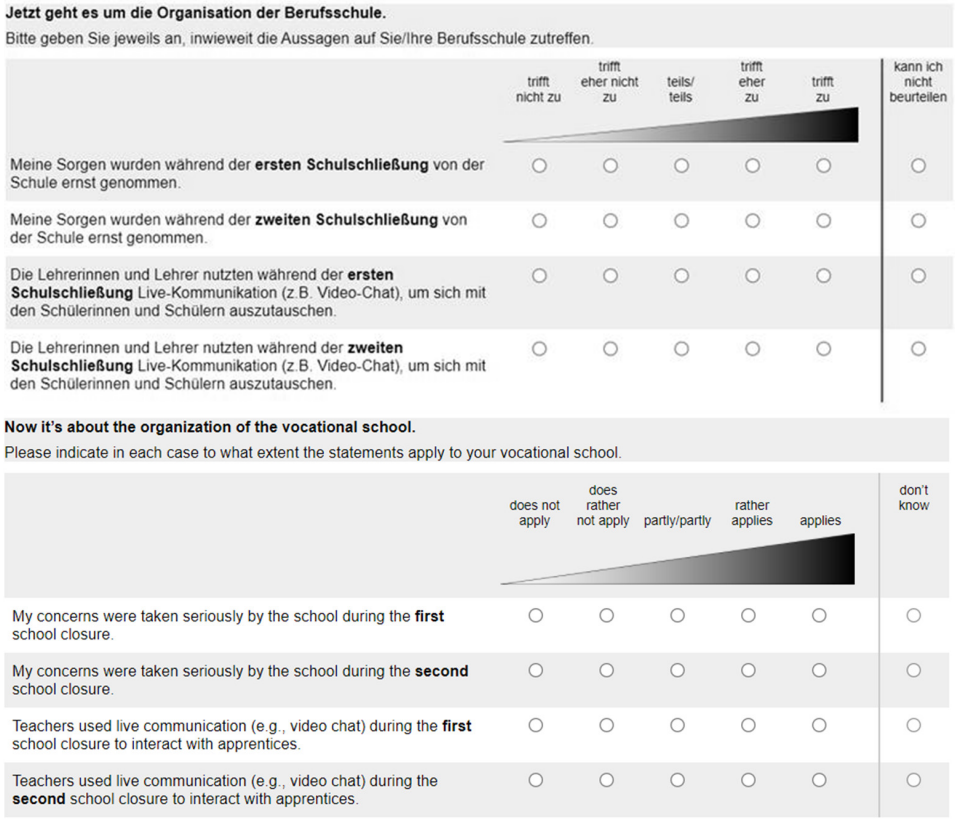
Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the privacy policy of the University of Applied Labor Studies, Mannheim, Germany.

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

Appendix A



Jetzt geht es um die Organisation der Berufsschule.

Bitte geben Sie jeweils an, inwieweit die Aussagen auf Sie/Ihre Berufsschule zutreffen.

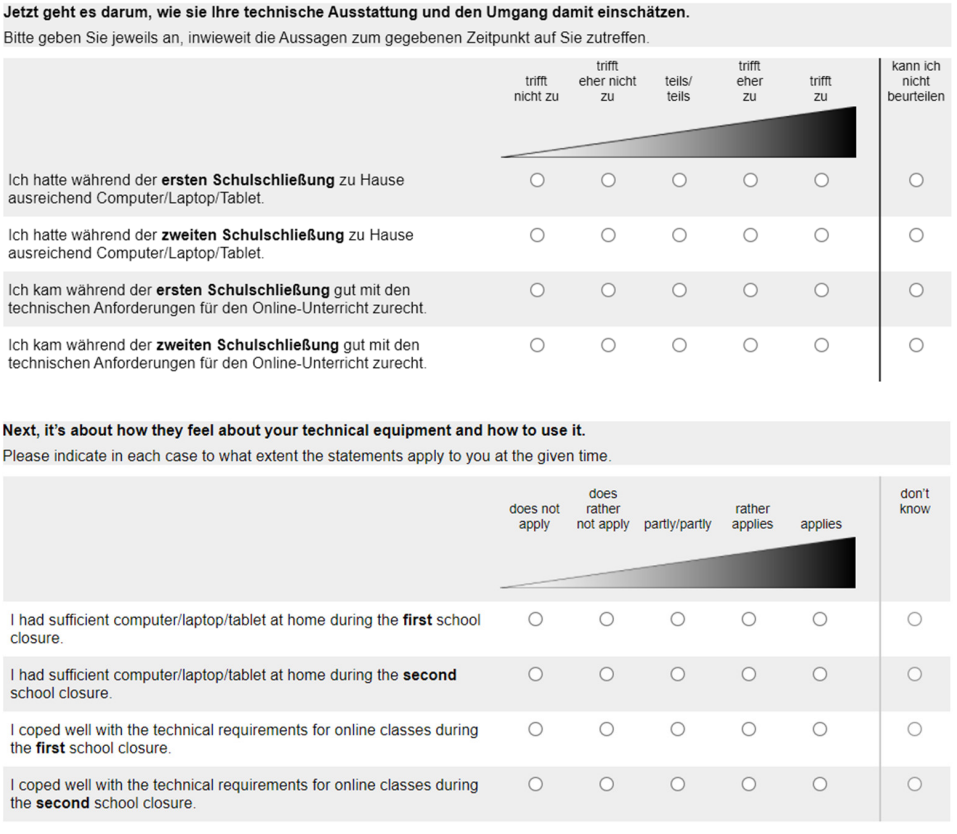
	trifft nicht zu	trifft eher nicht zu	teils/ teils	trifft eher zu	trifft zu	kann ich nicht beurteilen
Meine Sorgen wurden während der **ersten Schulschließung** von der Schule ernst genommen.	○	○	○	○	○	○
Meine Sorgen wurden während der **zweiten Schulschließung** von der Schule ernst genommen.	○	○	○	○	○	○
Die Lehrerinnen und Lehrer nutzten während der **ersten Schulschließung** Live-Kommunikation (z.B. Video-Chat), um sich mit den Schülerinnen und Schülern auszutauschen.	○	○	○	○	○	○
Die Lehrerinnen und Lehrer nutzten während der **zweiten Schulschließung** Live-Kommunikation (z.B. Video-Chat), um sich mit den Schülerinnen und Schülern auszutauschen.	○	○	○	○	○	○

Now it's about the organization of the vocational school.

Please indicate in each case to what extent the statements apply to your vocational school.

	does not apply	does rather not apply	partly/partly	rather applies	applies	don't know
My concerns were taken seriously by the school during the **first** school closure.	○	○	○	○	○	○
My concerns were taken seriously by the school during the **second** school closure.	○	○	○	○	○	○
Teachers used live communication (e.g., video chat) during the **first** school closure to interact with apprentices.	○	○	○	○	○	○
Teachers used live communication (e.g., video chat) during the **second** school closure to interact with apprentices.	○	○	○	○	○	○

Figure A1. Vocational school: original German scale with English translation.



Jetzt geht es darum, wie sie Ihre technische Ausstattung und den Umgang damit einschätzen.

Bitte geben Sie jeweils an, inwieweit die Aussagen zum gegebenen Zeitpunkt auf Sie zutreffen.

	trifft nicht zu	trifft eher nicht zu	teils/ teils	trifft eher zu	trifft zu	kann ich nicht beurteilen
Ich hatte während der **ersten Schulschließung** zu Hause ausreichend Computer/Laptop/Tablet.	○	○	○	○	○	○
Ich hatte während der **zweiten Schulschließung** zu Hause ausreichend Computer/Laptop/Tablet.	○	○	○	○	○	○
Ich kam während der **ersten Schulschließung** gut mit den technischen Anforderungen für den Online-Unterricht zurecht.	○	○	○	○	○	○
Ich kam während der **zweiten Schulschließung** gut mit den technischen Anforderungen für den Online-Unterricht zurecht.	○	○	○	○	○	○

Next, it's about how they feel about your technical equipment and how to use it.

Please indicate in each case to what extent the statements apply to you at the given time.

	does not apply	does rather not apply	partly/partly	rather applies	applies	don't know
I had sufficient computer/laptop/tablet at home during the **first** school closure.	○	○	○	○	○	○
I had sufficient computer/laptop/tablet at home during the **second** school closure.	○	○	○	○	○	○
I coped well with the technical requirements for online classes during the **first** school closure.	○	○	○	○	○	○
I coped well with the technical requirements for online classes during the **second** school closure.	○	○	○	○	○	○

Figure A2. Digital devices: original German scale with English translation.

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Opening or Not Opening Educational Centers in Time of SARS-CoV-2? Analysis of the Situation in Galicia (Spain)

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Abstract: The appearance of the SARS-CoV-2 pandemic on the world stage has implemented changes in all social activities and, therefore, in teaching at all educational levels. On the one hand, it is argued that the closure of centers and virtual teaching minimizes the risk of contagion and, on the other, this closure implies a reduction in social interactions in the population at ages in which social skills are lower developing. In addition, it is necessary to guarantee that all children and adolescents have access to the necessary means for distance education. This article analyzes the impact of the COVID-19 pandemic during the second, third and fourth waves in Galicia (northwestern region of Spain), where the centers were kept open with strict security protocols, with the aim of evaluating whether the measure of the center closure is a proportionate measure or not. The results obtained show that, at all educational levels, the incidence of infections has been low, as has the appearance of outbreaks of infections related to educational centers, so the damage caused by this measure can be considered uncompensated, with greater health security.

Keywords: classroom education; pandemic management; schools closed; health education

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1. Introduction

COVID-19 is an infectious disease caused by the new coronavirus known as SARS-CoV-2 [1,2]. The World Health Organization became aware of the existence of this virus on 31 December 2019 after being informed of a group of cases of viral pneumonia in the city of Wuhan [3] (People's Republic of China). From that moment on, all countries began to find cases of this virus that spread significantly throughout the world. The appearance of this virus and its rapid incidence of infection, together with the damage it was causing to the world population and the lack of knowledge of how to treat the sick and how to eradicate the virus, led many countries to take precautionary measures [4]. The complex health situation has forced far-reaching political decisions to be made that have a very important influence on all social spheres. One of the first measures to be taken in many countries was to limit the social life of citizens: states of emergency, curfews, massive disinfection, prohibition of meetings, closure of educational centers, etc. In China, on 23 January 2020, they decreed a quarantine for the 11 million citizens of Wuhan, later the same was done with the province of Hubei. Other parts of the country activated social distancing measures [5]. Finally, many countries of the world followed this example and carried out confinements

in their own territories. In some cases, the confinement was limited to certain activities or time slots, and in others it meant a total closure of activities. Thus, during the months of February and March, countries such as: Italy, Denmark, Norway, Czech Republic, Spain, Lebanon, Germany, Holland, France, Belgium, Peru, Portugal, Slovenia, Argentina, Jordan, Poland, Tunisia, Rwanda, Dominican Republic, Malaysia, Bolivia, Canada, El Salvador, Greece, Australia, the United Kingdom, South Africa, Mexico, India, Bangladesh, Brazil, Ireland, Egypt, New Zealand, and the United States applied measures to minimize the damage caused by the virus. Parallel to the extension of restrictive measures to prevent contagion, a debate began to emerge about the suitability of the measures applied. From a strictly health point of view, the need to minimize social contacts to curb contagion was highlighted. On the other hand, from an economic point of view, the radical decrease in all activities meant an economic slowdown and an unprecedented period of global economic recession. In addition to these two factors considered (health and economic), more and more incidence was made of the repercussion that these periods of isolation (increasingly long) could have a very important impact on people's mental health and, more specifically, in the cognitive and social development of children and adolescents.

In this context, one of the most questioned measures has been the closure of educational centers [6–8]. At first (during the course of the first wave of the pandemic), many countries opted to close the entire educational system (nursery schools, non-university teaching and university teaching). This decision was made without clear criteria, since ignorance of the behavior of the virus meant that most decisions were made more for prevention than with established and verified criteria. With the advent of the second wave, this trend changed, and most countries decided to open schools. Some examples of them are: USA, Russia, China, France, Germany, Italy, Spain, United Kingdom, etc. [9].

The maintenance of face-to-face activity in educational centers has been based on the fact that the infection rate of COVID-19 in children is low [10,11] and, therefore, schools are not sources of the spread [12]. Despite this, the measures taken to reopen have been very strict [13–15] and studies have considered that emotional development is important enough to open schools by adopting the necessary measures to preserve the health of students [16,17]. Some countries, like Italy, have opted to implement virtual education for students between 14 and 18 years old, as adolescents are considered to be the main causes of transmissions [18,19].

In 14 of the countries affected by the pandemic, schools have been closed since March 2020, mainly in the areas of East Asia and the Pacific, the Middle East and North Africa, Latin America and the Caribbean, and South Asia [20,21]. The aforementioned countries have kept schools closed and this has created an increase in inequality [22] since not all students have access to the means to be able to train online, and this education has been relegated in many countries to the part of the population with the greatest resources.

Thus, two conflicting currents were established in relation to the management of educational centers [23]. On the one hand, those who defended that the risk of contagion was very high and that schools could be the focus that spread the virus to all social strata [20]. This could lead to a new collapse of the health systems in the countries. On the other hand, those who believed that the harm to which children and adolescents were subjected did not justify such a restrictive measure [24]. The lack of social interaction was highlighted as a possible cause of social and cognitive development problems, especially in those who are at the ages where these skills are being established [25]. In addition, another argument that supported this option was the fact that the most economically disadvantaged sectors and the rural sectors were the most affected by the lack of attendance [26,27]. In both cases, access to the technological resources necessary to replace face-to-face teaching was much less accessible.

The situation that has been experienced with the appearance of COVID-19 has been aggravated by the lack of information and the lack of preparation of society in general. There have been no clear guidelines to help make firm political decisions, which is why, in general, they have acted with a degree of improvisation that has sometimes been detri-

mental. An analysis of the impact of the measures adopted is necessary. In this way, in the face of a possible health situation equivalent to the current one that may arise in the future, there will be more tools to help make more precise decisions. These decisions must keep a balance between the need to protect the population healthily, and the economic and social damage that they entail. It would be essential to have better information than is currently available to be able to decide when a restrictive measure is more harmful than beneficial. With this objective, we have carried out an analysis of the results of the restrictive measures imposed in the second, third and fourth waves. To carry out the stated objective, the research has focused on the impact on the incidence of infections during the periods indicated in the educational field. The incidence at the different educational levels has been evaluated, taking into account the security protocols established by the authorities at each stage, to determine whether, as initially assumed, they are a source of contagion or not.

The case that concerns us in this study is that of Spain [28]. This country, despite having closed the classrooms in the first wave, has opted in the second, third and fourth waves to keep classrooms open. This decision has been made for both nursery schools and non-university education. In the case of university education, attendance has been a very important factor, provided that the safety distance established by the authorities could be maintained in the centers. In this case, university teaching has been fundamentally mixed, combining tele-teaching with face-to-face teaching [29,30]. In addition, the closure of university centers causes less economic disruption and to the users themselves, since students have greater maturity and greater access to non-face-to-face teaching.

In this work, the incidence of COVID-19 in both nursery schools and educational centers of university and non-university education in Galicia (a region of northwestern Spain) has been analyzed. The objective of this research is to know if the decision to have educational centers open during periods of pandemic in Galicia has been appropriate [31,32].

2. Methodology

The research carried out has been based on the analysis of the incidence of COVID-19 in university and non-university educational centers and in nursery schools in the Spanish region of Galicia, located in the northwest of Spain. In Spain, the regional authorities are the ones that make the decisions that concern education within their region, so the Galician authorities are responsible for making decisions about the closure or not of the centers and about the protocols to carry out in them.

At the start of the study, Spain has experienced four main waves, the first one when COVID-19 appeared in the country (March 2020), the second one in November 2020, the third one in January 2021 and the fourth one in April 2021. The analysis of the present work starts on the second wave, since the educational centers were directly closed during the first wave, and it is not possible to find data about the incidence if they had remained open. During the second, third and fourth waves, the educational centers have remained open, except for very specific cases of some educational center closed due to contagions, but never as a general measure. Therefore, it can be considered that teaching has been entirely face-to-face for non-university educational centers and nursery schools during these three waves.

On the other hand, seven sanitary areas have been taken into account (these are population areas in which the policymakers in the Galician community have divided its health services). These sanitary areas are: Ferrol, A Coruña, Santiago de Compostela, Lugo, Ourense and Vigo. See Figure 1. The data provided by the Galician authorities is separated in these areas, and even the protocols and measures adopted may be different depending on the number of infections that occur over time in each one.

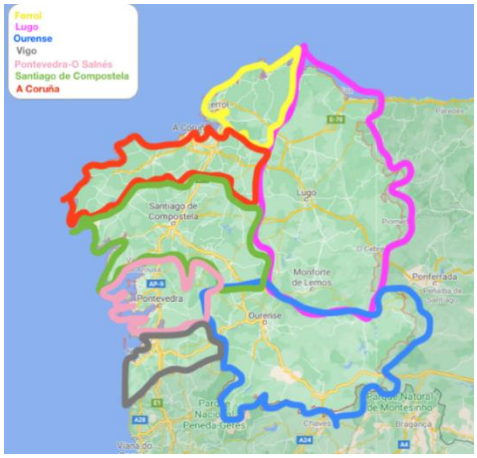

Figure 1. Sanitary areas. Source: Own elaboration.

These areas encompass the entire population of Galicia and have had special relevance when it comes to applying perimeter restrictions, curfews, opening and closing times, depending on the incidence of COVID-19 in each of them.

To complete this study, the incidence in higher education (universities) of one of the provinces of the Spanish region of Galicia, A Coruña, has been analyzed in order to find differences between the diverse educational sectors, since the age ranges are different and the way of carrying out teaching has also been differentiated in the moments of greatest incidence of the pandemic (universities stablished periods based on non-face-to-face teaching, while this factor has not been considered in non-university education during the course of the second, third and fourth wave, and the teaching has been only face-to-face).

The information used account to carry out this study has been:

- Information from the Ministry of Culture, Education and University [33]. This is the organization responsible for providing data on the incidence of infections of the general population.
- Information from the Galician Health Service (SERGAS) [34]. Together with the previous organism, it provides the incidence of infections by regions within Galicia. It also provides information on the number of centers that have had to be closed or that have had confined classrooms.
- Information from the Galician Statistics Institute (IGE) [35]. Provides information on the composition of the population in Galicia (percentage of people for each age group and in the different areas of Galicia).
- Information from the University of A Coruña (UDC) [36]. It is the organization responsible for collecting data on infections within the university centers it manages.

The information gathered from these four sources has been consolidated for weeks to be able to display the data in a more meaningful way.

Regarding the data of the Ministry of Culture, Education and University, the data have been collected in two educational bands:

A. Kindergarten (ages 4 months to 3 years)
B. Non-university teaching (ages 4–18 years)

It is also worth mentioning that the incidence was very low during the first and second waves in Galicia, in comparison to the rest of the country (Spain). Therefore, the immunization of the community was very insignificant and hence the incidence of the third wave has been more pronounced, despite the fact that the prevention measures taken in both have been the same. On the other hand, the fourth wave has had very little impact on the population, not only in Galicia but in most of the Spanish territory. Possible reasons

are both the immunization of the third wave and the application of the vaccines to certain sectors of the population.

For each population group, the number of COVID-19 positive cases has been divided by the population of each sanitary area in that age group. In this way, it is possible to know the number of positives in nursery schools, non-university schools, and universities based on the total population in each of the age ranges corresponding to each educational level and for each sanitary area. This facilitates the comparison between the data observed for the different age ranges. The information about the positive cases for each educational center is published each day on the website of the Ministry of Culture, Education and University [33] and the information on the total population by age ranges is published on the website of the Galician Statistics Institute [35].

On the other hand, another curve that shows the percentage of infected in each sanitary area was elaborated. This curve is based on data about the positives that appear on the website of the Galician Health Service (SERGAS), divided by the total of the population (data from the Galician Statistics Institute) for each sanitary area. In this case, the age ranges were not taken into account. (see Figure 2).

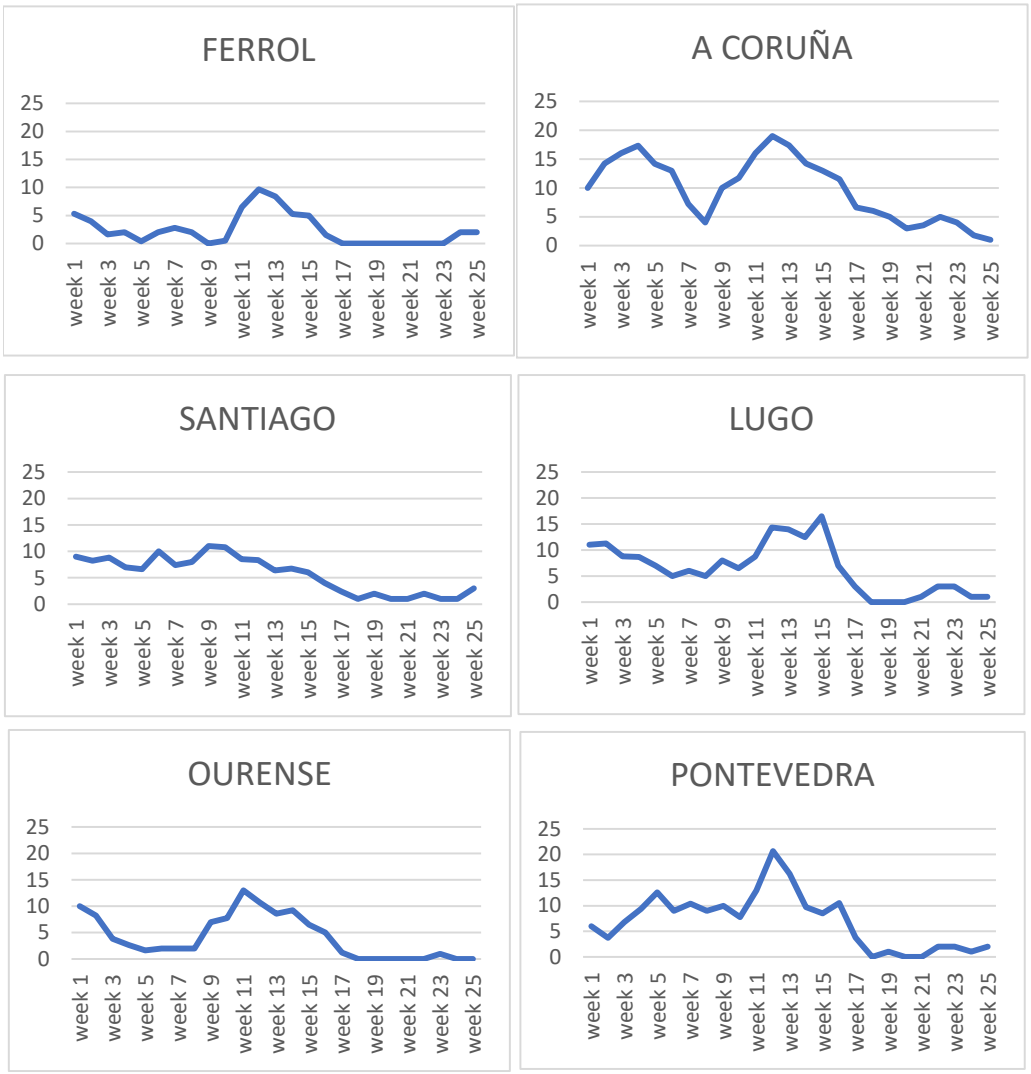

Figure 2. *Cont.*

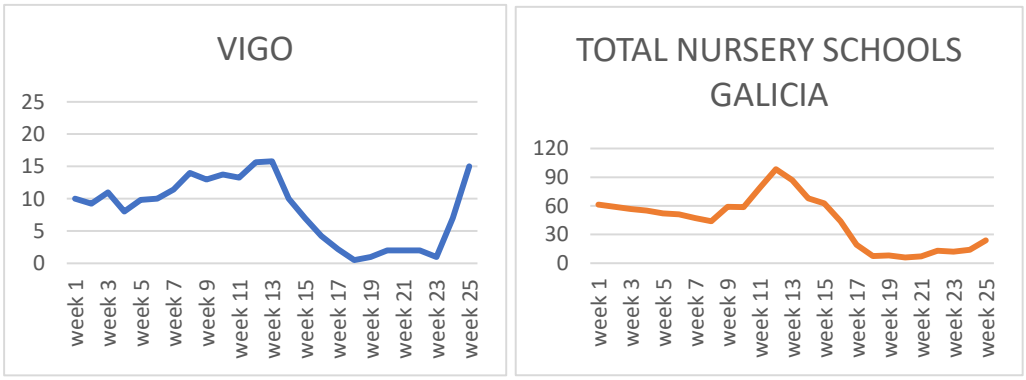

Figure 2. Active cases in nursery schools in each sanitary area of Galicia. Source: Own elaboration based on data from the Ministry of Culture, Education and University [33].

Finally, closed classrooms and closed educational centers were analyzed to find out where medical needs have resulted predominant over educational ones [37]. In order to carry out this analysis, it is necessary to know the protocols established by the authorities that determine under what conditions it is necessary to close individual classrooms or entire educational centers.

In the Galician educational system, the Ministry of Culture, Education and Universities establishes in its "Action Guide in the Event of COVID-19 Cases in Educational Centers" [37] that an outbreak in an educational center will be under any group of 3 or more cases with active infection in which an epidemiological link has been established. This is included in the Strategy for the Early Detection, Surveillance and Control of COVID-19 [38] (Ministry of Health). The Ministry of Culture, Education and University sets out actions for the following four possible scenarios. The scenarios described below are those established by the authorities to determine when it is necessary to close a classroom or an entire center. The authorities establish the four possibilities and determine the measures or protocols that must be applied in each of them. This gives us an idea of the requirements that had to be met for a classroom or center to be closed.

- Scenario 1: the outbreak occurs in a classroom. When there are 3 or more cases in a group with stable coexistence (GCE, being a group with stable coexistence that group formed by a maximum of 15 students together with the tutor and must avoid iteration with other groups of the educational center, as well as limit the maximum the number of contacts), or class not organized as GCE with epidemiological link between them. Specific control actions will be indicated through the implementation of the usual control measures:

- Home isolation of cases.
- Identification and quarantine of members of the GCE or the close contacts of the class not organized as GCE.
- If the cases belong to a GCE: suspension of the teaching activity until 10 days after the start of quarantine of the contacts.
- If the cases belong to a class that is not organized as GCE: maintenance of teaching activity for students not classified as close contacts or, based on the risk assessment, indicate the quarantine of the entire class.

The indication of quarantine to the whole group or only to close contacts should be based on whether the group really functions as a GCE or not, and not so much on the course to which it belongs.

It will be taken into account if:

- Inside the classroom, prevention measures are not followed (use of a mask, distance, ventilation. . .).
- Students from that classroom mix, at some point, with students from other classrooms (socialization, recess, joint activities, dining room. . .) without maintaining preventive measures (mask, distance, ventilation. . .).

Teaching activity continues in a normal way, extreme prevention and hygiene measures in the rest of the educational stages (infant, 1st, 2nd or 3rd cycle of primary, ESO or Baccalaureate), with the exception of the affected group.

- Scenario 2: An outbreak in several classrooms with no epidemiological link: 3 or more cases in GCE or classes not organized as GCE with no epidemiological link between the cases in the different classrooms (each case may have an out-of-school epidemiological link, for example outbreak but the cases of the different classrooms do NOT have an epidemiological link between them). Specific control actions will be indicated for each of them through the implementation of the usual control measures:

- Home isolation of cases.
- Identification and quarantine of the members of each GCE or the close contacts of each class not organized as GCE.
- If the cases belong to a GCE: suspension of the teaching activity of each GCE until 10 days after the start of the quarantine.
- If the cases belong to a class that is not organized as GCE: maintenance of teaching activity for students not classified as close contacts in each of the classes not organized as GCE or based on risk assessment, indicate quarantine of the whole class.

Teaching activity continues in a normal way, extreme prevention and hygiene measures in all educational stages (infant, 1st, 2nd or 3rd cycle of primary, ESO or Baccalaureate), with the exception of the affected groups.

- Scenario 3: outbreaks in several classrooms with epidemiological link: Detection of cases in several GCE or classes not organized as GCE with a certain degree of transmission between different groups, regardless of the way the virus was introduced in the school (that is, the cases do NOT have a clear epidemiological link outside of school and the most likely link between them is the school itself).

- Home isolation of cases.
- Identification and quarantine of the members of each GCE or close contacts of each class not organized as GCE.
- The relationship between the cases will be studied and if the existence of an epidemiological link is demonstrated and the prevention and hygiene measures have not been maintained, the adoption of additional measures such as the extension of the quarantine and suspension of the teaching activity will be assessed. from other groups up to 10 days after the start of quarantine or the time indicated depending on the evolution of the outbreaks. The action may entail closure of complete lines, cycles or educational stage.

Teaching activity continues in a normal way, extreme prevention and hygiene measures in the educational stages (infant, 1st, 2nd or 3rd cycle of primary, ESO or Baccalaureate), with the exception of the affected groups.

- Scenario 4: Outbreaks in the context of uncontrolled transmission: If it is considered that there is an uncontrolled transmission in the educational center with a higher number than expected due to the transmission existing in the community in a specific territory for that age group, the public health services of the Spanish region will carry out a risk assessment to consider the need to scale the measures, ultimately assessing the temporary closure of the educational center.

- Home isolation of cases.
- In a situation of uncontrolled transmission, after an evaluation of the epidemiological situation, control measures must be scaled up, which may lead to the temporary closure of the educational center.
- Initially the closure of the center would be for 10 days, although the duration of this period could vary depending on the epidemiological situation, the appearance of new cases that develop symptoms and the level of transmission detected in the educational center and in the community.

- The reopening of the educational center will take place when the situation is controlled and does not pose a greater risk to the educational community.

3. Results

As mentioned previously, the data has been grouped in weeks. Week 1 for this study would therefore be the week of 1 November 2020 (second wave, covers from week 1 to 5) as shown in Table 1.

Table 1. Correspondence between weeks and dates.

Week	Dates
week 1	01/11/2020–08/11/2020
week 2	09/11/2020–15/11/2020
week 3	16/11/2020–22/11/2020
week 4	22/11/2020–29/11/2020
week 5	30/11/2020–06/12/2020
week 6	07/12/2020–13/12/2020
week 7	14/12/2020–20/12/2020
week 8	21/12/2020–28/12/2020
week 9	04/01/2020–10/01/2021
week 10	11/01/2021–17/01/2021
week 11	17/01/2021–24/01/2021
week 12	24/01/2021–31/01/2021
week 13	01/02/2021–07/01/2021
week 14	08/02/2021–14/02/2021
week 15	15/02/2021–21/02/2021
week 16	22/02/2021–28/02/2021
week 17	01/03/2021–07/03/2021
week 18	08/03/2021–14/03/2021
week 19	15/03/2021–21/03/2021
week 20	22/03/2021–28/03/2021
week 21	05/04/2021–11/04/2021
week 22	12/04/2021–18/04/2021
week 23	19/04/2021–25/04/2021
week 24	26/04/2021–02/05/2021
week 25	03/05/2021–09/05/2021

Source: Own elaboration.

Table 2 shows the infected students in each sanitary area up to 3 years of age, i.e., nursery school:

Table 2. Active cases in nursery schools in Galicia by sanitary areas.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Total Nursery School
week 1	10	5	9	11	10	6	10	61
week 2	14	4	8	11	8	4	9	59
week 3	16	2	9	9	4	7	11	57
week 4	17	2	7	9	3	9	8	55
week 5	14	0	7	7	2	13	10	52
week 6	13	2	10	5	2	9	10	51
week 7	7	3	7	6	2	10	11	47
week 8	4	2	8	5	2	9	14	44
week 9	10	0	11	8	7	10	13	59
week 10	12	1	11	7	8	8	14	59
week 11	16	7	9	9	13	13	13	79
week 12	19	10	8	14	11	21	16	98
week 13	17	8	6	14	9	16	16	87
week 14	14	5	7	13	9	10	10	68
week 15	13	5	6	17	7	9	7	63

Table 2. *Cont.*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Total Nursery School
week 16	12	2	4	7	5	11	4	44
week 17	7	0	2	3	1	4	2	19
week 18	6	0	1	0	0	0	1	8
week 19	5	0	2	0	0	1	1	8
week 20	3	0	1	0	0	0	2	6
week 21	4	0	1	1	0	0	2	7
week 22	5	0	2	3	0	2	2	13
week 23	4	0	1	3	1	2	1	12
week 24	2	2	1	1	0	1	7	14
week 25	1	2	3	1	0	2	15	24

Source: Own elaboration based on data from the Ministry of Culture, Education and Universities [33]. Key: (1) A Coruña; (2) Ferrol; (3) Santiago; (4) Lugo; (5) Ourense; (6) Pontevedra; (7) Vigo.

As can be seen in Figure 2 the values are really low, reaching more critical values in the third wave (covers from week 9 to 15) than in the second one. These values do not exceed 21 positive cases in the sanitary area of Pontevedra and 19 cases in the sanitary area of A Coruña.

It can also be observed that the graphs in Figure 2 do not follow the same pattern. In some of them, such as the sanitary area of A Coruña, the two waves are clearly reflected, but in others, such as Santiago, the trend is more horizontal and even it can be seen that the incidence of the third wave has hardly been noticed.

Next, we will show these same data applied to non-university education, i.e., corresponding to ages between 3 and 18 years. In this case, as can be seen in Table 3 and in Figure 3, the trend is the same for the seven sanitary areas. The values of the second wave are much less significant than in the first wave.

Table 3. Active cases in non-university education centers in Galicia by health area.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Total Non-University Education
week 1	210	143	148	148	108	145	371	1273
week 2	241	108	123	174	100	153	370	1269
week 3	267	68	114	179	93	153	343	1215
week 4	256	76	120	148	64	147	316	1128
week 5	215	80	117	128	42	144	248	973
week 6	191	78	135	100	42	124	202	872
week 7	157	76	159	73	65	149	203	883
week 8	140	54	161	62	70	164	195	846
week 9	232	60	240	78	109	118	196	1033
week 10	365	97	267	112	184	143	280	1446
week 11	644	174	409	206	283	261	511	2487
week 12	944	248	508	314	367	403	638	3421
week 13	1015	297	536	353	397	527	683	3808
week 14	790	224	394	272	287	456	507	2928
week 15	547	115	194	223	108	260	284	1730
week 16	408	90	137	149	50	162	200	1195
week 17	291	63	82	60	25	110	112	743
week 18	227	44	54	26	20	81	86	537
week 19	186	66	37	33	21	47	79	468
week 20	184	60	38	38	19	55	94	486
week 21	112	12	49	11	15	65	111	373
week 22	121	11	67	17	27	80	120	443
week 23	164	14	72	28	33	105	149	535
week 24	154	13	55	43	29	101	198	592
week 25	169	10	74	31	34	101	195	614

Source: Own elaboration based on data from the Ministry of Culture, Education and Universities [33]. Key: (1) A Coruña; (2) Ferrol; (3) Santiago; (4) Lugo; (5) Ourense; (6) Pontevedra; (7) Vigo.

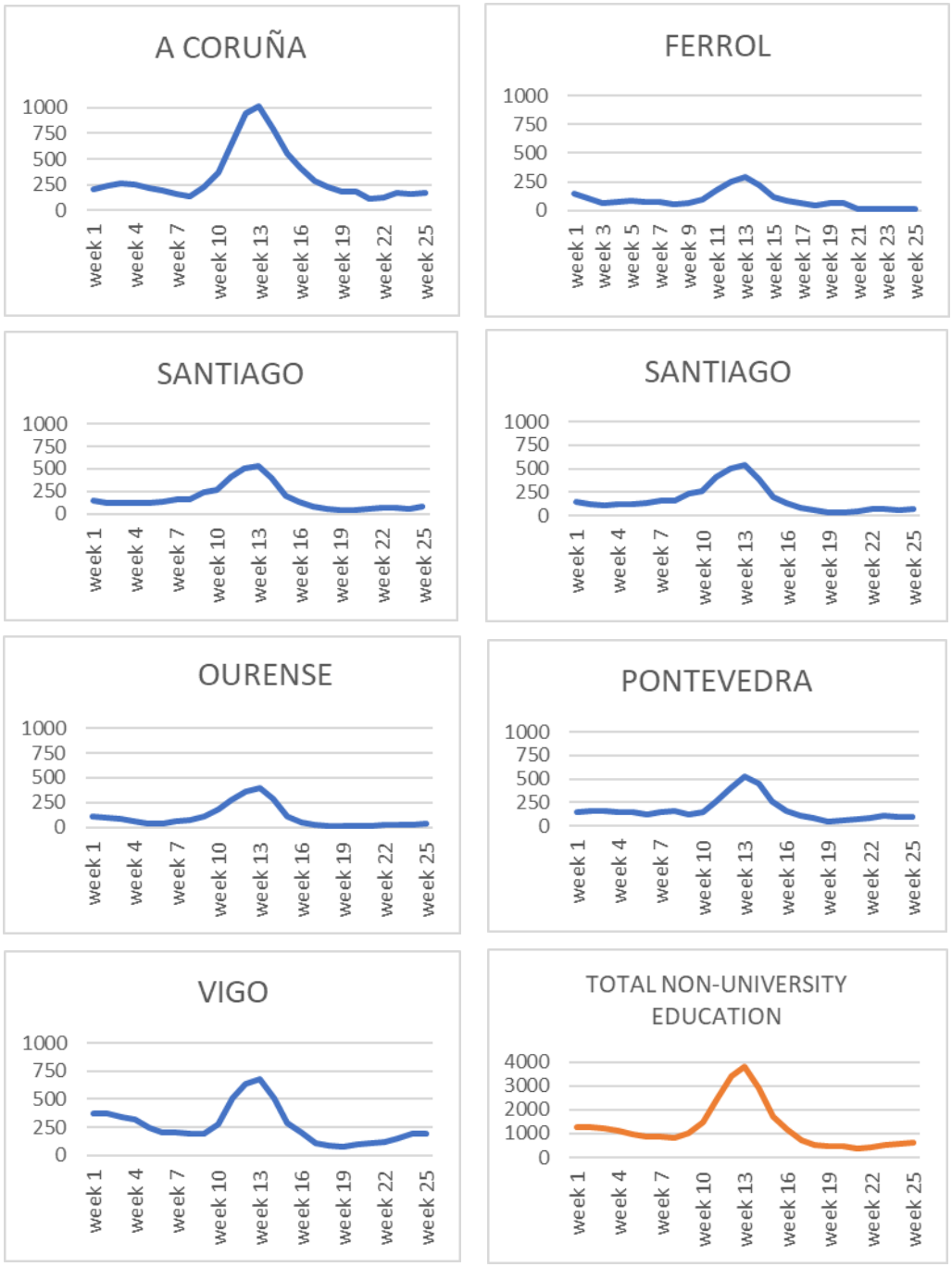

Figure 3. Active cases in non-university education centers in each sanitary area of Galicia. Source: Own elaboration based on data from the Ministry of Culture, Education and University [33].

In order to analyze this in further detail and see if the cases obtained, both in nursery schools and in non-university education, are really relevant, the percentage of active cases has been calculated, taking into account the total population in that band of age and this has been compared with the percentage of active cases for all ages.

In the case of nursery schools, the number of active cases (for each sanitary area and for the total population from 4 months to 3 years) has been divided by the total population in that age group (data provided by the Galician Institute of Statistics) and in the case of non-university education centers (ages between 3 and 18 years), the same has been done, i.e., the number of active cases due to COVID-19 has been divided in each center among the entire population in Galicia in that age group.

The results are shown in Figures 4 and 5. As can be seen in Figure 4, the incidence percentages in nursery schools are much lower than the incidence in the population of that age. Many studies show that several reasons are responsible for this. The incidence in young children is very insignificant in terms of the possibility of being infected, but once they are infected, the ease of transmission is seen to be less, possibly because in nursery schools children are without masks, and prevention measures are not as harsh as in non-university education centers. Transmission to other children is also low, so the incidence in these centers does not facilitate the appearance of outbreaks as is happening in nursing homes, etc.

Figure 5 shows that the trend is totally different from that of nursery schools. Despite the school children wearing a mask in these centers, bubble groups have been established, both in classrooms and in common facilities, etc., i.e., there are many more preventive measures. In this age group, as shown in Figure 5, each sanitary area is very similar to the total population.

In order to analyze whether the measures that have been carried out in non-university education centers are correct, we would have to analyze whether the infections occur in educational centers or come from abroad, i.e., if there are outbreaks in educational centers. For this, we have analyzed the number of closed classrooms and the number of closed non-university education centers.

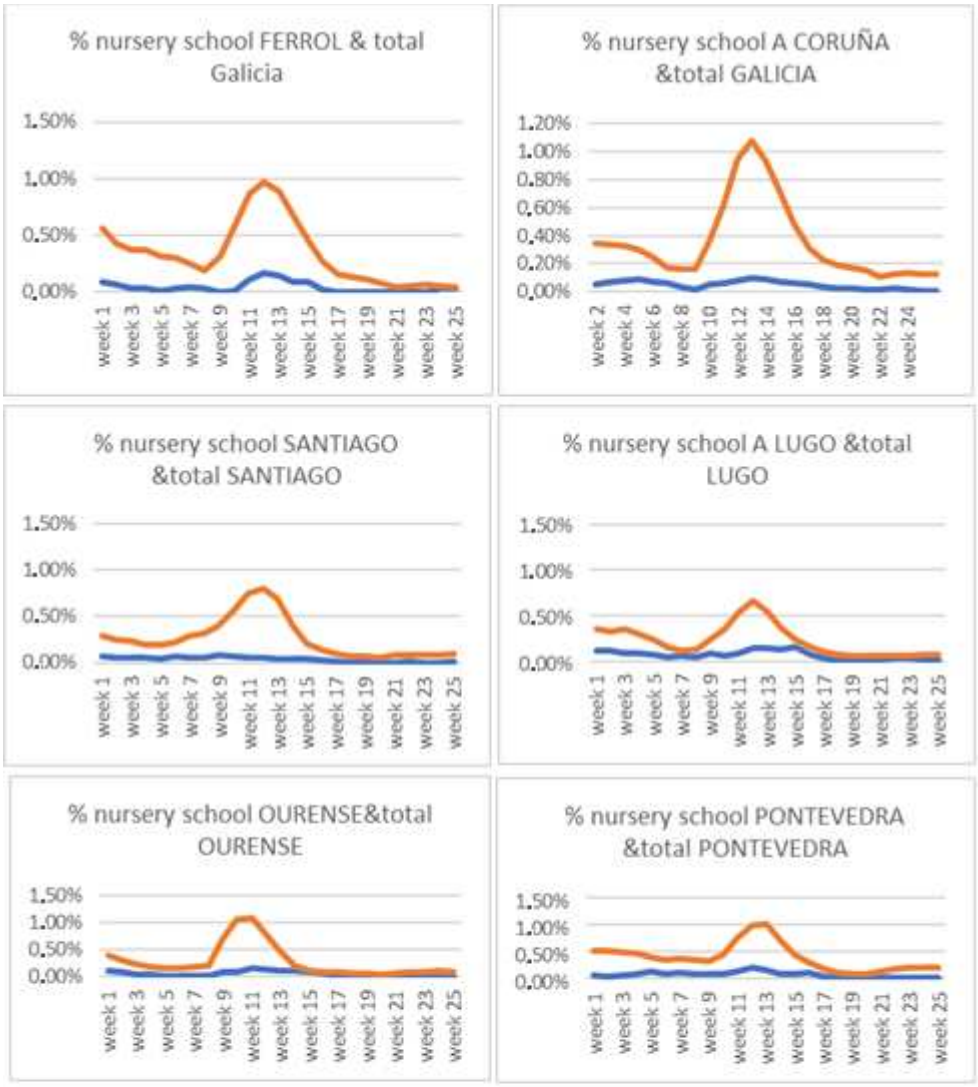

Figure 4. *Cont.*

Figure 4. Percentage of active cases in nursery schools in each sanitary area (blue line) of Galicia compared to the percentage of active cases in that age group (red line). Source: own elaboration based on data from the Ministry of Culture, Education and University ("Volta segura ás aulas | Consellería de Cultura, Educación e Universidade," n.d.), SERGAS ("Datos Coronavirus," n.d.) and the Galician Institute of Statistics ("IGE. Cifras poboacionais de referencia," n.d.).

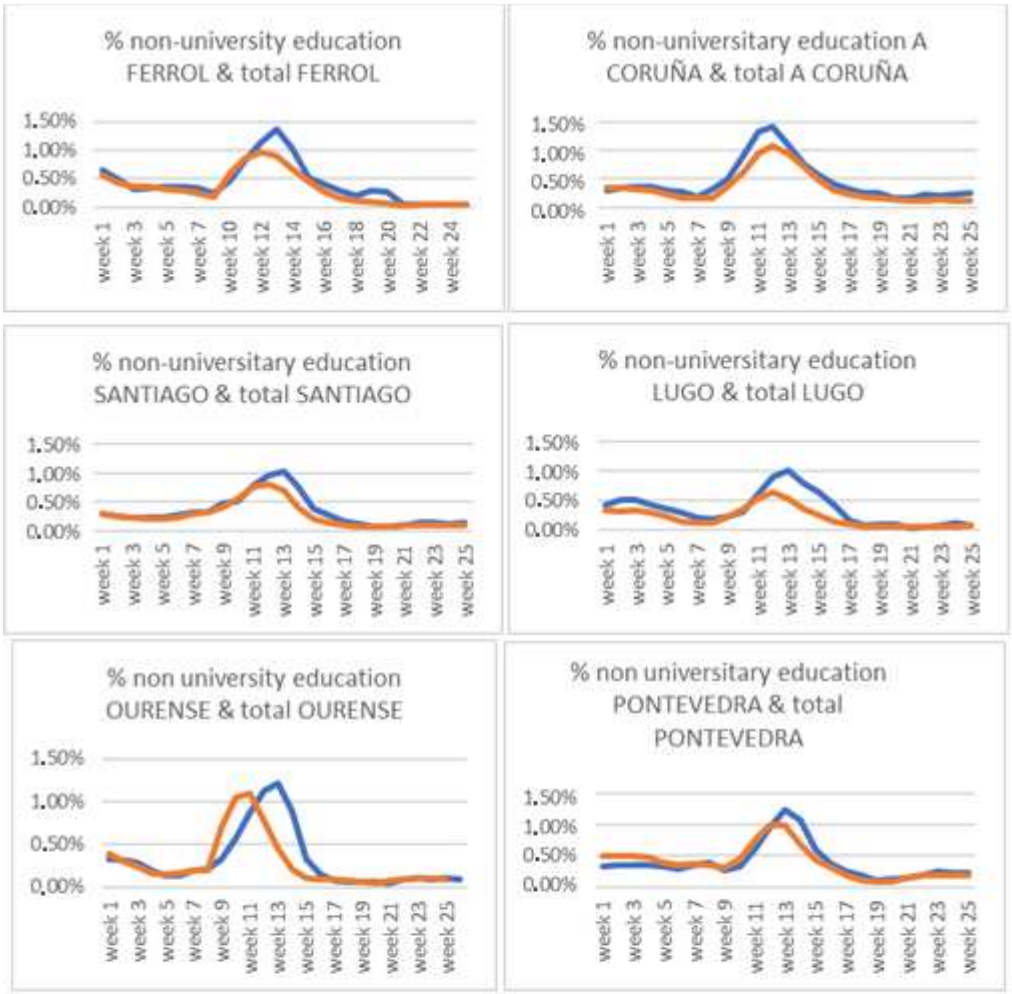

Figure 5. *Cont.*

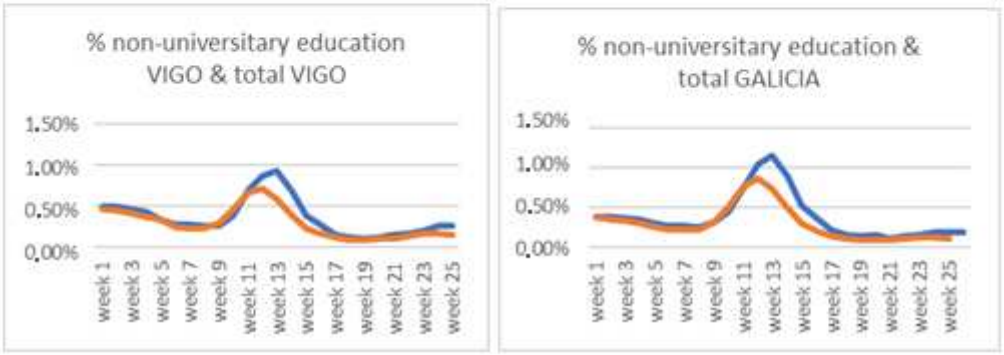

Figure 5. Percentage of active cases in non-university teaching centers in each sanitary area of Galicia (blue line) compared to the percentage of active cases in that age group (red line). Source: own elaboration based on data from the Ministry of Culture, Education and University [33], SERGAS [34] and the Galician Institute of Statistics [35].

Once the measures carried out by the Ministry of Culture, Education and University have been analyzed, we will analyze the number of closed classrooms and closed centers during this second and third waves. This will provide information about if the decision that the educational centers have been open during this pandemic has been correct, Table 4.

Table 4. Classrooms and closed centers in nursery schools by sanitary area.

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		Total Galicia	
	AC	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**
week 1	6	0	3	0	4	0	2	1	2	0	0	0	6	0	23	1
week 2	9	0	2	0	5	0	3	1	2	0	0	0	2	0	23	1
week 3	8	0	1	0	4	0	4	0	1	0	2	0	3	0	23	0
week 4	8	0	1	0	2	1	6	0	1	0	4	0	1	0	23	1
week 5	7	1	0	0	2	0	4	0	0	0	4	1	1	1	18	4
week 6	7	0	0	1	7	0	2	0	0	0	2	1	1	1	19	3
week 7	5	0	2	1	4	0	3	1	0	0	3	1	2	1	18	4
week 8	3	0	0	0	5	0	2	1	0	0	2	1	2	1	14	3
week 9	3	0	0	0	4	1	5	1	2	1	3	2	2	1	19	6
week 10	4	0	0	0	3	1	2	0	2	1	1	0	3	0	15	2
week 11	8	0	4	0	3	0	0	1	6	2	5	2	2	1	28	5
week 12	7	0	3	0	2	1	0	2	1	2	3	2	6	1	21	8
week 13	5	0	2	1	1	0	0	1	5	0	3	0	3	1	18	4
week 14	1	0	2	0	4	0	1	1	3	0	1	0	2	0	13	2
week 15	1	0	0	0	3	0	0	2	2	0	1	1	1	0	8	2
week 16	0	0	0	0	2	0	0	0	1	0	4	1	3	0	9	1
week 17	1	0	0	0	1	0	0	0	0	0	2	0	1	0	5	0
week 18	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
week 19	3	0	0	0	1	1	0	0	0	0	0	0	1	0	5	1
week 20	3	0	0	0	1	0	0	0	0	0	0	0	1	0	5	0

Table 4. *Cont.*

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		Total Galicia	
	AC	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**
week 21	0	0	0	0	1	0	1	0	0	0	0	0	0	0	2	0
week 22	0	0	0	0	2	0	1	1	0	0	2	0	1	0	6	1
week 23	0	0	0	0	1	0	1	0	1	0	2	0	1	0	6	0
week 24	1	0	1	0	0	0	0	0	0	0	1	0	4	0	7	0
week 25	0	0	1	0	2	0	0	0	0	0	1	1	5	0	9	1

Source: Own elaboration based on data from the Ministry of Culture, Education and University [33]. Key: (1) A Coruña; (2) Ferrol; (3) Santiago; (4) Lugo; (5) Ourense; (6) Pontevedra; (7) Vigo.

Tables 5 and 6 show closed classrooms (AC) and closed centers (CC) for nursery schools, non-university teaching and for the whole of Galicia, respectively.

Table 5. Classrooms and closed centers in non-universitary schools by sanitary area.

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		Total Galicia	
	AC	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**	**AC**	**CC**
week 1	9	0	5	0	6	0	7	1	6	0	7	0	24	0	64	1
week 2	19	0	2	0	7	0	13	1	4	0	8	0	18	0	70	1
week 3	19	0	1	0	7	0	8	0	1	0	4	0	10	0	49	0
week 4	15	0	5	0	6	1	6	0	1	0	6	0	4	0	43	1
week 5	13	1	5	0	6	0	8	0	1	0	7	1	8	1	49	4
week 6	13	0	2	1	10	0	2	0	2	0	3	1	8	1	40	3
week 7	12	0	6	1	10	0	7	1	7	0	8	1	15	1	65	4
week 8	5	0	5	0	11	0	7	1	4	0	10	1	11	1	53	3
week 9	3	0	0	0	4	1	5	1	2	1	3	2	2	1	19	6
week 10	8	0	1	0	5	1	2	0	3	1	3	0	8	0	30	1
week 11	24	0	10	0	15	0	4	1	11	2	12	2	31	1	107	5
week 12	39	0	15	0	18	1	8	2	10	2	20	2	54	1	165	9
week 13	35	0	18	1	22	0	10	1	28	1	24	0	51	1	187	5
week 14	17	0	6	0	14	0	12	1	15	0	22	0	40	0	125	2
week 15	15	0	2	0	9	0	10	1	5	0	17	1	18	0	75	1
week 16	7	0	2	0	3	0	3	0	2	0	8	1	8	0	33	1
week 17	7	0	6	0	3	0	2	0	2	0	8	0	7	0	34	0
week 18	9	0	3	0	2	0	1	0	2	0	4	0	6	0	25	0
week 19	7	0	5	0	1	1	1	0	2	0	2	0	5	0	23	1
week 20	7	0	2	0	1	0	1	0	0	0	1	0	4	0	16	0
week 21	0	0	0	0	2	0	1	0	0	0	0	0	1	0	4	0
week 22	2	0	0	0	5	0	1	1	1	0	3	0	2	0	14	1
week 23	3	0	0	0	4	0	2	0	3	0	7	0	7	0	26	0
week 24	4	0	1	0	2	0	2	0	1	0	4	0	21	0	35	0
week 25	8	0	1	0	7	0	0	0	2	0	5	1	18	0	41	1

Source: Own elaboration based on data from the Ministry of Culture, Education and University [33]. Key: (1) A Coruña; (2) Ferrol; (3) Santiago; (4) Lugo; (5) Ourense; (6) Pontevedra; (7) Vigo.

Table 6. Closed classrooms and closed centers in nursery schools and non-university education centers throughout Galicia.

	Nursery School		**Non-Universitary Education**	
	AC	**CC**	**AC**	**CC**
week 1	23	1	64	1
week 2	23	1	70	1
week 3	23	0	49	0
week 4	23	1	43	1
week 5	18	4	49	4
week 6	19	3	40	3
week 7	18	4	65	4
week 8	14	3	53	3
week 9	19	6	19	6
week 10	15	2	30	1
week 11	28	5	107	5
week 12	21	8	165	9
week 13	18	4	187	5
week 14	13	2	125	2
week 15	8	2	75	1
week 16	9	1	33	1
week 17	2	0	25	0
week 18	5	1	23	1
week 19	5	0	16	0
week 20	2	0	4	0
week 21	6	1	14	1
week 22	6	0	26	0
week 23	7	0	35	0
week 24	9	1	41	1

Source: Own elaboration based on data from the Ministry of Culture, Education and University [33].

Figure 6 shows the evolution of closed classrooms in nursery schools in Galicia as a whole. As can be seen, the worst case corresponds to 187 closed classrooms in non-university education centers and 9 in the case of nursery schools.

Figure 7 shows the number of closed centers. As can be seen in this figure, the graphs are practically similar. The highest value was reached in week 13 with 8 and 9 closed centers for nursery schools and non-university teaching centers.

If we take into account that the number of face-to-face educational centers in Galicia, according to the Xunta de Galicia [33], is 1624 and that the nursery schools are 171, we can see the low incidence that COVID-19 has had in the educational centers and the effective management carried out, Table 7. The worst value was reached for nursery schools in week 13, with 4.48% of nursery schools closed and 0.53% of higher education centers closed.

Although the graphs of non-university teaching centers were less favorable, it can be seen that the impact on teaching has been very low.

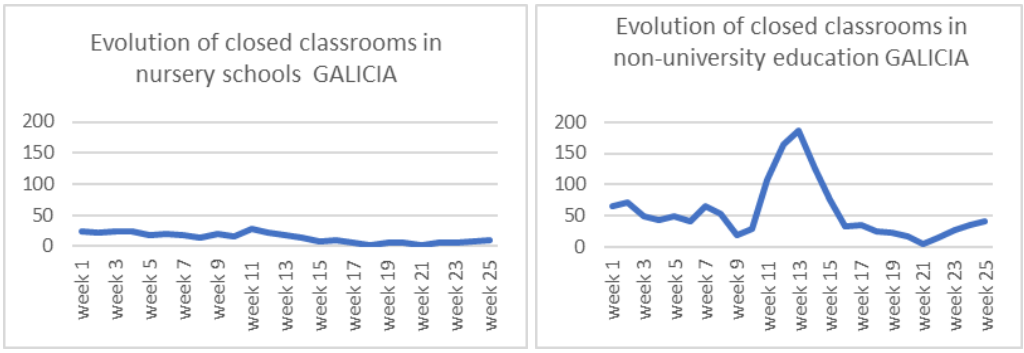

Figure 6. Closed classrooms in nursery schools and non-university education centers for the whole Galicia. Source: Own elaboration based on data from the Ministry of Culture, Education and University [33].

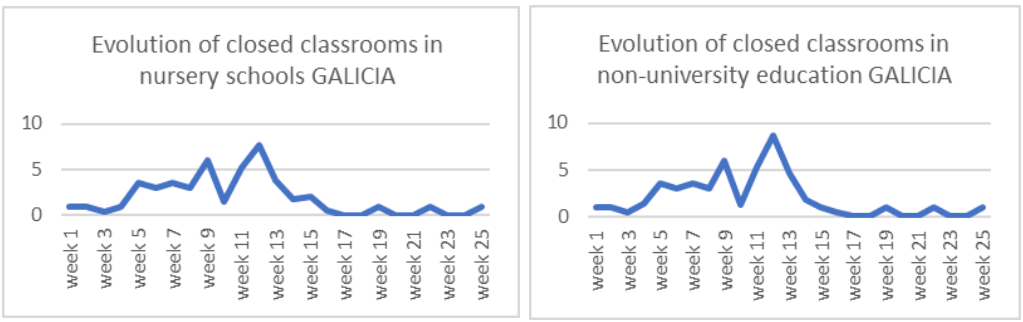

Figure 7. Evolution of closed classrooms and closed centers in nursery schools and non-university teaching. Source: Own elaboration based on data from the Ministry of Culture, Education and University [33].

Table 7. Percentage of nursery schools and non-university education centers closed in Galicia during the second and third waves.

	Nursery Schools	Non-Universitary Education
week 1	0.58%	0.06%
week 2	0.58%	0.06%
week 3	0.23%	0.02%
week 4	0.58%	0.08%
week 5	2.11%	0.22%
week 6	1.75%	0.18%
week 7	2.11%	0.22%
week 8	1.75%	0.18%
week 9	3.51%	0.37%
week 10	0.88%	0.08%
week 11	3.07%	0.32%
week 12	4.48%	0.53%
week 13	2.22%	0.28%
week 14	1.02%	0.11%
week 15	1.17%	0.06%
week 16	0.29%	0.03%

Table 7. *Cont.*

	Nursery Schools	Non-Universitary Education
week 17	0.00%	0.00%
week 18	0.00%	0.00%
week 19	0.58%	0.06%
week 20	0.00%	0.00%
week 21	0.00%	0.00%
week 22	0.58%	0.06%
week 23	0.00%	0.00%
week 24	0.00%	0.00%
week 25	0.58%	0.06%

Source: Own elaboration based on data from the Ministry of Culture, Education and University [33,39,40].

As a complement to this study, data from the University of A Coruña (UDC) has been analyzed. The University of A Coruña encompasses two health areas: Ferrol and A Coruña. These areas are included in the data of Table 8, which shows the active people in the sanitary areas of Ferrol and A Coruña in the age range of 18 to 24 years, which is the average age of the university students of the University of A Coruña.

Table 8. Data of active cases in the UDC during the second and third waves.

	Active Cases	Students	Administration and Services Staff (PAS)	Teaching and Research Staff (PDI)
week 1	6	5	0	1
week 2	7	5	0	2
week 3	11	10	1	0
week 4	8	8	0	0
week 5	12	10	2	0
week 6	6	5	0	1
week 7	6	4	2	0
week 8	3	3	0	0
week 9	9	9	0	0
week 10	19	16	1	2
week 11	32	26	3	3
week 12	41	32	1	8
week 13	18	13	1	4
week 14	13	12	1	0
week 15	3	2	0	1
week 16	2	2	0	0
week 17	4	2	1	1
week 18	8	7	1	0
week 19	1	1	0	0
week 20	7	7	0	0

Source: University of Coruña (UDC) [36].

As can be seen in Figure 8, the incidence in the UDC is much lower than in non-university education centers and in nursery schools, with values evaluated at all times well below the mean for the population of the same age.

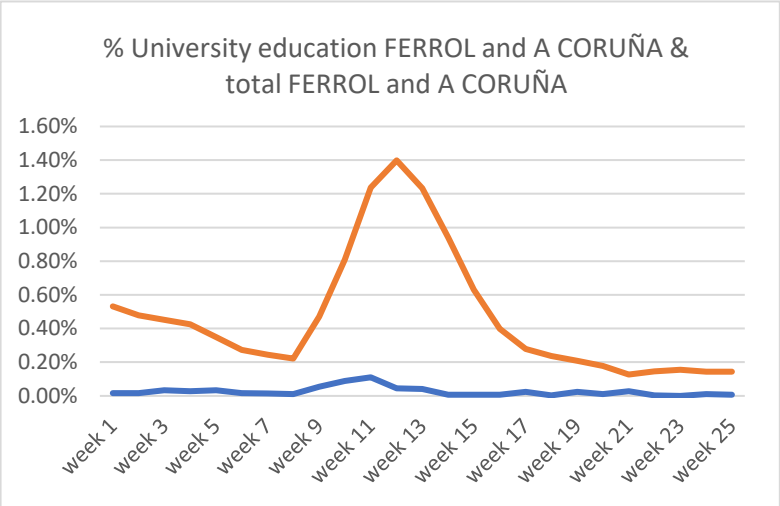

Figure 8. Percentage of active cases in university teaching centers of the University of A Coruña (blue line) compared to the percentage of active cases in that age group (orange line). Source: own elaboration from the University of A Coruña [34,36], SERGAS [34] and the Galician Institute of Statistics [35].

4. Conclusions and Discussion

After analyzing the data, it has been possible to demonstrate that the decision not to close the educational centers has been adequate since the spread of the virus in them has been low.

With the data obtained by official statements, it is shown that the incidence in nursery schools has had very low values. This may be due to the management that the nursery schools have carried out, following the protocols of the competent authorities, or because contagion in these age groups seems lower than in other groups.

Comparing the values of incidence of infections between the general population and that corresponding to non-university education centers, it can be deduced that the values are very similar. Analyzing the data on the appearance of outbreaks in these centers, it can also be seen that the number registered is not very significant, despite the fact that the teaching in this case has been completely face-to-face.

In both cases, nursery schools and non-university schools, it can be seen that the worst data correspond to those registered for week 12 (second wave of infections). In this period, the percentage of closed nursery schools was 4.48% and that of non-university education centers was 0.53% (Tables 6 and 7). With these data, it could be concluded that face-to-face teaching at these educational levels has not posed a risk for the increase in infections, taking into account the action protocols of the corresponding organizations [41]. In this way, it can be estimated that the closure of these centers could have caused greater health and social damage [42,43], being able to also cause, as can be seen in the article by Eiji Yamamura and Yoshiro Tsustui, that the gender gap is greater [44] than the health risk assumed.

From the analysis of the situation observed in university education, it can be seen that the incidence of contagion is even lower than that registered for nursery schools (see Figures 4, 5 and 8). It could be affirmed that, guaranteeing the social distance protocols, it would be possible to have maintained face-to-face teaching at this educational level [41].

On the other hand, it has been seen that there are hardly any differences between the different health areas in infections. The health area with the highest percentage of children of nursery school age are in Vigo, with 3.7% of the population between 4 months and 3 years old. However, the highest incidence values in the general population are not found in this health area, but in the Ferrol area. In this area, the percentage of children with infection is 3.1%. In the case of non-university education, the highest percentages are in Pontevedra with 14% of infections between the students. In addition, the highest incidence is found in the health areas of Ferrol and A Coruña, whose percentages of children in this

age group are lower. With these data, it cannot be concluded that there are significant differences between the different health areas, despite differences between restrictions and in the composition of the population.

In addition, the number of outbreaks detected within the centers of the different educational levels has not been significant, so it does not seem that the total closure of these centers is an effective or necessary measure to face a pandemic of these characteristics. Moreover, it is important to note that the need for socialization of both younger children and adolescents and university students makes face-to-face teaching essential for their development, both intellectual and social, since the lack of socialization, isolation and fear are creating even more serious problems in students, as can be seen in the studies carried out by Vyjayanthi N V and Camila Saggoioro de Figueiredo [45,46]. Therefore, the future perspectives of research of this kind of topic will indicate the importance of face-to-face teaching in school education.

On the other hand, it is important to comment that the data obtained may be helpful in treating subsequent waves of the SRS-CoV-19 pandemic, since although it is a disease that is normalizing in our country, there are countries that have suffered from the pandemic since the first moment and they are still carrying out confinements of the general population.

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Deciphering Learning Motivation in Open Distance Learning towards Sustainable Medical Education

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Abstract: Open distance learning has become a new norm in medical education since the COVID-19 pandemic. The abrupt shift from conventional medical education to fully virtual learning deserves a reflection on how it affected the learning motivation among medical students. Hence, this study aimed to investigate the effect of open distance learning on their learning motivation during this pandemic period, with suggestions to improve through reflections and recommendations. This qualitative study involved 152 medical students undertaking the Doctor of Medicine program in Universiti Kebangsaan Malaysia, Malaysia, during the COVID-19 pandemic. All data were collected through a validated questionnaire. We found that medical students portrayed intrinsic motivation—mainly self-motivation, self-discipline, and self-adaptation—in open distance learning during the pandemic period. Feedback from medical students also showed that they advocated a better internet connection, innovative teaching, and learning, as well as new appropriate assessment methods and strengthening of the learning management system for a sustainable open distance learning outcome. Hence, medical educators should be creative in making use of open distance learning as an attractive complementary platform in medical education to ensure life-long learning.

Keywords: education; medical; online learning; motivation; COVID-19

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1. Introduction

Open distance learning has emerged to be the new norm since the novel coronavirus disease 2019 (COVID-19) pandemic. Medical education is not spared from this new norm, as the implementation of the nationwide Movement Control Order (MCO) has forced all medical teaching and learning to be conducted fully online. The abrupt transformation from conventional medical education to exclusive open distance learning is challenging [1–6] and the effect on learning motivation among medical students remains unelucidated.

Generally, open distance learning, also known as digital learning, is a way to complement students' learning process by integrating the advancement of technology in assessing, tutoring, and instructing students for educational purposes [7]. It comprises a few components, mainly digital teaching materials, digital tools, digital delivery, and autonomous learning [8]. Other terminologies that are commonly used to represent open distance learning include 'e-learning', 'technology-enhanced learning', 'internet-based training', 'web-based training', 'online learning', 'network learning', and 'distance learning' [7,9]. Students can learn online synchronously and asynchronously without time and location restrictions, with indirect cultivations of autonomous learning ability through open distance learning [10,11].

In fact, open distance learning has been incorporated into Malaysia's medical education through the Learning Management System (LMS) in conjunction with the ministry's initiative, MyHE4.0 (Education 4.0) in the Higher Education Blueprint 2015–2025. A 'blended learning' environment is created that enables virtual communications between students and lecturers, assignment submission, and group discussion [12]. Even though most

medical students are tech-savvy and support the use of open distance learning in medical education due to its interactivity, cost-effectiveness, and convenience [13–15], open distance learning has been a complementary role in medical education. Our conventional medical education setting is mainly involved a physical lecture in the hall and conventional bedside teaching and learning methods with real patients. However, the shift towards fully open distance learning will involve several challenges, including the increasing time constraints and demands faced by educators and students, network issues, availability of infrastructures, and the perception of being distracted while using high-end technologies that will further impede the development of open distance learning in medical education [16–19].

Learning motivation is affected by a few factors including intrapersonal determinants (i.e., age and gender); interpersonal determinants (i.e., academic conditions, cognitive outcomes); affective outcomes (i.e., anxiety and depression); behavioural outcomes (i.e., academic engagement) [20,21]. Parental and teacher support [22,23], as well as positive personality traits such as perseverance, gratitude, and desire for learning [24–26], also have positive correlations with learning motivation.

The effectiveness of open distance learning depends on students' ability to learn independently, initiate discussions with peers and educators, and develop understandings through active engagement with digital resources [27]. This requires sustainability of learning motivation [28]. Previous studies have reported that blended learning in medical education improves learning motivation. However, the impact of the COVID-19 pandemic on open distance learning and learning motivation remains unexplored. The unforeseen stressors of the pandemic may affect learning motivation and the outcome of open distance learning [29].

The recommendations and reflections from medical students are crucial to enhancing the sustainability of medical education. Hence, this study aimed to qualitatively analyse medical students' learning motivation during this COVID-19 period, as well as their points of view on improving open distance learning.

2. Materials and Methods

2.1. Study Design

This study embraced a qualitative approach in collecting both reflection and feedback from undergraduate medical students of Universiti Kebangsaan Malaysia (UKM), Malaysia. A set of validated questionnaires including an information sheet and a consent form were distributed via Google Forms (Supplementary file), from March 2020 to May 2020, two weeks after the initiation of lockdown in Malaysia. A pilot study to validate the questionnaire was carried out among 35 UKM medical students, with Cronbach's alpha, $\alpha = 0.91$. This study was approved by UKM Ethics Committee (UKM PPI/111/8/JEP-2019-702).

2.2. Selection of Respondents and Data

All current UKM students undertaking the course of Doctor of Medicine were eligible to participate in this study. Stratified convenience sampling was used in which the sample was stratified by year of study and each year contributed an equivalent ratio to population. A study by Universiti Putra Malaysia, Malaysia (UPM) [30] with a power of 1.000 was referenced for sample size calculation. Eventually, there were a total of 152 year 1–year 5 UKM undergraduate medical students that participated in this study.

Demographic data and educational background of respondents were collected, including age, year of study, and phase of the study. The phase of the study consisted of year 1 and year 2 representing the preclinical phase, and year 3 to year 5 for the clinical phase. Reflections regarding their learning motivation during the pandemic period, as well as their opinions on future open distance learning improvements, were collated and further divided into different emerging themes.

2.3. Statistical Analysis

Results were recorded using Statistical Package for Social Science (SPSS) Version 27 by the IBM Corporation, New York, United States, and analysed qualitatively based on the aforementioned objectives. The reflections on learning motivation during the pandemic and recommendations to improve open distance learning were coded into respective emerging and main themes. The coding was performed by two independent authors and cross-checked to determine any discrepancies. Should there be any discrepancies in opinions, a third author would address the difference in opinions and reach a consensus together with the two authors.

3. Results

3.1. Demographic Characteristics

Among 152 UKM undergraduate medical students, the mean age was 21.94 ± 1.63. Preclinical and clinical medical students comprised 38.8% and 61.2% of the total students, respectively (Table 1).

Table 1. Demographic characteristics of respondents (n = 152).

Demographic Data		Number of Students, n(%)
Year of Study	1	31 (20.4)
	2	28 (18.4)
	3	27 (17.8)
	4	35 (23.0)
	5	31 (20.4)
Phase of Study	Preclinical	59 (38.8)
	Clinical	93 (61.2)
Total Students		152

3.2. Themes of Learning Motivation (LM) during the COVID-19 Period

The reflections on learning motivation during the pandemic period were collated into 11 emerging themes (Table 2), which were further summarised into 2 main themes—intrinsic and extrinsic motivations (Figure 1). Respondents were labelled as 'R'.

Table 2. Main themes of learning motivation.

Quote	Emerging Theme	Main Theme
'I set up a to-do list every day and focus on things I want to study in small sessions.' (**R2**)	Self-motivation	Intrinsic motivation
'Regardless of whether we're in difficult times, learning is a continuous journey, the one that can only stop you from learning new knowledge is your own self.' (**R12**)	Self-discipline	
'Very badly. No motivation most of the day' (**R29**)	Self-adaptation	
'To pass the year and move on.' (**R139**)	Feeling indifferent	
'Weekly teaching and lecture motivate me to understand things better.' (**R1**)	Online teaching	Extrinsic motivation
'My supervisor is the main reason why I am able to cope with this kind of learning method.' (**R4**)	Lecturer	
'I watch videos to understand better.' (**R54**)	Open distance learning using different resources	
'Always remind myself about the pro exam.' (**R14**)	Examination	
'Ask motivation from friends and family.' (**R11**)	Family	
'By continuously keeping in touch with my friends, making a checklist of the subjects that I need to cover, having a conducive study area, and online group study with friends.' (**R31**)	Friend	
'Not having a conducive studying environment at home ...' (**R43**)	Learning motivation	

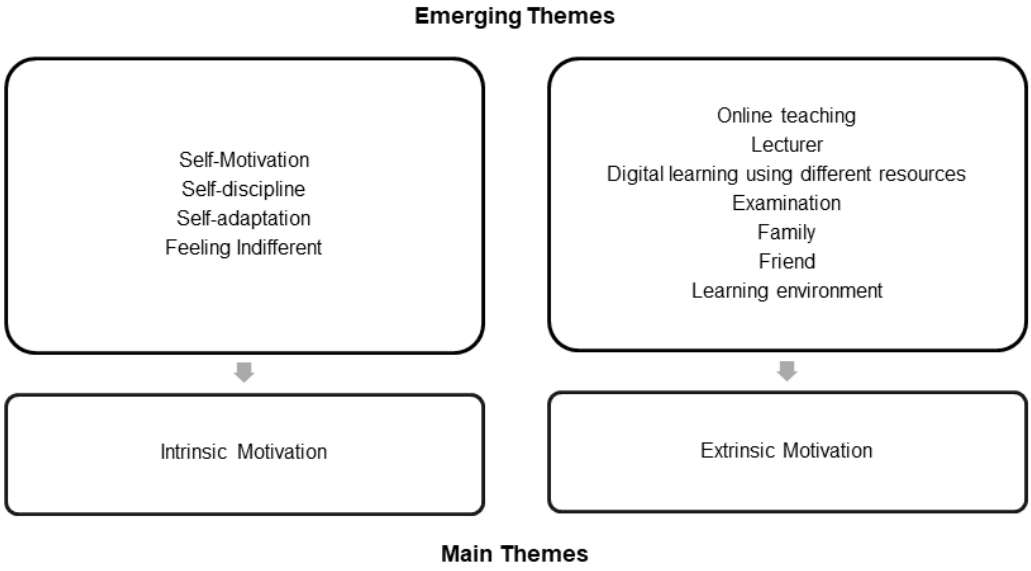

Figure 1. The summary of emerging themes based on the reflection on learning motivation.

3.2.1. Theme LM1: Intrinsic Motivation

Out of 152 responses, 55.9% of students reflected intrinsic motivation in their answers. Of those, 28 responses pointed towards self-motivation during the COVID-19 pandemic. Most of the responses mentioned reminding oneself subconsciously regarding the reason for choosing the medical profession and the necessity of continuous learning.

'Regardless of whether we're in difficult times, learning is a continuous journey, the one that can only stop you from learning new knowledge is your own self.' **(R12)**

Some medical students also boosted their self-motivation via other sources available while learning at home.

'Watch vlogs of medical students like Ali Abdal, etc. to make me feel like studying.' **(R59)**

'By watching motivational videos.' **(R64)**

Another emerging theme that was categorised under intrinsic learning motivation would be self-discipline. In total, 50 responses portrayed medical students applying the principle of self-discipline as learning motivation.

'I set up a to-do list every day and focus on things I want to study in small sessions.' **(R2)**

'A lot of self-studies, researching materials, and discussions with lecturers.' **(R45)**

'Study a lot and never forget to rest in between online sessions.' **(R110)**

Additionally, there were three responses that mentioned the feeling of indifference despite the transformation.

'To pass the year and move on.' **(R39)**

Shifting from face-to-face learning to open distance learning is an enormous challenge for medical students, especially those clinical students who used to practice clinical skills in hospital settings. This transformation requires one to have the skill of self-adaptation. However, despite various themes of learning motivation, there were four responses pointing towards incapability to adapt due to the lack of both intrinsic and extrinsic motivation. Three out of four responses were from clinical students.

'Very badly. No motivation most of the day.' **(R30)**

'Difficult.' **(R55)**

3.2.2. Theme LM2: Extrinsic Motivation

The learning environment was the extrinsic factor that cause the inability to adapt, as indicated by one student with the following statement:

'...Not having a conducive studying environment at home and also a lot of reading materials have been left at the college . . . ' **(R43)**

As online classes had become the bread-and-butter routine of everyday life, there were students (n = 10) who said that online learning motivated them to understand the lessons better.

'Weekly teaching and lecture motivate me to understand things better.' **(R1)**

Among the students whose learning motivation was extrinsic, six of them thought that lecturers can be a source of learning motivation.

'My supervisor is the main reason why I am able to cope with this kind of learning method.' **(R4)**

Different sources of open distance learning which were found online such as research articles, e-books, educational videos, etc. were considered students' extrinsic motivation because these sources were very informative and easily accessible.

'I watch videos to understand better.' **(R54)**

Cancellations or delays of examinations over the COVID-19 pandemic did not demotivate the students; in contrast, upcoming delayed examinations had become a learning motivation for 18 students, especially those who were in the final year.

'Counting days for professional exams.' **(R7)**

A total of 32 students reflected that family (n = 6) and friends (n = 26) acted as strong support for them to study at home during COVID-19.

'Ask for motivation from friends and family.' **(R11)**

'My friends and I have discussions frequently regarding questions we encounter during our teachings . . . ' **(R26)**

3.3. Reflections on Methods (RM) to Improve Open Distance Learning

Recommendations on open distance learning improvement were collated (Table 3), consisting of a total of 18 emerging themes, which were further summarised into 5 main themes (Figure 2).

Table 3. Main themes of open distance learning improvement.

Quote	Emerging Theme	Main Theme
'Improve the Wi-Fi connection and online course platforms.' (**R2**)	Improve Wi-Fi connection	Better internet connection
'Provide free internet to those who are in need, give lectures in more fun and challenging ways, e.g., playing games, Kahoot.' (**R52**)	Free internet	
'Pre-record the video so it can be played many times.' (**R1**)	Pre-record videos/lectures	Different teaching and learning methods
'Students should participate actively in discussion and share their ideas more with the classroom.' (**R12**)	Make it more interactive (involve lecturers and students—discussion)	
'Having online lectures every day for at least one hour to sustain the knowledge.' (**R90**)	More online teaching	
'Be more creative and graphical.' (**R18**)	More graphical explanation	
'Upload examination videos that are verified and agreed by all the lecturers as a standard.' (**R10**)	Videos on theory/clinical part	
'Can involve real patients in learning history taking.' (**R64**)	Video conferencing with patients	
'Case-based scenario, virtual ward rounds' (**R114**)	Virtual ward round	
'Tele-viva sessions and use of simulation software instead of lectures' (**R6**)	Simulation software	

Table 3. *Cont.*

Quote	Emerging Theme	Main Theme
'We need virtual reality; it will make it a lot more fun but then again not realistic at all.' (**R51**)	Virtual reality	
'Hope University expands and adds more resources to online medical courses (subscribe to them, e.g., UpToDate).' (**R116**)	Learning apps (UpToDate)	
'Provide free eBooks or any study materials that reliable/easy to understand.' (**R79**)	Free eBooks	
'Prepare more questions along with the lecture slides so that can stimulate thinking other than just simply listening to lecture.' (**R15**)	Quizzes/Question banks/Kahoot	
'Develop more systematic systems in conducting online courses including various forms of teaching and learning methods.' (**R13**)	Improve and standardise online course platforms	Strengthening of LMS platform
'Tele-viva sessions and use of simulation software instead of lectures.' (**R6**)	Tele-viva sessions	Assessment
'Improve the assessment system. Instead of sticking to the same weightage for final semester exams, maybe the management team can adjust the weightage and methods of evaluation if either exams or teaching and learning sessions are held online.' (**R39**)	Different weightage, methods	
'I prefer the traditional way of learning rather than online as history taking and physical examination cannot be trained via digital learning.' (**R33**)	Human Interaction	The traditional method of learning

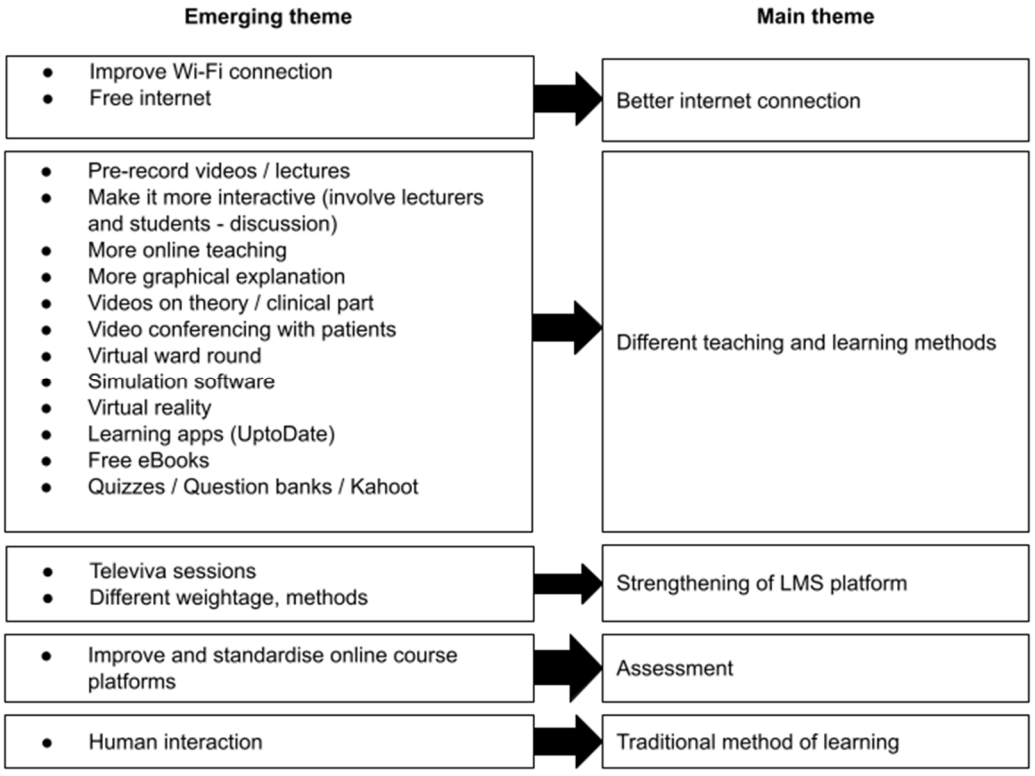

Figure 2. The summary of emerging themes based on the feedback on open distance learning improvement.

3.3.1. Theme RM1: Better Internet Connection

Online learning is dependent on internet access, and without a stable internet connection, the learning process would be interrupted since most of the materials and resources were available online. In this theme, there were two groups of responses which included improvement of Wi-Fi connection (16 responses) and free internet access (2 responses).

'Improve the Wi-Fi connection and online course platforms.' **(R2)**

'Provide free internet to those who need it, give lectures in more fun and challenging ways, e.g., playing games, Kahoot.' **(R52)**

3.3.2. Theme RM2: Different Teaching and Learning Methods

Twelve different approaches used in medical learning were collated from the responses under the main theme of different learning methods. Due to occasionally unstable internet connections, some students were unable to access synchronised online classes; therefore, there were nine students who suggested that lectures and educational videos be pre-recorded before the class or recorded during the class as a reference for those students.

'Record teaching video for practical besides concept lecture because it is better than online discussion. Sometimes the line does not cooperate, I can't get the full content of the discussion...' **(R32)**

There were students (n = 27) who deemed e-learning as a more interactive way of learning and involved intercommunication between both lecturers and students instead of plain lecturing.

'More group discussions and problem-based learning than mass lecture.' **(R46)**

While all medical students were staying at home under the Movement Control Order, three students mentioned that online teaching should be delivered more frequently, and one of them gave the following example:

'Having an online lecture every day at least for one hour to sustain the knowledge.' **(R90)**

To enhance the understanding of certain topics, especially lessons involving anatomy and physiology, there were two comments about the preparation of more graphical explanations; for instance, lecturers may incorporate more mind maps or diagrams when delivering lectures.

'More exciting and easier to understand by using more pictures along with the explanation.' **(R144)**

For the substitution of physical examination, 22 responses suggested that it can be learned through demonstration via video, and an explanation of each step should be recorded simultaneously.

'Upload examination videos that are verified and agreed by all the lecturers . . . ' **(R10)**

Students also suggested that history taking can be carried out through video conferencing with patients whose condition was stable to be interviewed.

'Can involve real patients in learning history taking.' **(R64)**

There was one response that suggested virtual ward rounds to replace the routine ward round performed in a hospital setting.

'... virtual ward rounds.' **(R114)**

Learning via simulation software was also mentioned by 23 students.

'Can improve session like 'DxR Clinician' so students can improve (on) their clinical reasoning skills.' **(R14)**

Three responses suggested virtual reality replacing clinical exposure learning for medical students.

'We need virtual reality; it will make it a lot more fun but then again not realistic at all.' **(R51)**

Two students hoped that the faculty can subscribe to more learning applications during this COVID-19 period.

'.... subscribe to UpToDate.' **(R21)**

For students who used to borrow medical books from the library or left their study materials at their accommodation in the faculty, there was one suggestion about free e-books which can be accessed online.

'... provide free eBooks or any study materials that are reliable/easy to understand . . . ' **(R79)**

To consolidate one's knowledge and explore their own understanding of certain topics, there were 16 responses that mentioned quizzes, question banks, or Kahoot.

'...provide practice questions/clinical scenarios as homework, to be discussed further online.' **(R21)**

3.3.3. Theme RM3: Strengthening of LMS Platform

Learning Management System (LMS) is another crucial component in the transformations of medical education via open distance learning. An ideal LMS will provide a standardised platform for all students to access e-learning content systematically and interact with each other, while lecturers can track the progression of students. Some medical students recommended that UKM's LMS, UKMFolio^{TM} should be improved, as shown in the following statements:

'...my suggestion is that our university should prepare a dedicated website for online learning where all the syllabus is structured.' **(R66)**

'Standardising the way, the instructions are given such as displaying the submission date and time in a column where all students and lecturers can see clearly.' **(R74)**

'(LMS) a stable platform where students and lecturers can communicate well because it's more like one-way communication now and taking longer than usual.' **(R82)**

3.3.4. Theme RM4: Assessment

A small proportion of students (n = 2) suggested that the assessment method should be modified to be in line with the modifications upon implementation of open distance learning.

'Improve the assessment system. Instead of sticking to the same weightage for final semester exams, maybe the management team can adjust the weightage and methods of evaluation if either exams or teaching and learning sessions are held online.' **(R39)**

3.3.5. Theme RM5: Traditional Method of Learning

A total of four students insisted on having traditional methods of learning, as they believed that clinical components especially cannot be replaced with open distance learning. Three out of these four students were clinical students. Two of them even proposed that they were willing to postpone the current semester and graduation until they were allowed to enter the hospital and resume the usual way of learning from patients.

'I prefer traditional ways of learning rather than online as history taking and physical examination cannot be trained via digital learning.' **(R7)**

'Nothing, no online classes ever can beat the actual learning method by seeing patients. Postpone the semester.' **(R130)**

4. Discussion

Generally, it is believed that open distance learning cannot replace the conventional teaching and learning methods in medicine [31–34], as the nature of the medical degree involves substantial hands-on skills that open distance learning lacks. Open distance learning has been playing a complementary role in medical education thus far [31]. Indeed, the unanticipated full implementation of open distance learning upon the introduction of the Movement Restriction Order (MCO) in Malaysia has left all faculty members unprepared, and the actual outcome is yet to be observed. Open distance learning has been implemented in medical schools worldwide during the COVID-19 pandemic [2,35–38]. Various innovative teaching and learning methods have been introduced such as virtual clerkships, simulation software, and digital clinical placements [39–44]. However, one of the main concerns is internet connection issues such as poor coverage, low speed, and network congestion [16]. This has been the main challenge faced by undergraduate students throughout their studies [45–48]. In fact, our preliminary data found that 40% of

medical students had a poor internet connection (<5 Mbps). Feedback from the medical students also showed that internet connection must be improved, and free internet should be provided to achieve effective open distance learning.

We believe that this medical education transformation has caused certain changes and impacts on learning styles among medical students. Multimodal has been the preferred style of learning among medical students, especially among universities that use integrated curricula [49–53]. Hence, with the implementation of open distance learning, there are adaptations from lecturers and medical students, as they are required to make use of the available resources in digital platforms to gain the utmost knowledge and skills for practical clinical components that were initially obtained through clinical clerkships at the hospital. As such, clinical students would be more impacted, as they have missed the most crucial part of learning directly from patients. Indeed, there were several responses from clinical students stating that they had a tough time adapting to open distance learning. They hoped that they could be provided with more interactive forms of digital learning, simulation software, videos regarding the topics to be learned, and recordings of lectures. These strategies make up the multimodal style of learning, including aural and visual, and can partially replace the kinaesthetic style since students do not have any direct experience with patients via clerkships in hospitals during the pandemic period. In fact, medical students have positive views towards the use of simulation-based learning [54–57] and virtual reality [40,58–60], as they provide hands-on practice and improve learning competency with clinical reasoning skills especially when there is limited availability of patients in hospitals. Hence, the development of simulation labs should be encouraged in medical institutions to allow medical students to gain medical–procedural experience with more intensive training workshops provided for lecturers so that it could be used as an additional tool for medical teaching and learning.

Our results found that medical students portrayed intrinsic motivation, mainly self-motivation, and self-discipline, in coping with this tough time. For instance, some of them motivate themselves to learn continuously by recalling the actual intention of medical pursuit, while some create an organised study plan with daily learning objectives to ensure that they learn something every day. This is reasonable, as medical students are known to have high intrinsic motivation, compared with undergraduate students of other courses [61,62]. High motivation has been one of the vital components during selections or interviews for the course of medicine [63,64]. Thus, medical students with pre-existing high intrinsic motivation will make use of all available digital resources for their study despite the challenges they faced during the pandemic.

Hence, it can be concluded that most of the medical students' learning motivations are not impacted by the pandemic. As open distance learning has been part of the blended learning in UKM medical curricula, medical students generally adapted well during the pandemic. However, the challenges that they face from full digitalisation of open distance learning mainly emerged from extrinsic factors, especially the learning environment. As suggested by medical students, stable internet connection, more variety of online learning platforms such as UpToDate and full-text journals that are accessible without any time and place restrictions, and ideal LMS platforms to access all learning materials while encouraging discussions between lecturers and students via online assessments such as quizzes and viva sessions are required if the university were to embark on the sustainable open distance learning experience. Based on these recommendations, students with high intrinsic motivation can improve their lifelong learning skills through open distance learning.

This study was conducted with a few potential limitations. Further quantitative synthesis to determine the impact of potential confounders such as age, gender, the phase of the study, and household income on learning motivation among medical students was not carried out due to the lack of relevant data. Since only UKM medical students were involved in this study, the representativeness and generalisability of the findings to other medical faculties are limited. Additionally, there was a likelihood of respondents giving socially desirable responses, as they may answer the questionnaire positively based on

what they perceived to be expected of them since our study used self-reported data. Further longitudinal studies with mixed methods are recommended to explore the impact of open distance learning on learning motivation among medical students. Constant feedback, reflections, and evaluations from medical students on the implementation of open distance learning are required to improve medical education.

5. Conclusions

The majority of medical students portrayed intrinsic motivation in their studies during the current pandemic period. Better internet connection, innovative ways of teaching and learning, new assessment methods, and strengthening of LMS is recommended for optimal outcome of open distance learning. Open distance learning should be improvised based on students' needs and recommendations to be an additional driving factor to further increase learning motivation, especially during this pandemic period, when face-to-face teaching and learning methods are limited.

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Final Year Undergraduate Students' Representation of the COVID-19 Pandemic and the Lockdown: Adaptability and Responsibility

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Abstract: The COVID-19 pandemic has generated a new reality worldwide and reconfigured identities, behaviors and interests. It has called for heroic representations and highlighted the role of social media in efficient communication. All of the above considered, the current article focuses on the representation of the COVID-19 pandemic generated by the undergraduate students enrolled in the Social Work study program in Transilvania University of Brașov (Romania) by indicating the main connotations of the pandemic and drawing a comparison between students' representation and the early representations of the same pandemic produced by specialized literature on the topic. The thematic analysis of the essays produced by students highlights their frustration with the havoc brought about by the pandemic to their graduation plans and with the lack of interaction with colleagues and academic staff, as well as their gratitude for the efforts undertaken by their professors to make online education functional, their availability to adapt and support the restrictive measures imposed by authorities, and their optimism about the evolution of the pandemic. The content analysis of 60 bibliographic sources on the topic of COVID-19, indicated by the Anelis+ network as the most relevant in the spring of 2020, highlights a thematic convergence between the aforementioned sources and students' representation of COVID-19, and thus their responsible attitude toward meeting the challenges of the pandemic.

Keywords: representations; COVID-19 pandemic; undergraduate students; online education; thematic analysis

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1. Introduction

1.1. The Challenge of Managing the COVID-19 Pandemic

On the 11 March 2020, the Director of the World Health Organization acknowledged that the COVID-19 virus originating from the Hubei province of China had led to a worldwide pandemic [1]. The virus spread swiftly in western Europe and the USA, particularly in cities hosting important international transportation hubs. The pandemic has affected different countries around the world, challenging them to find common means of facing it [2]. It has also put pressure on the medical system and jolted social structures [3]. COVID-19 and the related social isolation imposed worldwide as a result of measures aimed at assuring social distancing [4,5] have led to an increased number of regulations on traveling, working conditions and meeting contemporary people and also pushed social, work and entertainment activities into the virtual world, thus impacting the use of public and private spaces [4]. Its presence has led to the emergence of the neologism "coronaphobia" [6].

The concept of "social distancing", initially designating relationship among individuals and groups in society, has changed its meaning during the pandemic Nowadays, it is used to indicate simple physical distancing [7]. In any case, the use of the term "social distancing" is risky, and authorities should promote spatial distancing and social closeness, according to De Rosa and Mannarini [4].

Vokó and Pitter's [8] research on the evolution of the pandemic in every European country focused on identifying the moment when social distancing started to contribute to a decrease in the spread of COVID-19 cases. Indoor social distancing measures have been found disturbing [9]. Lockdowns and social distancing have damaged the economy and hence the living conditions of a great number of people [10]. Similarly to other pandemics, blaming others and employing stigmas have started to manifest outside people's regular groups of belonging [4], while scapegoating and discrimination have emerged [3]. During the COVID-19 pandemic, the perceived severity of the disease has been associated with representations of the habits of the Chinese, the evil elite and the irresponsible "other" [11], and blaming models among colleagues have emerged [12].

The pandemic has led to a reconfiguration of individual identities in the context of the "new" economic, political and social "normalcy" [13], generated panic shopping [14] and cut off personal projects and pathways of migrants and refugees [15] who, structurally speaking, are vulnerable categories in the face of COVID-19 [16]. COVID-19 has also temporarily eased the restrictions for drug addicts in the USA [17] and led to the inclusion of alcohol and cannabis sales among essential services in Canada [18].

The times we live in are perceived as interesting [19]. Politicians and other decision-making agents need to balance values and divergent requirements [1], as well as short-term individual interests and long-term common benefits [20].

The lockdown caused by the COVID-19 pandemic has seriously impacted the education system. Didactic activities had to be migrated to online environment in many parts of the world and were supported by very different and various technological solutions. The actors involved in the didactic process had to manage a wide and challenging range of issues, consequences and forecasts. Online assessment instruments have their limitations and can be a source of errors, whereas the stovepipes in the assessment process impact the undergraduate process of accession into the labor market and hence drive costly consequences for both the undergraduates and for society in general [21]. Social distancing rules are difficult to follow when conducting research activities and, in this respect, the career plans of many undergraduates and researchers have been compromised by the halt of their projects [22]. The constraints imposed during lockdown periods have recalibrated the outlook on access to technology. In this context, video games, in addition to their negative impact, have also been identified as useful for stress reduction in adults and children, as well as for controlling depression, stimulating creativity, cognition and other abilities in the case of children [23]. The necessity to abruptly resort to digital resources as part of didactic activities has been both a source of motivation and additional stress for teachers [24]. Their initial optimism concerning the usefulness and efficiency of digital technology for all levels targeted by education programs has been replaced by the nostalgia for face-to-face interactions facilitated by the school environment [25]. The context of the pandemic has pushed for changes in the design of teaching activities [24] and highlighted different attitudes toward online education: resistance on behalf of teachers and openness on behalf of students [25]. In the absence of good practices and tested models, higher education institutions have been challenged to rethink their role and optimize their education decisions [22].

1.2. Students' Representations of the COVID-19 Pandemic, Research Objectives

The current article focuses on how future social workers studying in Brașov (Romania) related to the COVID-19 pandemic. It is about logging impressions and approaches dating back to the early phase of the pandemic, and we consider those as important social documents. They are part of a future history of the COVID-19 period. The way students have adapted to the challenge of the pandemic, namely to an unusual and potentially dangerous situation, reveals some of their features as a generation.

Thus, what is the representation of COVID-19 of the students enrolled in their last year of undergraduate studies in the Social Work study program in Brașov? The question above prompted the following two research objectives:

- highlighting the main connotations attributed by those students to the overall pandemic context;
- underlining the relationship between students' representation of COVID-19 and the viewpoints identified in specialized literature on the topic.

In order to accomplish the aforementioned objectives, we employed thematic analysis to peruse the essays produced by students on the theme of the pandemic, as well as the most relevant and earliest academic papers on the same topic.

We use the term "representation" in accordance with the definition of social representations by Serge Moscovici [26,27], namely a set of values, ideas and practices allowing individuals to orient themselves, get a hold of their environment, communicate among themselves and integrate in the community. Social representations generate expectations and anticipations and are thus attributes of inter-human relations [28]. They are part of the social construct of reality and are built by communities in order to make their members' behavior and communication more efficient [29,30].

The COVID-19 pandemic has been an unexpected and unwanted opportunity for supplementary professional development for the undergraduates in the Social Work program. Furthermore, it was their first informal exam testing their professional maturity. The essays they wrote show their capacity to correctly grasp the size of a social and medical crisis, the weaknesses of the social system, the potentially vulnerable persons and groups and, last but not the least, the most efficient methods to adapt and manage the social challenges raised by the newly emerged situation. The lockdown imposed at the beginning of the pandemic led to an interruption in the volunteering work conducted by the students in the Social Work program in retirement homes or orphanages and/or disabled children's homes. The halt of such activities and its direct consequences represent an additional starting point for students' further analysis and identification of alternative volunteering solutions adapted to the new constraints.

Before highlighting the effect of those constraints on students' representations of the COVID-19 pandemic, we will underline the latter's place in the history of pandemics and its geographical and demographic features.

1.3. The COVID-19 Pandemic and Its Place in a Long Line of Epidemics Impacting Humankind

Widespread diseases have affected humankind on numerous occasions in the past. They marked historic periods, leading to deaths of thousands of people.

The plague was one of the best-known diseases. Its best-known episode was in 1348, when it claimed thousands of victims in Italy, France, Germany, England, the Scandinavian Peninsula, Spain and Russia. In addition to the 1348 plague, De Rosa and Mannarini [4] mention several more epidemics: the plague of Athens dating back to 430 B.C., the bubonic plague of Justinian that killed 40% of the population in Constantinople between 541 and 542 A.D. and the bubonic plague of 1630.

Leprosy, feared for its highly infectious nature and for its effects on human extremities, has been known since the antiquity and has not been eradicated yet.

The typhoid fever, also known since the antiquity, was described as a "fatigue caused by all things, which was usually fatal" [31] (p. 85).

Cholera was a common disease during the middle ages and during the modern era. During the Balkan Wars of 1912–1913, "the cholera epidemics spread rapidly among the fighting Romanian troops [...], it has already burst out in Bulgaria at the time the Romanian troops were advancing, and the source of contamination was the infected water" [32] (p. 112).

The Spanish flu has been by far the greatest pandemic at the end of the modern age. It came in several waves at the end of the First World War between 1918 and 1920. It caused more victims than the war. It started with minor symptoms, manifested in the soldiers going back home from war: fever, headache and fatigue [33]. The symptoms manifested mostly in the case of young people, and around 2.5% of world population died because of it. It has been considered the most violent epidemic ever known by humankind since then.

All those diseases led to a dramatic decrease in population in certain regions and globally. The diseases affected human communities much more than military confrontations. The discovery of penicillin and improvements in living conditions, hygiene and education led to considerable reduction in the incidence of such diseases. However, it has been almost two years already since the beginning of the COVID-19 pandemic, which has generated victims and induced feelings of insecurity in people across the globe.

Unlike the state of affairs up to the end of modernity, contemporary communication facilities allow the configuration of overall global image of the evolution of the COVID-19 pandemic and of the different regional ways of tackling it during its development.

1.4. Regional Particularities in Approaching the COVID-19 Pandemic

There have been regional differences in approaching the reality imposed by the pandemic [34]. Mask wearing was more easily accepted in the east rather than in the west [35]. The measures taken by countries facing the COVID-19 pandemic were, at least right after its outbreak, very different, ranging from stopping untested persons at the border, as was the case in Montenegro, to maintaining a relaxed attitude while waiting for herd immunity to take hold, as in Great Britain [36]. The efficiency of Spanish local and regional public administration in managing the first phases of the pandemic was undermined by bureaucracy [10], and the experience of civil war still present in the memories of older Spaniards imposed the cautionary use of war-related metaphors when describing the current pandemic context [37]. Social assistance in Australia would stand to gain from correlating the debates on minimum income with the COVID-19 socio-economic crisis [38]. The pandemic has not generated any cultural traumas in Sweden, a country that maintained its national pride, nor in Greece, which regained its national pride [39].

In Brazil, the opinions on approaching the COVID-19 pandemic have been divergent. On the one hand, it was seen as a "health crisis", while on the other hand as an "economic crisis" [40]. This divergence points out the presence of two different philosophical positions: universalism, characterized by its concern for life and health, and utilitarianism, with a focus on the importance of diminishing the economic crisis [41]. Brazilians viewed health and safety as more valuable than the health of their economy or the stability of their own jobs [41], but consumption has led to a polarized society, thus contributing to increased social inequalities [13].

1.5. Demographic Differences in Relation to the COVID-19 Pandemic

COVID-19 impacted various segments of the population differently. In the USA, the risk of experiencing severe COVID-19 symptoms was lower in the Hispanic population than in the non-Hispanic one. Mostly single unemployed Afro-American women, experiencing difficulties in transportation and payment for medication, were among the people most exposed to severe symptoms. The probability for married people to experience severe symptoms of the disease was 30% lower compared to the situation of single people. Health factors, such as asthma, cardiovascular diseases, diabetes, chronic kidney disease and liver diseases, contribute to patients experiencing more severe COVID-19 symptoms in the case of ethnic and racial minorities compared to white populations [42].

In Chicago, the odds for sexual, gender, ethnic and racial minorities to be more affected than the rest of the population were higher, and some of their needs were not met. The Afro-American people and the Hispanics had difficulties in accessing food and healthcare services; members of the sexual minority accessed virtual services for mental health to a lesser extent, while members of the gender minority had less access to primary health care [43].

Mobility in American communities with high social capital dwindled, whereas the willingness to be informed about the COVID-19 pandemic and about mutual protection behaviors was visible long before the official lockdown. The norms related to reciprocity and social sanctioning were applied before legal actions were taken [44]. On the other hand, in Italy, people paid less attention to the risk of transmitting the disease among the

members of their own group and showed less regard for social distancing in the presence of outsiders and of those viewed as "different" from the dear ones or friends [4].

People in the United Kingdom and mostly young adults, women and those living in under-privileged areas had difficulties in mentally managing the challenges raised by the disease, perceived its associated risks at a higher level and hence felt more anxious about it. Nonetheless, the relationship between age, gender and mental health and its related mechanisms may not be specific only to the pandemic period [45].

Most people living in north London who participated in a study conducted by Hills and Eraso [46] did not observe social distancing rules, and almost half of them did not accept such rules. A negative correlation was established between breaking rules, reduced vulnerability to COVID-19 and control over social distancing and contact with others. The intention to disregard rules was positively correlated with the level of professional training (those holding doctoral degrees were the most willing to disregard rules), positive electoral options in relation to the government in power, the pressure felt on behalf of neighbors and friends' help.

People with low income were more exposed to the disease in Italy because they could not work from home and thus avoid crowded public transportation. People with high income had more freedom to adjust their working conditions [4].

Older people perceived higher costs in relation to the risk of getting the virus. This can be explained as a result of their higher awareness of the risk of getting infected compared to young people, while the costs of their everyday livelihood during the pandemic were lower as a result of being lonely and not having a stable job. In the initial stages of the pandemic, there was no positive correlation between age and pro-social cooperative behaviors. On one hand, the elderly stayed home less often, to the despair of their mature children. On the other hand, young people's parties on the beach generated outrage [20].

The evolutions in the area of social study-related resources (SSR) and social wellbeing (SWB) of Dutch graduate students were positively correlated before the onset of lockdown, while afterward, they were distinct and different from initial expectations. SSR was in decline before the lockdown and has spiraled afterward, whereas SWB has remained moderate and stable. The changes generated by the pandemic in the education system could hence be beneficial. In this respect, neither the SSR nor the SWB were negatively affected [47].

We are witnessing a unique event and have the opportunity for an education and social experiment whose live observation is a moral and professional duty of academics [36]. The aforementioned context also delineates research results presented by the current article, which focuses on the early impressions on the COVID-19 pandemic.

2. Materials and Methods

We thematically analyzed the contents of essays on the topic of *How I felt during the lockdown and how the pandemic affected me?* produced by 28 students in their third year of undergraduate studies in the Social Work study program run by Transilvania University of Brașov. Essay writing was one of the options from which students could choose in order to be evaluated. As a result of students' freedom of choice in this respect, the 28 resulting texts (all that were sent by students) are not the output of a mandatory task.

The students were presented with the topic of the essay they were supposed to write, along with a number of editing rules. They were given the freedom to choose the subjects that, in their opinion, fell under the topic suggested. Students were encouraged to log what they viewed as important and significant in relation with how they had experienced the first months of the pandemic. There were no limitations regarding the length of essays to be submitted. The essays were written in May 2020 after two months of lockdown (March–April) when all didactic activities in the Transilvania University of Brașov, Romania, were conducted fully online via the e-learning platform of the university that was made available to students and academic staff. Essay writing was one way of evaluating students as part of the overall assessment and evaluation process. Consequently, they received feedback on

their essays from their instructor, and this was a previously and distinct approach from the thematic analysis of their work conducted as part of the current article. During the feedback discussion, students were introduced to the relevance of their opinions and impressions of understanding the context of COVID-19 and were informed about the authors' intention to process the essays as anonymous social documents in further research.

The essays were uploaded and archived on the e-learning platform of the university. The platform can be individually accessed by every student, an academic formulating a specific task, a supervisor assigned by the university and a platform administrator, based on individual accounts. When we introduced the essays into the NVivo software in order to analyze them, they were renamed and coded as S1 through to S28 in order to ensure author anonymity. We used the aforementioned codes when referencing the fragments in the essays.

We chose to employ thematic analysis as a result of the method's flexibility, its independence from a pre-established theoretical framework and its applicability in under-investigated fields [48]. We deem all aforementioned features as adequate for the topic approached by this paper.

We used NVivo10 to analyze the content of students' essays. We read the texts paragraph by paragraph, identified the different topics approached by every essay, grouped them in emerging sub-categories with the support of the software, and then we grouped these sub-categories in ten thematic categories: *COVID-19 Effects, Online Schooling, Pandemic as a Lesson, General Remarks, Adaptation, Positive Approaches, The Surprising Reality of COVID-19, Foreseen Solution, At Home, Role of the Media*. The software ordered the sub-categories and categories by their frequency (i.e., the number of essays in which they appeared). The analysis was conducted by using texts in the Romanian language. We translated the names of the categories and sub-categories identified after their analysis into English.

We combined the thematic analysis of the essays with a quantitative content analysis of the references on the pandemic. Unlike thematic analysis, a qualitative method focused on identifying the topics presented by the material under analysis [26] and with no previously formulated hypotheses as to what the topics might be, content analysis looks at counting the presence of pre-determined categories resulting from hypotheses in the material under analysis [49]. Our hypothesis is that, at the beginning of the pandemic, the viewpoints of students and authors of academic studies on the matter converged. In order to test it, we analyzed the content of the most relevant articles, chapters and studies on COVID-19 (amounting to 60 in number) from the databases made available by the Anelis + platform of the university, paragraph by paragraph, during the second half of March 2021. Anelis+ is a platform employed by universities in Romania in order to access the main scientific databases. It was established as part of the project "National Electronic Access to Scientific Literature for Supporting the Research and Education System in Romania—ANELIS PLUS 2020" [50]. We considered the papers identified on this platform as the most relevant social documents and as fresh reports on relevant aspects related to the ongoing pandemic. We analyzed these social documents, looking for the presence/absence of the thematic categories we identified in students' essays, thus comparing students' and references' approaches to the COVID-19 pandemic. We focused on identifying whether the COVID-19 pandemic raised questions and indicated problems of a similar nature, both for students and authors of relevant research in the academic field. Their resembling approaches indicated students' responsible attitude toward the pandemic. We will present the contents of the ten categories identified both in students' essays and in specialized literature under peruse in parallel.

3. Results

Based on our analysis of students' essays, we isolated ten main thematic categories. They are presented in decreasing order by the number of the essays (Sources) approaching them and the total number of times they were mentioned (References) in Table 1, as they emerge as a result of using NVivo 10 to analyze the data.

Table 1. Thematic categories.

Seq.	Categories	Sources	References
1	COVID-19 effects	25	130
2	Online schooling	24	160
3	Pandemic as a lesson	20	55
4	General remarks	20	49
5	Adaptation	17	37
6	Positive approaches	15	28
7	The surprising reality of COVID-19	14	25
8	Foreseen solution	12	23
9	At home	12	14
10	Role of the media	6	29

The content analysis of the papers highlighted as relevant by Anelis+ led to the identification of ten thematic categories whose frequency is indicated in Table 2. Additionally, the content analysis unveiled two more categories, namely *Conspiracy theories during the COVID-19 pandemic* and *Social representations of COVID-19*, which the thematic analysis of students' essays did not identify.

Table 2. Categories and sub-categories in the literature on the COVID-19 theme in March 2021.

Seq.	Categories and Sub-Categories	Sources
1	General remarks	46
	• The challenge of managing the pandemic	22
	• Regional particularities in approaching COVID-19	11
	• Demographic differences of the COVID-19 impact	10
	• Usefulness of social media during the pandemic	10
	• Post-pandemic	4
	• The COVID-19 mythology	3
2	• Foreseen solutions	39
	• Efficient communication	16
	• Making the measures more efficient	14
	• Using information technology	14
3	COVID-19 effects	24
4	Role of the media	17
5	Adaptation	12
6	Conspiracy theories during the COVID-19 pandemic	10
7	Social representations of COVID-19	9
8	Positive approaches	8
9	Online schooling	5
10	At home	5
11	Pandemic as a lesson	4
12	The surprising reality of COVID-19	3

The ordering of thematic categories identified in students' essays by the interest expressed toward them (namely by the number of times they were mentioned) is different compared to the ordering of isolated categories in the early literature on the pandemic. The differences are highlighted in Table 3.

Table 3. Ordering the categories from essays and bibliographical sources.

Seq.	Categories from Bibliographical Sources in Descending Order	Categories from Students' Essays in Descending Order	Interest in the Category in Students' Essays Compared to BIBLIOGRAPHICAL Sources
1	General remarks	COVID-19 effects	higher
2	Foreseen solutions	Online schooling	higher
3	COVID-19 effects	Pandemic as a lesson	higher
4	Role of the media	General remarks	lower
5	Adaptation	Adaptation	equal
6	Conspiracy theories during the COVID-19 pandemic	-	absent
7	Social representations of COVID-19	-	absent
8	Positive approaches	Positive approaches	equal
9	Online schooling	The surprising reality of COVID-19	higher
10	At home	Foreseen solution	lower
11	Pandemic as a lesson	At home	lower
12	The surprising reality of COVID-19	Role of the media	lower

The categories resulting from thematic analysis indicate the representation of students in the Social Work undergraduate study program on the COVID-19 pandemic. The following chapter presents the content of all identified categories.

3.1. The COVID-19 Effects

3.1.1. In Students' Representation

Most of the COVID-19 effects experienced during the lockdown period and mentioned by the undergraduates are under the shadow of frustration (17/37): the experiences of their last year in the faculty (S24: "It should have been a memorable year"); the festive course and beautiful months spent with colleagues (S2: "We no longer meet our colleagues and maybe we will never get to see one another again . . . "); S3: "I would do anything for another day in the dorm"); the teachers, even the school, things and people held dear, or the job in some cases, are mentioned as losses. Undergraduates indicate having reviewed their relationship with time (16/20), in relation with which they mention the rapid passage (S1: "It's like time flies by"), its flexibility (S11:"I did multi tasking"), as well the way they had managed it and how they had found time for themselves. They further show their rediscovery of nature (S27: "Nature was livelier than ever") in contrast with the COVID-19 threat. Other effects they mention are related to the psychological discomfort generated by the restrictions characteristic of the pandemic: fear, anger, concern (8/12), tiredness, stress (8/8), comparisons of the lockdown to being caught in a bird cage (6/9; S17: "House arrest", S1: "I would hardly wait to go and buy supplies and take out the garbage", S17: "Living in a block of flats is like living in a cage"), monotony (4/5), as well as the feeling of being on alert all the time (3/6; S2: "You were afraid to get on the elevator with your neighbors", S17: "The city was almost empty and you could feel the tension and fear"), exasperation (2/2), the pressure of uncertainty (2/2), the wish for the nightmare to be over (2/2), apathy (2/4), solitude, sadness and confusion (2/2).

3.1.2. In Specialized Studies

A number of effects are attributed to COVID-19. Social distancing, associated with the COVID-19 pandemic, is successively perceived as a threat to normal life, to social order and a new burdening reality similar to "house arrest" [7] in a house that, depending on the quality of family relations, could be a jail [4]. COVID-19 has changed the way in which people relate with themselves, with the others and with the world and has defamiliarized spatial closeness by counter-intuitive semantic antinomies, such as "spatial distancing—affective closeness", "the far away near" and "together but divided" [4]. The absence of interaction has sabotaged civic solidarity [51]. The pandemic has generated loneliness [19,45,47], the unmet need for social support, a negative impact upon mental health—especially in the case of women and young people [45]—and an increased need for para-socialization among the elderly [19]. It has also amplified the need for commendation and pleasant comments from others, even at the cost of online exposure while performing individual physical exercises [52].

COVID-19 has generated insecurity in the workplace [20], led to job losses [39,53] and other economic difficulties [54]. The manner in which the states managed the shock of the pandemic on the labor market depended on local public programs [55].

In the context of threats and fears, COVID-19 has activated the interest of searching for meaning [14] and made students (in the Netherlands) more aware of their social needs [47]. In some countries, there were solidarity and political unity manifestations [38,39]. The pandemic has also changed emotional manifestations dominating online platforms, making them mellower and orientating them toward admiration and hugs [56].

COVID-19 has significantly affected psycho-social welfare and people's everyday life [1,34,47,57,58]. It has generated anger, paralyzing distrust and emotional tiredness [12]. It has caused social disruption and negative emotions [59], sadness, confusion [6], depression, loss of hope [2], worries and distress [34], and mostly anxiety and fear [3,6,14,19,39,47,56], even paranoia, stigmatization and xenophobia [3]. The pandemic made people fearful of those in their close proximity on the grounds that they might be carriers of the disease [3]. The news on it has amplified psychotic symptoms, even hallucinations [60]. It has taken away people's peace, faith and convictions [57]. The COVID-19 time has been associated with mystery, guilt and redemption [51], and its perception turned days into weeks and then months [4].

For all these contents there are subcategories and/or corresponding codes resulting from the thematic analysis of student essays.

3.2. School during the COVID-19 Pandemic

3.2.1. In Students' Representation

A theme often mentioned, as it was all too natural for undergraduates in their third year of study, is online schooling. The authors of the essays complain about many things, but they also show their appreciation and highlight the advantages of online schooling. They underline the lack of interaction among academic staff and colleagues (14/18), the high volume of homework (11/14), problems with the internet (11/11), the difficulty in paying attention during online courses (10/17; S10: "Online schooling meant information flowing incessantly", S24: "I pay more attention to the dog than to the course"), teamwork-based projects that are hard to accomplish in the online environment (3/3) and the tiredness felt from sitting for so long in front of a computer(2/2). However, according to the same students, academic staff showed their support for the undergraduates (12/31; S28: "I discovered the human side of academic staff" and "We did not feel alone in the online environment", S12: "I startle when I hear my teachers' voices"), online courses save time (9/9), they are even a challenge (8/9; S9: "It takes understanding on both sides, teachers and students", S28: "We became the generation of an academic experiment "), they are among the best things throughout the pandemic (7/16; S14: "The interest in courses increased", S6: "People are more active when taking online courses") and can be an opportunity from a comfort perspective (6/6), students adapted (6/6) and team-based projects inspired them

with optimism. The courses were in line with the curricula (3/4), and online education was not a novelty for students (2/4) who managed to consolidate the relationship with their colleagues (2/2).

All the remarks concerning the way academic staff managed online courses are appreciative. Students believe they managed to cope with a situation posing challenges for everybody with their teachers' support. They view them as understanding, willing to take the suggestions of students into account and consider them friends and comrades.

3.2.2. In Specialized Studies

According to Jandrić [36], the COVID-19 pandemic should be seen as a challenge for teachers and students all over the world. The challenge presents itself in various forms: some academic staff were ready to conduct online teaching, whereas others had to work extra hours to prepare themselves or, when that was possible, they chose simpler topics to teach, based on available resources. Some staff did not have adequate work space at home, others had their own school children to monitor. Regardless of their situation, and similarly to their students, the teaching staff mentioned the quality of internet connection and equipment among the most common problems they faced when teaching. All of the above considered, previous research on online training technologies should be reconsidered. What it indicates as good practice for online teaching is not all encompassing in terms of the emotional and physical isolation imposed by the pandemic. In this respect, attending virtual courses represented the center of some students' social universe [5].

The pandemic affected the necessary conditions for conducting the didactic process. However, the changes were not perceived as generating negative impact. The pandemic also influenced relations among colleagues in school, but Italian teenagers coped surprisingly well with the challenges [34]. Kalani et al. [61] present the advantages of the Net.Create network for students 'group work in history classes, when they would try to understand a complex historical text on the pandemic while experiencing a forced lockdown. Van Zyl [47] highlights the changes generated within master's programs in the Netherlands. At the beginning of the pandemic, all education activities were interrupted for nine days in order to allow for the transition of education programs to an online format. The students perceived the days as a holiday, and this helped them mobilize afterward to catch up with the activities that had been stalled. Additionally, the academic staff provided information in real time and showed understanding when addressing their students' problems and flexibility when establishing tasks and deadlines. This paints a friendly image of academic education during the pandemic.

Similar contents were also identified in the sub-categories and/or codes resulting from the thematic analysis of students' essays.

3.3. The COVID-19 Pandemic as a Lesson

3.3.1. In Students' Representation

There are numerous remarks concerning the pandemic as a lesson. The pandemic has taught undergraduates to cherish the time spent with their dear ones (8/14) and what they have (7/7; S6: "I am grateful for what I have", S9: "I have come to realize that simple things give meaning to life") and has made them more self-conscious and patient (6/6). Undergraduates have understood the importance of freedom (4/5), noticed the beauty of human relations (4/5) and learnt how to live within the imposed boundaries (3/3). The pandemic is something bad from which good things have been learnt (3/4); it has shown that life is unpredictable (3/3), narrowed down activities to the minimum necessary (2/2) and made students more powerful and responsible (2/2).

3.3.2. In Specialized Studies

Natural disasters, wars and diseases, fear, death, but also hope, have always been part of human history. The COVID-19 pandemic is a challenge for everything that humankind has learnt from its own history [5]. Any threat to health tends to acquire significance and is

associated with other themes that incur negative representations [3]. On the other hand, in crisis situations, the feeling of common identity is activated, and that generates empathy, solidarity, mutual support and assuming considerable risks for the sake of others [14]. This feeling underpins social capacity to face unpredictable threats and is the lesson taught by the COVID-19 pandemic [4].

All the above contents have corresponding sub-categories and/or codes in students' essays.

3.4. General Remarks on COVID-19

3.4.1. In Students' Representation

The content in the category of general remarks is very diverse. The category contains general observations on the pandemic and lockdown. These are remarks on the surprising evolution of the pandemic (5/9; S4: "We thought the virus was far away", S20: "In February, it seemed a joke"), its profound impact (5/7; S9: "A return to normal is impossible"), the importance of the internet as a communication means in the overall context (5/5; S4: "Dozens of years ago, it would have been more difficult", S25: "Socio-cultural life did not stop, it just moved to the online environment"), the fact that Romania was not prepared for the pandemic (3/4), the difficulty of the situation (2/2), the rapid emptying of the shelves in shops (2/3) and people's behavior as social animals (2/2). There are also many individual opinions on the fact that the planet surrendered to the virus, jokes about how people who stayed home got fat and remarks concerning unjustified price increases.

3.4.2. In Specialized Studies

This is the richest category in terms of sub-categories and codes resulting from content analysis. We have chosen to present the contents in a detailed manner from the *Introduction* part of this paper onward because we view them as early reports (i.e., at the beginning and immediately after the first wave of the pandemic in 2020) on the pandemic by people living through it in unmediated manner. Most likely, the evolution of events will change the perspective and theoretical approaches. Therefore, we consider the underlining of first representations of the pandemic to be a useful endeavor, giving testimony as to the process underpinning the development of the future narrative on COVID-19. In addition to the challenges of the pandemic, its regional features and demographic differences highlighted in the introductory part of this paper, we also identified the following sub-categories pertaining to the *General Remarks* category.

- Post-epidemic reality. Páez and Pérez [14] highlight four stages in the development of pandemic-related representations, namely: awareness, divergence, consolidation of the divergence between perceptions of pandemic as a health crisis on one hand and as an economic crisis on the other hand, and normalcy. Normalcy (a future stage at the moment this article was written) means integrating the experience generated by the pandemic into common knowledge, stripping off its emotional side, treating it as a common event and consolidating a unitary representation of it.

The post-pandemic reality will still be characterized by a tendency to avoid air transportation and the crowded places associated with transportation in general, as well as by the preference for individual transportation in urban area and for bikes and scooters to travel small distances [4]. Shoppers' preferences may also shift from the standard offers of the big chains in malls to the rediscovery of hand-made products. As for tourism, people may change their choices from attending tours in large cities to rediscovering villages and forgotten itineraries [4].

Collective memory has very few recollections of the Spanish flu [14,39]. The COVID-19 pandemic might as well be forgotten and its memories preserved only by bereaved families [4].

- The usefulness of social media during the pandemic. Technology has supported the development of significant relationships in the new context and facilitated new

connections and means of interaction [5]. Social distancing has led to mass use of social networks during the pandemic [62], the latter playing in important role in relaying information [63], as well as in modelling perceptions of risks associated with the disease and the usefulness of employing restrictions [55].

- The COVID-19 mythology. The COVID-19 pandemic has validated Moscovici's theory on cognitive polyphasia. Contemporary people have met the challenges of the pandemic by resorting to both scientific and magical/religious, logical and metaphorical thinking at the same time [4,57]. The pandemic has reactivated the mythological dimension of social knowledge. The actors involved in campaigns targeting the reduction of COVID-19 spread have acquired heroic, shaman-like and even God-like features, their authority being almost sacred and their actions resembling magical acts of cleansing and divination [51]. The social distancing measures have found ground in collective memory that associates the avoidance of contagion and of the contagious, hand washing, maintaining the hygiene of personal items and wearing masks with rituals intended to manage the disease [4].

With the exception of the contents in the last sub-category (the COVID-19 mythology) and the contents in the sub-categories on regional features and demographic differences, all other contents included in the *General Remarks* categories have counterparts in the subcategories and/or codes identified in the thematic analysis of student essays.

3.5. Adapting to COVID-19 Challenges

3.5.1. In Students' Representation

The remarks in the category of adaptation mainly indicate the occupations of undergraduates during the pandemic (12/21), namely watching movies, reading books (S10: "I read a lot"), zapping through the internet, searching for new cooking recipes or just lying idle. There are also specific highlights of the fact that they (i.e., the undergraduates) have adapted (7/7; S12: "We learn to adapt", S18: "We have adapted to the new living conditions", S21: "You need to adapt", S6: "We resisted, we're just social workers").

3.5.2. In Specialized Studies

The pandemic forced the population to adapt to the new reality. Fasanelli, Piscitelli and Galli [6] show the good tolerance of contemporary people of isolation measures. Dwellers in most countries have adapted their behaviors gradually [55]. During the lockdown period, the pandemic led to community involvement and participation at unprecedented levels, as Hills and Eraso [29] show when referring to the residents in north London. The first American cities affected by the COVID-19 virus were also the first to react by taking social distancing measures [59]. Buzzi et al. [44] highlight the ability of the new generations to manage the uncertainty and discomfort of the pandemic by finding innovative ways to meet their social and psychological needs. Emiliani et al. [64] indicate women's capacity to manage their day-to-day personal and social life through new rituals and collective meetings in response to the COVID-19 challenges.

With the exception of the latter, the contents highlighted above have their counterparts in students' essays. The contents in the category *Adapting to COVID-19 Challenges* presented below are present only in specialized literature.

Solidarity has been part of the adaptation response. It allowed for widespread lockdown, mutual support [7] and a civilized approach to challenges [51]. In Spain, non-profit organizations have become even more involved in supporting national response to disasters [10]. The willingness to show solidarity determined the community of Chinese migrants in Prato to successfully adopt isolation measures before national lockdown was enacted [16]. It is solidarity, creativity, adaptability and resilience that should be mentioned in the documents that history will choose to keep in relation to the COVID-19 pandemic, as Kirk and Rifkin hope [65].

3.6. Positive Approaches to the COVID-19 Pandemic

3.6.1. In Students' Representation

The sub-categories in the *Positive Approaches* category are presented in Table 4 below.

Table 4. Sub-categories in the *Positive Approaches* category.

Seq.	Sub-Categories	Sources	References
1	This unpleasant period wil go by	6	7
2	We need to look at the bright side of the situation	6	6
3	Change is a new chance	4	4
4	We always need to keep up our hope	3	3
5	It is a prolonged holiday	2	3
6	So far so good	2	2
7	We will enjoy the festive course in autumn	1	1
8	Combining the useful with the pleasant	1	1
9	Thank God for keeping me healthy	1	1

Students write: S17: "Eventually we shall overcome it", S13: "There is an end to every beginning, and we will get back to our lives", S12: "I saw the rainbow—it is going to be just fine" and also S16: "In autumn, I will be proud of what I have accomplished so far", or S24: "No pain, no gain".

3.6.2. In Specialized Studies

The COVID-19 pandemic has also generated positive, optimistic approaches. Hardship, difficulties in generating opportunities and people's feeling of having a common destiny, is a gain for globalization [66]. The fear of contagion can stimulate solidarity and the feeling of belonging to the community of the entire mankind [4]. Crisis is an opportunity to see others in the same manner we see ourselves, namely as human beings holding the same rights and freedoms [37] and able to express our creativity [65]. The fear caused by the pandemic amplifies humor and makes people overly cautious [3]. Distanced collective rituals, such as the synchronized applauses for professionals working in the health system, create cohesion [14].

The COVID-19 pandemic encourages transdisciplinary collaboration aimed at transforming urban spaces that used to be employed for mere survival into places of co-existence and joy [4]. The pandemic could also be an opportunity for academic staff. COVID-19 challenge creates new possibilities in the online environment, and hence it could reconfigure the academic world by opening spaces for learning in an equitable manner [5].

All of the above contents can be subsumed to the sub-categories identified through thematic analysis and is presented in Table 4.

3.7. The Surprising Reality of COVID-19

3.7.1. In Students' Representation

The thematic category of the surprising reality of COVID-19 contains remarks highlighting the astonishment of undergraduates. These are young people, and their lives would have continued smoothly and rather nicely until 2020 when they were actually confronted with the restrictions characteristic of the pandemic. They had never thought that something like that would happen (6/7) or that what had begun as a small holiday (5/5) would change everything (4/4; S4: "The epidemic reached us and changed our lives entirely") and that life stood still (3/3) instead of returning to normal conditions in two or three weeks' time (3/3). They had not been trained to go through such experiences (2/2).

3.7.2. In Specialized Studies

The outburst of the COVID-19 disease was an exogenous shock, a strange, dangerous and disruptive novelty [51]. Social distancing changed the stakes: what used to be a regular attitude toward deviation and stigma became a recommendation for everyone, whereas non-compliance with the recommendation was labeled as social deviation [7].

The aforementioned contents can be associated with the last thematic category mentioned before, which refers to the fact that people have not been trained to go through such experiences.

3.8. Possible Solutions to the COVID-19 Issue

3.8.1. In Students' Representation

The sub-categories in the category *Foreseen Solutions* indicate the undergraduates' representations of managing the situation. They are presented in Table 5.

Table 5. Sub-categories in the *Foreseen Solutions* category.

Seq.	Sub-Categories	Sources	References
1	Rules protect	5	6
2	Far away to protect the dear ones	4	4
3	It is time that we become better	2	2
4	Prayers	2	2
5	Our desire to grow should prevail	1	1
6	We should focus on what we want to achieve in life	1	3
7	We need to stay healthy	1	1
8	We should get more involved in school activities	1	1
9	Self-displine is needed	1	1
10	Calm and optimism are needed	1	1

According to students, "By respecting rules, activities can unfold normally" (S14) and "We stay away from our dear ones to protect them" (S12). "We need to do less evil" (S10) and "We need to rediscover ourselves" (S6), they also wrote.

3.8.2. In Specialized Studies

For this category, we identified the following subcategories:

- Efficiency of restrictions. Recommending simple behaviors ensures the success of the message [67]. Nonetheless, the impact of restrictive norms needs to be analyzed in relation with local cultural features and social inequalities [4]. Individuals perceiving higher personal cost in relation to the pandemic are more willing to get involved in pro-social behaviors. Therefore, it would be efficient if they were the first category of people targeted by the policies aiming at behavioral change [20]. Furthermore, access restrictions and fines are also solutions to support the implementation of recommendations [68].

The services providing greater control over social distancing, such as the delivery of food, essential goods and medicine, should be extended to reach out to the people living in high-risk environments [46]. Generally, increased attention should be paid to high-risk communities, such as the elderly and those suffering from chronic diseases and in need of health support [8]. As always, the pandemic also provides opportunities for scams and for some people to become rich at the expense of others' trustworthy attitude. Governments should take preventive measures and discourage fake claims in relation to COVID-19 prevention, treatment and cure [3].

- Highlighting commonalities. When confronted with the COVID-19 pandemic, various authors of various specializations started searching and formulating different solutions. Thus, in times of crisis, it is of utmost importance to understand risks in a unitary manner [7], to communicate efficiently, to use common language when it comes to social parties and social agents, to push back criticism, to strengthen both right-wing authoritarian measures and left-wing solidarity in order to have a common response to a global threat [14]. The tensions among groups and the perception of the threat posed by the pandemic can be prevented by emphasizing commonalties, closing contracts with minorities and showing openness toward other cultures, as well as by focusing on an "Us" type of communication and on an identity superseding local or national identity [69]. During the pandemic, democratic states have had the chance to develop social solidarity and overcome differences, according to Alexander and Smith [51]. The consolidation of social support increases public resilience [58]. It is important to consolidate social capital at a community level [44]. Leaders need to learn how to be crisis heroes so that they can ask for sacrifice and self-discipline [51]. Public policies based on information and motivation could be efficient, even in the countries where relations with the rest of the world are poor [55].

Knowledge of people's media preferences may make the messages of crisis managers more efficient [67]. Public health messages should underline common responsibility and appeal to public consciousness in order to consolidate social trust and a sense of belonging [46]. More credit should be given to tools and mechanisms contributing to smooth development of trust and cooperation [10]. Clear recommendations concerning courses of action and involvement should be formulated, and social distancing measures should not be threatening because of fear's limited efficiency [35]. The narratives on COVID-19 pandemic should support the human and community dimension of history [37]. Last but not the least, people enjoy humor, and its use by the social media creates joy and re-establishes relationships altered by social distancing [2].

Martínez García [37] indicates some students' initiative to archive the experience of the pandemic as a number of human stories and as an alternative to neutral news. Additionally, global lockdown can be considered an opportunity to obtain answers concerning any future social restrictions [20].

- Using information technology. Social media accessibility provides instruments for the investigation of the evolution of the pandemic. Maheshwari and Albert [53] show, with the help of a network-based modeling of human interactions, the importance of tracking the spread of the COVID-19 virus in hospitals. Rashid and Wang [70] highlight the possibility and efficiency of detecting information on COVID-19 in a dynamic manner and in real time with the help of intelligent devices employed by the omnipresent users of the internet.

Social media platforms offer many means of influencing and control their users' behavior. Twitter can serve as an instrument to monitor infectious diseases, indicating hot spots and their evolution, imposing the narrative on social distancing and facilitating the understanding of people's practices and reactions to social distancing measures [59]. Monitoring emotions expressed online allows for the detection of content-spreading fear and other negative emotions and also contributes to increasing the efficiency of emergency interventions in the context created by the pandemic [56]. Groups featuring high exposure to solitude could be supported through online targeted interventions [47]. Schillinger, Chittamuru and Ramírez [71] propose the SFERA continuum as a framework to be used in the evaluation and capitalization on the effects of social media on health. Rashid and Wang [70] introduce CovidSens, a risk-alert alternative detecting and spontaneously analyzing social systems in order to deduce the spread of COVID-19, inform people and model future spread. Bettencourt-Silva et al. [72] suggest using Google Trends in order to determine people's health status based on the SDoH (Social Determinants of Health) trend.

Wani et al. [63] search for automated techniques to detect fake news. Ayoub, Yang and Zhou [73] propose a model automatically analyzing natural language and detecting disinformation on COVID-19 and hence contributing to the improvement of public trust. Shahsavari et al. [74] present their own methods to identify, monitor and counter conspiracy narratives.

The employment of information technology to approach the pandemic is promising. Barsocchi et al. [9] propose an information system that would provide information on people's indoor location and the distance between them, thus revealing people's contacts as well. Maheshwari and Albert [53] suggest a model of man-to-man interaction and hence the spread of infectious diseases that has in-built monitoring and forecast functions. Shorten, Khoshgoftaar and Furht [75] show the potential of seep learning to provide applications for doing research and controlling the COVID-19 pandemic. Khanday, Khan and Rabani [62] suggest using automatic learning algorithms to control propaganda.

Only the first sub-category, referring to the *Efficiency of Restrictions*, finds its counterpart in the sub-categories resulting from the thematic analysis of students' essays.

3.9. Staying at Home during the COVID-19 Pandemic

3.9.1. In Students' Representation

The category *At Home* includes students' observations on the positive role of their families and of the return to their parents' homes during the lockdown. Communicating with parents was beneficial (4/5; S17: "Without my parents, I would not have gone through the isolation period"); living in the countryside and in households owning a yard and a garden was an advantage (3/3; S13: "I'm in my own house, so I cannot complain"), while being asked to become involved in household chores was also an advantage (2/2; S2: "At home, everyone would see you available", S11: "It is hard for me to work on the computer while my mom is working outside"). Being at home meant spending more time with the family (2/2; S3: "I just open the door and have dinner with my parents") and feeling safe (2/2; S24: "At home, I began to feel well").

3.9.2. In Specialized Studies

In the case of teenagers and young people, the period spent at home influenced their relationship with their parents [34] and did not necessarily have any negative social or psychological impact. In the case of Dutch students, the period they spent at home gave them the possibility to spend more time outdoors and with their dear ones while conducting pleasant and relaxing activities [47]. In the case of Turkish people living in urban areas, the time they spent at home rendered both positive and negative connotations [76].

COVID-19 has assigned new meanings and symbols to the term "home". This led to a symbolic, cultural and discursive approach to the term as a negotiated and continuously re-imagined space [76]. "Home", an emotionally loaded term, is the most important place in an individual's life, and the pandemic contributed to conducting activities normally held in other spaces in this personal area [4]. The changes occurring while being at home during the lockdown led to a privatization of the public sphere and its opening to the public. These changes were perceived differently in what Edward Hall (1966, apud [4]) calls "contact cultures" (i.e., the Mediterranean ones) or "non-contact" cultures (i.e., north American and northern European cultures).

In addition to those differences, being forced to stay at home had different connotations depending on a number of other parameters. Domestic space was shared with other family members in some cases and became the area for multi-tasking. The size and structure of households turned such arrangements into experiments concerning how to live in a crowded place. The eyes of the public could grasp details of the private space during school, work or social activities conducted online. Available or desired open spaces (e.g., balconies, terraces) essentially influenced the level of comfort experienced during lockdown, as well as the connection with nature and neighbors [4].

Forced to remain in their houses [36], individuals tried to reconfigure their dwellings by converting forced adaptation into a pleasant experience [76].

The above contents have their counterpart in the sub-categories resulting from the thematic analysis of students' essays.

3.10. The Role of the Media in Managing the COVID-19 Pandemic

3.10.1. In Students' Representation

The sub-categories in the category of *The Role of the Media* outline the role played by the media in managing the pandemic, according to students. The media sources caused panic (6/9; S26: "The media exploit our fears"), and there were many fake news stories from the beginning (3/7; S26: "The information on smokers was contradictory", S23: "The wrong information spreads fast"). At the same time, the media contributed to imposing the restrictions (3/4; S8: "I was thinking that we washed because that was what they would say on the TV"), whereas relay of uniform information calmed the population (2/5). Either way, in dangerous times, reliable sources of information are needed (2/4; S23: "I have learnt where to look for real information").

3.10.2. In Specialized Studies

The media is in the middle of sharing opinions on the pandemic. The COVID-19 pandemic spreads swiftly, and there is a lot of information on it disseminated at global level by social media networks [57]. As a result of their ability to process information and analyze available data on their own, people communicated about the health issues generated by the COVID-19 virus faster compared to the speed at which formal cautionary information was disseminated [70]. Social media has been viewed in many ways: as a generator of an "infodemics" or as a valuable tool for public health [71]. The perception of the Americans on COVID-19 risks is anchored in the type of sources to which they have access [72]. On the other hand, all forms of media work together in generating omnipresent and accessible information.

This type of openness comes together with all sorts of dangers. In this respect, the information meant to put people on their toes is omnipresent and accessible, inducing stress [3]. The COVID-19 pandemic acted as a catalyst for racism and focused attention on the unknown stranger and dangerous groups as traditional targets of fear and hatred [4]. Social media platforms favored fake news, hijacking behaviors and endangering human lives [63], delaying the search for treatment and a cure [3]. Chang et al. [77] indicate the role of social robots in manipulating social media in relation to the narrative on the COVID-19 pandemic and the presidential elections in the USA, as well as a transition to emerging domestic sources of distortion. The COVID-19 pandemic has its own disinformation and propaganda. In this respect, an analysis of the data on Twitter shows the heavy weight of propaganda texts [62]. Democratic media also means that what may seem realistic information when presented from a given perspective can be viewed as distortion and serve irrational ideologies in polarized societies [51].

The contents presented above correspond to the sub-categories resulting from the thematic analysis of students' essays. The content analysis of relevant papers on COVID-19 unveils supplementary references to the topics presented below.

Social media has hosted discussions on how to have stamina and stay healthy and avoid sickness and death. It also granted the right to control communication both to itself and to governance, regulatory agencies, corporations and other sponsors [71]. Social media can counter anxiety and bring comfort, as the study of Hussein and Aljamili [2] on memes and caricatures in Jordanian media indicates. Media para-socialization has consolidated the feelings of community, belonging, self-image and -esteem [19]. Public messages on empathy, altruism and safety of the vulnerable can support the observance of recommendations to self-isolate [46]. The British Prime Minister avoided any references to social distancing in his press conferences, and this was an unproductive approach from the

perspective of a person tasked with controlling the pandemic and imposing constraining rules on his citizens [7].

The media can also be upsettingly non-incisive. The Canadian press has descriptively and uncritically reported on health assistance services considered essential during the pandemic, access to alcohol and cannabis being a case in point, an approach that is tributary to the power of media unions [18].

3.11. Social Representations of the COVID-19 Pandemic

As previously highlighted, the content analysis of specialized papers on the topic of COVID-19 unveils two supplementary categories in comparison with those identified in students' essays. The first category concerns *Social Representations of COVID-19.*

Moscovici's theory of social representations is considered an adequate theoretical framework for approaching the COVID-19 pandemic by many authors. In this respect, it allows for the representation of emerging realities related to the lockdown [64], which result from the interaction between science and common sense [40] and from cognitive polyphasia [14].

The COVID-19 pandemic has been worryingly anchored in the HIV epidemic [35] or (intentionally) soothingly likened to the cold or common flu, despite the Spanish flu that claimed the lives of around 50 million people globally [14]. The objectification of COVID-19 has been accomplished by visuals and, mostly, metaphors of war and hardship, even though the social representations disseminated by scientists are easier to accept than those distributed by politicians [35].

Joia and Michelotto [41] show that the core of the social representations of the COVID-19 pandemic is based on the association of the terms fear–distancing–social–health and prevention–diseases. Nerlich and Jaspal [7] describe the evolution of representations on social distancing as a threat to normal life evolving into a threat to social order and ultimately becoming a burden to be removed. De Rosa and Mannarini [4] present the way in which, starting from the symbolic representation of the other as a source of fear for the vulnerable self, social distancing became the main measure meant to protect one's own health, as well as the health of others.

The development of representations is dependent upon various contextual features. Fasanelli, Piscitelli and Galli [6] show different representations of the pandemic, as developed by undergraduates in socio-humanities and medicine, and which are built around different central cores. According to the authors, the differences originate in different sources of information (i.e., media v. specialized sources). Pizarro et al. [11] show the preference of authoritarian people for social representations justifying social control measures and the sanctioning of deviants.

3.12. Conspiracy Theories during the COVID-19 Pandemic

The second category is conspiracy theories during the COVID-19 pandemic.

Conspiracy theories are attempts at explaining some aspects, significant events or political circumstances viewed as plots organized by powerful actors, based on information that cannot be verified but cannot be faked very easily either, as well as on loop, such as reasoning, biases or loose evidence, according to Chang et al. [77]. Fake rumors are less stable, spread more easily, and they have more chances to perpetuate than true information [77].

A considerable part of world population acknowledges its openness toward various conspiracy theories [77]. Explanations favoring conspiracies are used to justify the system and protect existing social and political structures. They share a number of common features: they assign meaning to events; they are developed based on the feeling that there is limited control over the situation; they are supported by fear, anxiety and vulnerability; they give credit to right-wing traditional values and catalogue minority groups as deviant [14]. Chang et al. [77] also mention the prevalent right-wing orientation of the supporters of conspiracy theories and highlight the visible configuration during the USA presidential elections of a new form of "conspiracy theory" that perpetuates itself through

the mere repetition of ideas and in the absence of any attempts at finding evidence or developing explanations.

Fear, anxiety, paranoia, along with various cultural influences, cause emotional responses and make the population vulnerable to conspiracy-based explanations on the causes of the pandemic and governmental approaches to it, as Freckelton shows [3]. Conspiracy theories thrive when trust in authorities is low, according to Shahsavari et al. [74]. The pandemic has led to the dissemination of conspiracy theories by regular people but also by political people [4]. The theories on COVID-19 spread in China and the USA and promoted by high-ranking officials show a cultural and nationalistic radicalization of opinions to the detriment of scientific evidence [66]. Páez and Pérez [14] underline quite a large spread of the opinion, according to which COVID-19 is a biological weapon of an evil political elite. Pizarro et al. [11] show a correlation between the perception COVID-19 as a severe risk and the social representations supporting conspiracies and the evil intentions of elites. Fasanelli, Piscitelli and Galli [6] show that, in direct relation to their sources of information, undergraduates in socio-humanities are more predisposed to conspiracy theories compared to medical school undergraduates.

As a result of their research on people's religious opinions on the origin and significance of the COVID-19 pandemic, Pieterse and Landman [57] identify three themes: COVID-19 is an act of God; God has the control in the middle of the pandemic; and COVID-19 is in no way related to God. The authors correlate conspiracy theories with the last theme. Shahsavari et al. [74] highlight the main four theories of conspiracy disseminated via social media networks in the USA as follows: there is a link between COVID-19, the 5G network and Bill Gates 'project to keep population growth under control; there are attempts to cover up the role of Chinese culinary practices in generating the mutation of the virus from animals to humans; the virus was conceived as a biological weapon and accidentally released; the exaggerated danger posed by the virus is a hoax. As discussions on the topic continue, these theories tend to connect with each other and form one coherent conspiracy theory, as authors show. The attacks on 5G networks and the ample demonstrations against the implementation of COVID-19 measures aimed at limiting the spread of the virus show the social force of conspiracy-based approaches, as Shahsavari et al. indicate [74].

4. Discussion and Conclusions

The content of the thematic categories resulting from the analysis of the essays outlines students' representation of the COVID-19 pandemic.

Thus, in relation with the main connotations attributed to the pandemic, the undergraduate students from Brasov did not think that the scenario of isolation would come true, nor that there could be a disease to generate it. The period was initially perceived as an unexpected and mostly welcome holiday, which then became a nightmare forcing students to change their habits. They will certainly remember the pandemic and, what is more, going back to how things used to be is not only impossible but also far away from becoming true. Their biter remark was that living in a block of flats is like living in a cage for days, doing the same monotonous things, while those retreating to their parents in the countryside, where they had a garden and a yard, were luckier.

During the lockdown, communication through social networks helped them see one another and their parents. Students concluded that both their social and cultural life had moved to the online environment.

Students responded rather swiftly to the security measures imposed by the authorities and viewed those as necessary for the pandemic period. They complied with them, they observed the distancing and hygiene rules and wore masks to protect themselves and the dear ones. They took up different hobbies during the pandemic, so as to adapt better; they adopted pets, read, cooked, took photos, did sports and even wrote their final undergraduate papers, which required spending a lot of time in front of the computer.

Students tried to develop their survival skills by adopting positive thinking and showing optimism. The idea that the period would pass helped them, and they considered

that everything would turn out right. They saw this period as their chance to discover themselves and evolve. Last but not least, they understood the relationship between constraints and freedom.

Students witnessed how the media reported on the virus and, while they digested the information, they noticed the panic generated by the media and the neutral and non-empathic messages of authorities. Having been shocked by the discovery, they understood that the media was also broadcasting fake news and chasing sensational situations and not the truth. They thus learnt how to digest and, more importantly, to search for information in reliable and credible sources.

The didactic activities in the Transilvania University of Brașov were conducted online. Students missed their interaction with colleagues and teaching staff, and that is the most dramatic part in their confessions. They had to manage an overwhelming amount of information and homework. They feared the novelty of online exams, but they showed appreciation for their teachers' prompt support, professionalism and empathy. They also perceived the opportunities of online education and its positive potential.

Concerning the relationship between students' representations of COVID-19 and the viewpoints identified in the specialized literature on the topic, the hierarchy in students' preoccupations with COVID-19 is highlighted in Table 1 above. Some of the differences between that hierarchy and that of those authoring studies on the pandemic (as in Table 3) result from the various types of texts where the categories were identified: essays v. academic articles. The former encourage free emotional expression of personal thoughts and/or correspond to the status and specific interests of students. The latter meet the requirements of scientific methodology.

Thus, the effects of the pandemic are seen by the students as most important. The challenges of online schooling come second in their remarks. Students who were invited to write about how they felt were in their final year of study before their last exams and delivering their undergraduate paper. In such a context, the tendency to refer to the effects of COVID-19 in relation with their frustrations over not experiencing a special moment in their lives when the pandemic started, as well as their comments on how school ended in a manner nobody could have predicted, can be better understood. Viewing the pandemic as a lesson has high spiritual connotations and it rather belongs to an essay. Similarly, showing the surprising nature of reality during the pandemic better fits an essay topic rather than an academic article. As a result, there are good arguments for the presence of a higher number of related categories in students' essays.

Students' increased interest in some of the categories identified through thematic analysis corresponds to their lower interest in others. However, behind such differences there is thematic convergence between students' and academic's approaches to the pandemic at its beginning. All the categories emerging from the thematic analysis of the essays are also identified in the content analysis of the relevant references on the topic. Apart from the categories identified in the essays, content analysis highlights two new ones.

The first of those, *Conspiracy Theories during the COVID-19 Pandemic,* includes information on what these theories are, how they emerge, what characterizes them and what the main conspiracy theories are during the current pandemic. There are no remarks on the topic on behalf of the students, and that seems to contradict the conclusions of Fasanelli, Piscitelli and Galli [6] who claim that students in socio-humanities are predisposed to crediting conspiracies. However, we believe that students' lack of interest in the topic is rather caused by other factors, such as the avoidance of conspiracy-related content and its programmatic undermining by the social media accessed by young people and also students' reluctance to mention a topic considered non-academic and inappropriate to be approached in school.

The second category, *Social Representations of COVID-19*, could be viewed as a meta-category. It contains references to the theory of social representations of Serge Moscovici, which is considered the adequate theoretical framework to approach the emerging social representation of COVID-19. The theory is well known to authors of specialized articles,

but it was not viewed as a necessary reference by the students, whose texts are rather personal confessions.

The categories *General Remarks* and *Foreseen Solutions* are different in their content. They are more analytical and pragmatic in the case of specialized works and more philosophical and/or spiritual in the case of students' essays. The solutions offered by authors of the articles refer to commonalities, making the restrictive measures more efficient and using information technology. On the other hand, between solutions, students indicate the transformation of people into better ones and prayer, as in Table 5.

These content differentiations are doubled by convergent viewpoints of students and specialized studies on the matter. The latter span from some sub-categories in the *General Remarks* category to specific findings or observations. Thus, students underline the importance of the internet in managing the pandemic. That is a justified observation, coming from a generation familiarized with this information source that offers rapid and generous access [78–81]. The observation is also in agreement with ones made by many of the analyzed sources [5,47,55,59,62,63]. Students underline their teachers' availability and support in the context of conducting education activities in the online environment. This results from their direct experience, but it confirms what L.E. van Zyl [47] notices in the case of Dutch education during the pandemic. Students believe that the new conditions are a challenge both for them and for their teachers, an aspect also underlined by Jandrić [36]. Students perceive the importance of owning a garden and a yard during lockdown, and that correlates with the writings of De Rosa and Mannarini [4] or Yalçın and Düzen [76]; the examples could continue. The titles students chose for their essays show an emotional approach: *The Chrystal Globe, Graduating during the Pandemic, Pandemic on TV, Lockdown Diary, Lockdown, a Nursery for Autumn Seeds, Today's Normalcy is not Guaranteed Tomorrow.* However, the emotional load is but a facet of students' reaction to the challenges of the pandemic. The overlapping representations of the COVID-19 pandemic of students and authors focusing on the topic suggest that students did pay attention to the issue under discussion, and they also took the challenge of discussing it. The convergence of categories and viewpoints shows not only that both students and authors of relevant academic studies identify the same dimensions of the pandemic, but they also indicate students' responsible attitude when reflecting on COVID-19 and seeking answers.

The categories *Adaptation* and *Positive Approaches* are in the middle of both hierarchies (as in Table 3). Students insist on the idea of adaptation and on the necessity to adapt. The sub-categories in the *Positive Approaches* category express students' optimism and their focus on overcoming the pandemic in good conditions (as in Table 4). Adapted and optimistic, the undergraduate students from Brasov corroborate the hypothesis of Buzzi et al. [34], according to which young generations show an unexpected balance when confronted with unpredictable, threatening and unforeseen challenges. They understand the seriousness of the phenomenon, willingly adapt to restrictions and find new ways to meet their social and psychological needs, thus proving better prepared than their parents to manage the pandemic, according to the aforementioned authors.

In conclusion, undergraduate students enrolled in the Social Work study program in Transilvania University of Brașov suffered from a lack of interaction with their peers and teachers, as well as from missing the festive moments normally accompanying their graduation. However, their analyses show a responsible and mature attitude in the context of the pandemic and their capacity to accurately capture its main features. They underline the importance of adapting to the new conditions and to the measures aimed at controlling the spread of the virus. They also show optimism about the situation. All of the above considered, we can conclude that students are an important part of the population on which authorities can count when trying to limit the effects of the pandemic.

Such a conclusion could be gratifying and reassuring. However, it is bewildering. Students claim they have complied with all the measures taken by the authorities and adopted them without challenging them. That, according to Jürgen Habermas [82], is an atypical attitude. According to the German philosopher, students are, by their very nature,

challenging individuals. Students from Brașov critically notice that the media generates panic and disseminates fake news. They also make the observation that Romania had not been prepared for the pandemic. However, they show their full support for the measures and policies of authorities employed to manage the spread of the COVID-19 virus. Their attitude could reflect a tendency to respond in accordance with their teachers' expectations. Their attitude could also be the result of subtle and programmatic manipulation on behalf of social media. They are not aware of it because it is conducted through channels of communication they choose to use. Both hypotheses formulated in relation to their atypical uncomplaining attitude raise concerns. They suggest a disagreement between the rebellious profile of the young people in the 1960s defending their freedom, depicted by Habermas and the profile of contemporary youth who serenely comply with constraining measures.

These hypotheses do not rule out the simpler hypothesis, according to which students show maturity in their decision making in dramatic conditions of health crisis. Such a hypothesis matches the initial conclusion underlining students' responsibility, cooperative behavior and optimism. Therefore, to test all hypotheses, students' conformism is worth another distinct and detailed investigation. As Jandrić [36] notes, observing all the aspects of the unfolding pandemic is a moral duty of academic staff. Students' papers on COVID-19 are fine and sensitive radiographs of their experiences during this period [83] and, for this reason, they are valuable research resources.

The way students think and their representations of the education process are important components, securing the sustainable functioning of the university. The confessions in their essays signal both the imminence of discussions on new education methods and the great availability of students to provide feedback. We consider this availability a gain of the pandemic, which must be maintained and cultivated.

The disruption brought about by the pandemic in the functioning of higher education has opened new avenues for change. The sudden migration of the education process to the online environment pushed for the active use/update of technological resources owned by education institutions and made teachers employ their digital skills. Teachers had to swiftly adapt their didactic content and its design to the new requirements. This incurred considerable consumption of energy and time, the results not always measuring up to the efforts [24]. The need to reinvent teaching approaches in higher education has placed considerable strain on academics as main actors, according to Toto and Limone [24]. It generated fears as to their ability to manage unforeseen situations. Meanwhile, it also made them grasp the didactic potential of the technology they were forced to use [24], increasing their chance to efficiently interact with the new generations of students already accustomed to the continuous challenge of technological innovation [25].

Academic research had to mobilize its resources precisely in order to provide innovative didactic instruments and, just as importantly, solutions to constructively manage academics' motivation, stress and resistance to change [24,25]. These are areas of academic interest where there is much to be said in the near future. Students' manner of approaching the COVID-19 pandemic is just one facet of the impact the pandemic has had on higher education.

Students' appreciation of teachers' efforts to efficiently migrate didactic activities into the online environment signals openness in the education process, and it could be one of the side effects caused by the pandemic. Therefore, an inclusive approach to all the facets of the issue could increase the chances to identify viable solutions.

The pandemic has been a litmus test for validating universities' value. Universities were already under pressure to balance financial costs, public health requirements, accomplishment of education and research goals, and provision of services to the society, and they still need to make decisions impacting their students' future [22]. However, who other than universities themselves could better meet such challenges?

While depicting the representation on COVID-19 of undergraduate students in Brasov and highlighting the researchers' perspective on the beginning of the pandemic, our paper

also highlights the usefulness of a wider, multi-fold approach to the transformations imposed by the pandemic context on education.

Limitations of the research: The current article investigates students' perceptions of the COVID-19 pandemic during its early stage, based on 28 essays written by undergraduate students enrolled in the Social Work study program conducted by Transilvania University of Brașov. The extrapolation of research results for all students enrolled in the aforementioned study program is justified by the theoretical saturation achieved when analyzing the essays. For a possible extrapolation at the level of Romanian students or students in general, we consider that a theoretical saturation-anchored justification is insufficient. Nonetheless, students' representation of the COVID-19 context is a topic worth resuming in future research by using a representative sample.

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Digital Learning Is an Educational Format towards Sustainable Education

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Abstract: The year 2020, due to the pandemic, was a milestone in the history of digital technology in the education sector, allowing a sustainable education although the world was facing a pandemic crisis without precedents. Therefore, in a few days occur a transformation from traditional classroom teaching to online teaching and consequently forced to use digital learning. Nevertheless, more researches are needed to know how was this experience and if there is the intention to maintain the online format. The main goal of this article is to study how digital learning can be an educational format focused on sustainable education. This paper presents a systematic literature review on digital learning through PRISMA methodology, based on a literature search and field research aimed to analyze the significant predictors related to the digital learning experience on the likelihood of choosing to "keep" the online format in the next academic year. An online survey was conducted with 173 university students. The results obtained showed that the significant predictors were factor 1-"Characteristics of online classes; factor 2-"Support from the School and Professors; factor 3-"Online classes vs. face-to-face classes" and gender. The probability of choosing to keep online classes increases exponentially with the characteristics of online classes, with Support from school and teachers; Online classes vs. Face-to-face classes, and keeping factors 1, 2, and 3 constant the probability if a man chooses the online format compared to a woman is higher. This online format thus acquires central importance in the contemporary sustainability debate. The kind of life, education, and society we will have in the future will depend on the quality, depth, and extent of the learning processes we can create and exercise individually and socially. Education, and educators in particular, who concentrate on the tasks of designing and implementing social teaching and learning models, have a unique responsibility in this process. Although the reduced sample size the present work can provide strategic information for university staff, contributing to designing and implementation a sustainable education.

Keywords: digital learning; sustainable education; systematic literature review; university education

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1. Introduction

Due to the COVID-19 pandemic, Universities were forced to fast transition from traditional classroom teaching to online learning. The development of new online teaching formats is challenging, time-consuming, and demands the availability of a proper IT infrastructure. Students and faculty members should be offered learning opportunities for the acquisition of digital skills (e.g., training in pedagogical methods and/or IT abilities [1–3]. Nevertheless, the main benefit of online learning identified was the flexibility of platforms and the main barriers were family-study balance and difficulties with internet connectivity [1]. Communication interactions, student assessment, use of technology tools, online

experience, pandemic-related anxiety or stress, time management, and technophobia were identified as the main challenges of online education [4].

In this context the goal of this article is to study how digital learning can be an educational format focused on sustainable education, being the research questions: Rq1: Which were the main experiences of digital learning during the period of the COVID-19 lockdown? Rq2: Is it sustainable to maintain the online format in the next academic year?

Higher education and sustainability are now widely recognized as closely related concepts. In today's culture, higher education, in addition to its two traditional responsibilities of research and teaching, has a responsibility and a crucial role to play in reshaping education for sustainability [5]. Technology, on the other hand, has made accessing resources much easier for people across the country and the world. The adoption and use of educational technology [5,6] in the education systems of countries in the COVID-19 era generated a new pedagogy that demanded the inclusion of digital platforms in the teaching process for a better understanding [6]. This is called digital learning and is considered one of the engines for the development of skills, which probably helps organizations in the transformation process [6].

Online learning has taken the place of traditional teaching with face-to-face interactions (lectures, laboratory sessions). For the sustainability of digital education, some technical advancements are being developed to utilize virtual reality, as it is becoming increasingly important for online learning in a variety of sectors, including health (e.g., patient simulation) [3,7,8]. In addition, a variety of instructional strategies were used, including flipped classroom teaching, gamification, massive open online courses (MOOCs), digital learning, and hybrid learning. Classes were held online, with digital technologies such as augmented reality, graphic design, and diversified interaction platforms offering interactivity between teachers and students. In this context, students should take advantage of opportunities to use ICT for learning digital as sustainability [5].

Numerous studies have acknowledged the necessity of integrating online platforms into teaching practices following a pandemic [1,4]. For example, in the curricula of computer science and data science courses, expanding and accrediting e-learning/teaching infrastructure is a must-do in the future to increase undergraduates' competencies and skills in information and communication technologies (ICT) [2].

Challenges to online education must be assessed and explored in light of a new and sustainable educational paradigm [4,9]. Several studies have already demonstrated that active student integration with technologies has numerous benefits: it integrates problem-solving approaches that motivate students, improve their collaborative skills, train self-study skills, and embrace the diversity of a student population in addition to promoting sustainable practices [5]. Create strives to understand how individuals learn and how to better design instructional systems and resources to promote this learning, according to new instructional trends.

In this regard, the purpose of this study was to combine a thorough evaluation of e-learning approaches with a questionnaire distributed to students during the pandemic of COVID-19. As a result, this article will conduct a PRISMA review of the literature on digital learning, using inclusion and exclusion criteria to gain a better understanding of the concept. In addition to the literature study, a survey was conducted and distributed via Google Forms to 173 university students between August and October 2020. The methodological approaches, which included a comprehensive literature review and field research, were designed to identify the major predictors of "maintaining the online format in the next academic year" based on the digital learning experience.

2. Digital Learning Overview

To make an overview of the digital learning experience a systematic literature review was made following the guidelines detailed by the PRISMA methodology.

2.1. Timeframe and Database

A systematic search online in Science Direct was conducted at the end of July 2021. These databases comprise a significant number of updated and peer-reviewed papers, which have justified their selection. The timeframe was from 2015 to 2021, to consider the most recent articles with studies on digital education.

2.2. Eligibility Criteria–Inclusion and Exclusion Criteria

The search was made using several queries, containing the terms "Digital learning", and "Higher Education". The criteria for this study's selection were the following: (a) studies about digital learning in higher education; (b) there were also restrictions on language (only English). Moreover, the papers need to (c) have full-text available and (d) be published after 2015.

More specifically the new research and trends in higher education selection were based on the first criteria of Keywords: "digital learning" and "Higher Education", which have resulted in 183 articles. The second criteria related to Peers-reviewed journals resulted in 125 articles, and the language as English criteria totally 124 articles. The fourth criteria are regarding the type of publication, and all were excluded besides the review articles (6), and the research articles (93), resulting in a total of 99 articles (Table 1). Finally, the fifth criteria were based on scientific papers in Science Direct since 2015, (2015–2021) resulting in 49 articles to be analyzed.

2.3. Results

The analysis of articles is presented in the VOSViewer software to show the co-authorship network, keyword networks used in title expressions, and the abstract and title expressions. VOSviewer uses the technique of mapping VOS (visualization of similarities) and in the construction of maps based on distance, which are maps in which the distance between two items reflects the strength of the relationship between them. A shorter distance generally indicates a stronger relationship.

2.3.1. Keyword's Occurrence

In the Keyword's occurrence network (Figure 1), nodes and major words reflect their highest occurrence, the colors indicate the clusters, and the lines show the interrelationship of the keywords.

From the clusters, one can assume the interrelationship theme that characterizes specific areas or applications of user studies. In a preview of the network, it can be seen that the nodes of the clustered and close clusters, characterize the interchange and diversity of user studies.

Figure 1. Keywords.

The analysis shows 7 clusters grouping the keywords as follows: the blue cluster is regarding the types of learning processes (Figure 2); the green cluster is focused on

the teaching and learning strategies; the orange cluster is focused on the education and learning processes; the red cluster is focused in digital transformation in higher education; the yellow cluster is focused on the innovation in education, and the light blue cluster is focused on introducing gamification in the learning process.

The distance between the terms (according to Figures 1 and 2) that effectively relate demonstrates a small distance among the nodes, which tends to reflect the higher number of published studies on the subject. As per the research attributes studied by the researchers according to digital education are organized as follows: the red cluster-id focused on the relation between the learning actors—The student and the instructor/teacher; the green cluster integrated the framework of the higher education institutions; the yellow cluster assumed the effects and impacts of online education; the blue cluster is focused on the benefits and the development of digital education; the orange cluster includes the research regarding the models and the adoption of digital education, and the purple cluster presents the studies focused on the educational theories.

Is observed the term education (according to Figure 3) as the most significant, with the majority of the occurrences in the titles of the articles, but terms as online learning, digital learning, digital transformation in education, digitizing education are also very present in the articles analyzed.

2.3.2. Co-Authorship

Figure 4 performs network analysis concerning co-authorship among all authors referring to the 49 documents analyzed. Each circle represents an author, and the lines connect the authors of the same document, each color assigned to a group means the authors share authorship of some document. Thus, it can be observed that, although the number of documents is small, there is little interaction between them in the development of research.

Table 1. Articles found per query.

Dimension	Topics	Autor	Ano
Technology: Learning systems	Massive Open Online Courses	Ref. [10] Loya, A.; Gopal, A.; Shukla, I.; Jermann, P.; Tormey, R.	2015
	Massive Open Online Courses	Ref. [11] Ortega-Arranz, A.; Bote-Lorenzo, M.L.; Asensio-Pérez, J.I.; Martínez-Monés, A.; Gómez-Sánchez, E.; Dimitriadis, Y.	2019
	Massive Open Online Courses	Ref. [12] Guerrero, M.; Heaton, S.; Urbano, D.	2021
	Computer Usage	Ref. [13] Alothman, M.; Robertson, J.; Michaelson, G.	2017
	Digital Technologies	Ref. [14] Nguyen, D.	2018
	Digital Technology Diffusion	Ref. [15] Nicoletti, G.; von Rueden, C.; Andrews, D.	2020
	Multimedia Tools in the Teaching and Learning	Ref. [16] Abdulrahaman, M.D.; Faruk, N.; Oloyede, A.A.; Surajudeen-Bakinde, N.T.; Olawoyin, L.A.; Mejabi, O.V.; Imam-Fulani, Y.O.; Fahm, A.O.; Azeez, A.	2020
	Digitalization, Education	Ref. [17] Habibi, F.; Zabardast, M.A.	2020
	Digitalization of Learning	Ref. [18] Alsmadi, M.K.; Al-Marashdeh, I.; Alzaqebah, M.; Jaradat, G.; Alghamdi, F.A.; Mustafa A Mohammad, R.; Alshabanah, M.; Alrajhi, D.; Alkhaldi, H.; Aldhafferi, N.; et al.	2021
	Digital Transformation Readiness in Higher Education	Ref. [19] Limani, Y.; Hajrizi, E.; Stapleton, L.; Retkoceri, M.	2019
	Lecture Recordings to Support Learning:	Ref. [20] Morris, N.P.; Swinnerton, B.; Coop, T.	2019
	Agile Model for the Digital Transformation of the University	Ref. [21] Kerroum, K.; Khiat, A.; Bahnasse, A.; Aoula, E.-S.; khiat, Y.	2020
	Mobile Game-Based Learning in Higher Education	Ref. [22] Troussas, C.; Krouska, A.; Sgouropoulou, C.	2020
	Podcasting	Ref. [23] Mobasheri, A.; Costello, K.E.	2021
	Web-Based Learning	Ref. [24] Mehrolia, S.; Alagarsamy, S.; Indhu Sabari, M.	2021
	Game Concepts in Digital Learning	Ref. [25] Schöbel, S.; Saqr, M.; Janson, A.	2021
	Gamification	Ref. [26] Krath, J.; Schürmann, L.; von Korflesch, H.F.O.	2021

Table 1. *Cont.*

Dimension	Topics	Autor	Ano
Digital Learning Methodologies	Self Learning	Ref. [27] El-Hmoudova, D.	2015
	Personalized e-Learning	Ref. [28] Rani, M.; Nayak, R.; Vyas, O.P.	2015
	Face-to-Face Instruction Over Digitally Embedded Instruction	Ref. [29] Kirovska-Simjanoska, D.	2016
	FLIP or Not to FLIP	Ref. [30] Şengel, E.	2016
	Personal Learning	Ref. [31] Marín-Díaz, V.; López-Pérez, M.; Sampedro-Requena, B.E.	2017
	Digital Education Methodologies	Ref. [32] Sousa, M.J.; Carmo, M.; Gonçalves, A.C.; Cruz, R.; Martins, J.M.	2019
Learning Design	Course Design	Ref. [33] Young, C.; Perović, N.	2016
	Developing Digital Educational Materials	Ref. [34] Álvarez-Nieto, C.; Richardson, J.; Parra-Anguita, G.; Linares-Abad, M.; Huss, N.; Grande-Gascón, M.L.; Grose, J.; Huynen, M.; López-Medina, I.M.	2018
	Design, Implementation, and Evaluation of an Inverted (Flipped) Classroom	Ref. [35] Foster, G.; Stagl, S.	2018
	Course Design Process in a Technology-Enhanced Learning Environment.	Ref. [36] Smith, C.; Onofre-Martínez, K.; Contrino, M.F.; Membrillo-Hernández, J.	2021
Digital Learning Environment	Digital Learning and Teaching Environment	Ref. [37] Hofmeyer, A.; Toffoli, L.; Vernon, R.; Taylor, R.; Klopper, H.C.; Coetzee, S.K.; Fontaine, D.	2018
	Digital-Age Learning	Ref. [38] Fleaca, E.; Stanciu, R.D.	2019
	E-Learning Adoption	Ref. [39] Mehta, A.; Morris, N.P.; Swinnerton, B.; Homer, M.	2019
	Online Teaching-Learning	Ref. [40] Sousa, M.J.; Rocha, A..	2019
	E-Learning Application	Ref. [41] Oyediran, W.O.; Omoare, A.M.; Owoyemi, M.A.; Adejobi, A.O.; Fasasi, R.B.	2020
	Network Distance Teaching	Ref. [42] Yao, S.; Li, D.; Yohannes, A.; Song, H.	2021
	Digital Higher Education	Ref. [43] Zheng, F.; Khan, N.A.; Hussain, S.	2020
	Online Education	Ref. [44] Damşa, C.; Langford, M.; Uehara, D.; Scherer, R.	2021
	Online Learning and Teaching	Ref. [45] Downer, T.; Gray, M.; Capper, T.	2021
	Online Teaching and Learning	Ref. [46] Hofer, S.I.; Nistor, N.; Scheibenzuber, C.	2021
	Online Education on Teaching	Ref. [47] Selvaraj, A.; Radhin, V.; KA, N.; Benson, N.; Mathew, A.J.	2021
	Online Education	Ref. [48] Grodotzki, J.; Upadhya, S.; Tekkaya, A.E.	2021
Learning Theories	Connectivism	Ref. [49] Corbett, F.; Spinello, E.	2020
Digital Learning Assessment	Automated Formative Assessment Model for Learning and Teaching	Ref. [50] Barana, A.; Marchisio, M.	2016
	Assessment of the Influence of Adaptive E-Learning	Ref. [51] Hubalovsky, S.; Hubalovska, M.; Musilek, M.	2019
	Effectiveness of the Emergency ELearning	Ref. [52] Roman, M.; Plopeanu, A.P.	2021
	Feedback in Online Learning	Ref. [53] Jensen, L.X.; Bearman, M.; Boud, D.	2021
	Student-Teacher Communication for Effective Learning.	Ref. [54] Liu, W.; Muthu, B.; Sivaparthipan, C.B.	2021
Others	Tendencies in Higher Education.	Ref. [55] Sorokova, M.G.	2020
	Teachers' Digital Information Skills -	Ref. [56] Saikkonen, L.; Kaarakainen, M.-T.	2021
	Learning Difficulties in a Digital Environment	Ref. [57] Hammershøj, L.G.	2019
	Brriers and Drivers of Innovation in Higher Education	Ref. [58] Lašáková, A.; Bajzíková, Ľ.; Dedze, I.	2017

Another point shown in Figure 4 is the relationship between authors, represented by the distance between the groups. The closer they are located, the stronger their connection in terms of co-authorship, and this case, there is little proximity between the groups. In addition, the size of each circle reflects the number of citations by each author, so the larger the circle, the more citations the author has concerning the selected document.

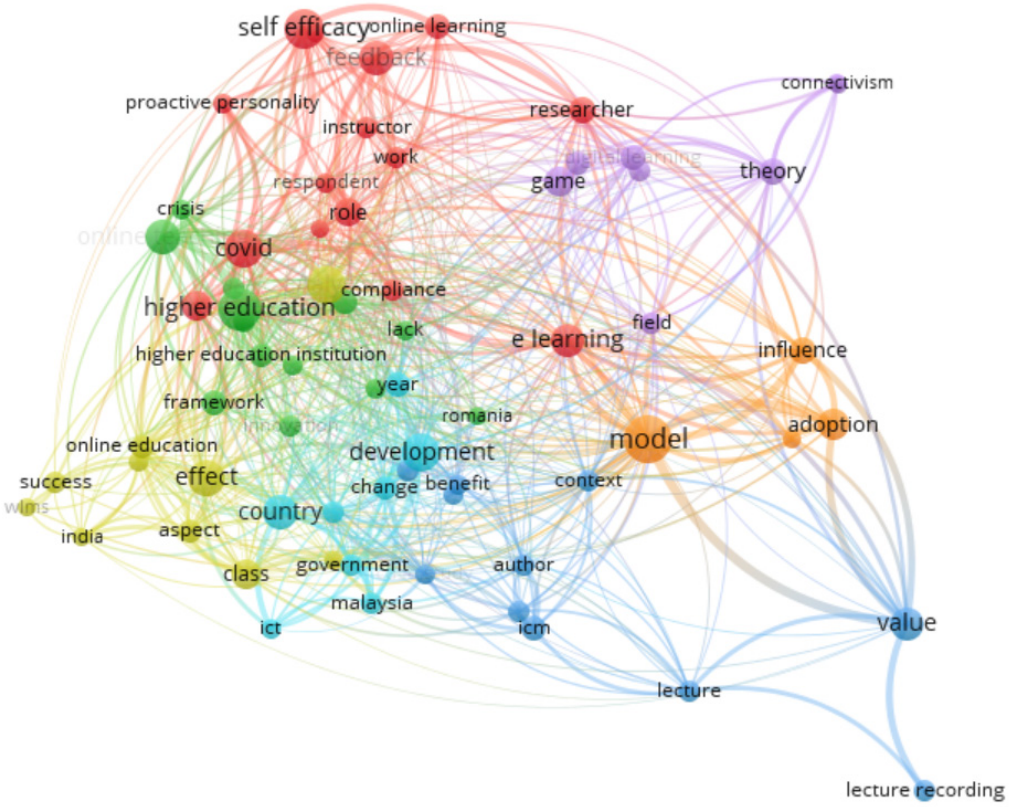

Figure 2. Research Attributes and expressions in title and abstract.

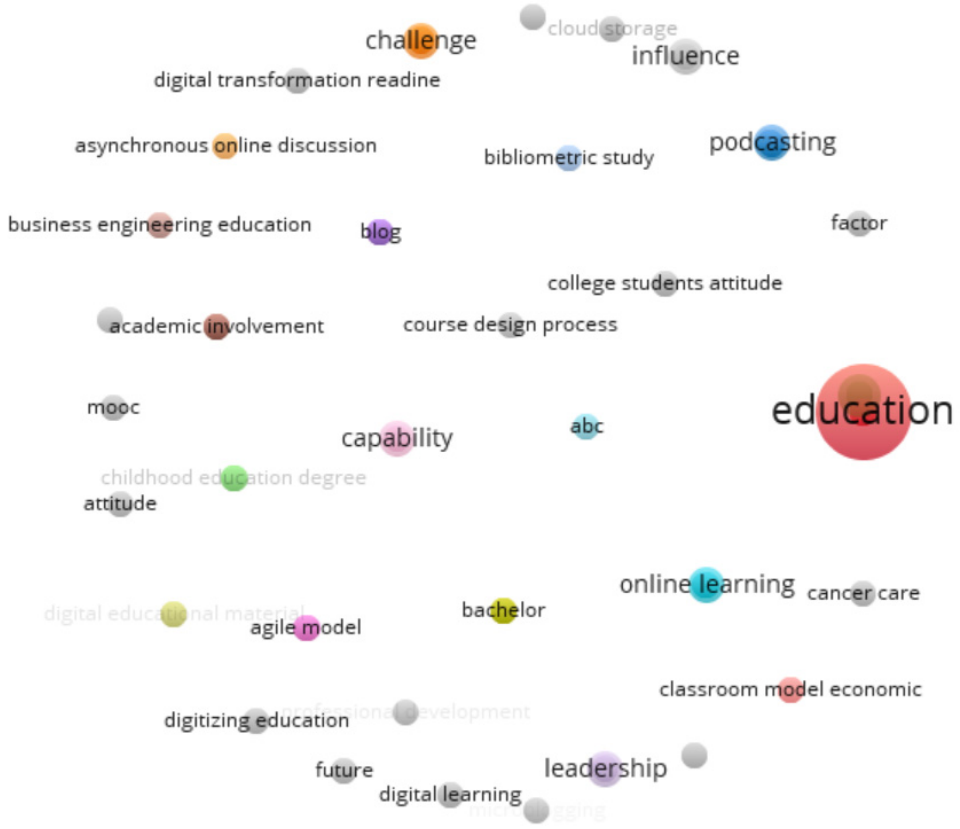

Figure 3. Expressions in title.

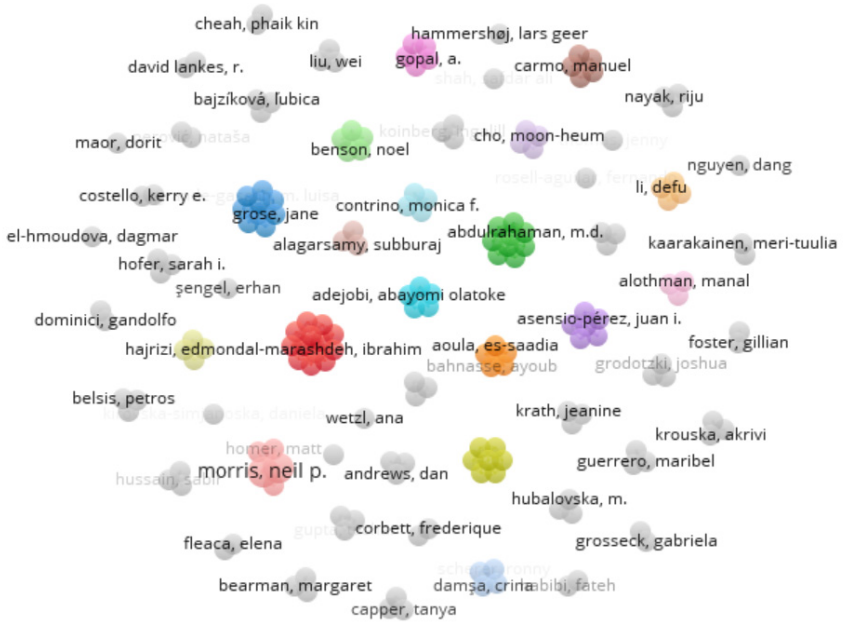

Figure 4. Co-authorship.

3. Methods

3.1. Data Collection Procedure

An online survey was developed through Google Forms and sent to higher education students associations with the available online contacts. The survey was active between August and October of 2020. The instrument's application lasted 10 min on average.

The ones who answered were informed of the anonymous and confidential nature of the collected data, noting that their participation in the survey was voluntary and there was no monetary or another kind of reward.

3.2. Instrument

The survey was presented in two sections. The first one is composed by the experience of digital learning during the period of the COVID-19 lockdown, including 18 items regarding the digital learning's experience (e.g., " I felt comfortable having online classes" answer in five points Likert scale 1 = totally disagree a 5 = totally agree), 2 items about the level of preparation and adaptation of the institution concerning the COVID-19 pandemic (1 = Nothing prepared/adapted to 5 = Fully prepared/adapted), 1 item regarding the satisfaction with the online classes format (1 = Not satisfied at all to 5 = Totally satisfied) and one item about the intention of maintenance of the online format in the next school year (answer as yes or no). The second section was related to a sociodemographic and academic characterization group.

3.3. Participants

The global convenience sample included 173 university students. In terms of sociodemographic characteristics, the participants were mostly female (n = 142; 82.1%), single (n = 157; 90.8%) with an average age of 24 years old (SD = 7.42). Majority of the ones inquired are from public universities (n = 151; 87.3%). The most common cycle of studies is the first cycle (n = 116; 67.1%), next is the second cycle (n = 52;30.1%) and lastly is the third cycle (n = 5; 2.9%). From the participating scientific areas of the course, the ones that stood out were Law, Social Sciences and Services (n = 43; 24.9%); Health (n = 34; 19.7%) and Economics, Management and Accounting (n = 21; 12.1%). The school year the participants are in goes from the first one (n = 20; 11.6%); second one (n = 51; 29.5%); third one (n = 63; 25.9%); followed by the fourth until sixth one (n = 39; 22.5%). Only 26.6% (n = 46) are working students.

3.4. Data Analysis Procedure

The variables under study were characterized using descriptive and frequency statistics. Chi-square tests were used to assess whether the percentage distribution of responses in the different categories of the variables under study was significantly different. In all inference analyses, a type I error probability (α) of 0.05 was considered.

An Exploratory Factor Analysis with factor extraction by the principal components' method followed by varimax rotation was applied to the 18 items regarding an agreement with the adaptation to online classes in COVID times. In factor retention, three criteria were simultaneously taken into account: (1) extract the factors that present eigenvalues greater than 1; (2) explain at least 50% of the total variance explained; (3) in line with the inflection point of the Scree plot. Since according to [59], the use of a single criterion may lead to the retention of more or fewer factors than relevant to describe the latent structure. The suitability of the variables to the EFA was assessed through the KMO value=0.841, which is an indicator of a good factorability of the correlations matrix. The subjects' scores on each of the retained factors were obtained by the Anderson-Rubin method and were then used in logistic regression to identify the significant predictors of the likelihood of choosing to hold classes in the online format in the next academic year. In addition to these scores, the sociodemographic variables (Gender, Age, Marital status, Student-worker) and also "the level of adaptation of the institution", "the level of preparation of the institution" and "the level of satisfaction with the assessment format" were used as independent variables in the logistic regression. Logistic regression was performed by the Enter method and the Forward LR variable selection method, the assumptions and the diagnosis of influential cases were validated by graphical analysis of residuals as described in [59]. It was found that 6 observations were outliers' candidates, but it was decided to keep them in the final model since their removal does not significantly improve either the significance or the quality of the model. All analyses were performed using IBM SPSS (v.27).

4. Results and Discussion

4.1. Preparation and Adaptation of Higher Education Institutions

Table 2 shows the perception of the higher education institution's level of preparation and adaptation concerning the COVID-19 pandemic. Regarding the institution's level of preparation, 120 (64.4%) of the inquired reported between nothing and partially prepared. Regarding the level of adaptation, at this moment, most of the answers (n = 90; 52%) are found between very and fully adapted. The results of the Chi-square test ($X^2(4) = 32.155$, $p < 0.001$), show that the two variables are not independent. The Correspondence Analysis (ANACOR) shows the associations between categories: It can be stated that there is an association between well prepared and well-adapted responses; partially prepared and adapted, and between not at all or partially adapted and prepared.

Table 2. Level of preparation and adaptation of the institution concerning the COVID-19 pandemic.

	Level of Preparation		**Level of Adaptation**	
Answers	**Frequency**	**%**	**Frequency**	**%**
Nothing prepared/adapted	32	18.5	12	6.9
Poorly prepared/adapted	43	24.9	26	15.0
Partly prepared/adapted	45	26.0	45	26.0
Very prepared/adapted	45	26.0	67	38.7
Fully prepared/adapted	8	4.6	23	13.3
Total	173	100.0	173	100.0

4.2. Satisfaction with Digital Learning

Regarding the course of their studies, the majority of participants were having online classes instead of face-to-face teaching (n = 170; 98.3%), considering that for 94.8%, it was their first experience of online classes. Students are satisfied with the online class format (Table 3). One sample Qui-square results ($X^2(4) = 31.017$, $p < 0.001$) show that

the distributions of responses in the different categories are not homogeneous. Further analysis of standardized residuals (see Table 3) shows that the categories satisfied and totally satisfied (|standardized residual| > 2) differ significantly from the proportion under the null hypothesis.

Table 3. Satisfaction with the online classes format.

Answers	Frequency	%	Standardized Residual
Not satisfied at all	24	13.9	−1.802
Not very satisfied	37	21.4	0.408
Satisfied	60	34.7	4.318
Very satisfied	35	20.2	0.060
Totally satisfied	17	9.8	−4.214
Total	173	100.0	

4.3. Intention to the Maintenance of the Online Format

When questioned about this format's maintenance in the following school year, 56.1% (n = 97) stated yes and 43.9% (n = 76) stated no (Table 4). One sample Qui-square results ($X^2(1) = 2.549$, $p = 0.110$) show that the distributions of responses in the different categories are homogeneous. The issue of the maintenance of the format was complemented with the justification request which was the content analysis' subject. The reasons pointed out for not wanting to maintain the format are associated with the reconciling difficulty of this format with practical classes, technological constraints, especially the internet one, and the need for social proximity with colleagues and Professors. The reasons pointed out to support this format's continuity are associated with the security made possible while in a pandemic and time and location's flexibility.

Table 4. Intention to the maintenance of the online format in the next school year.

	Frequency	%
No	76	43.9
Yes	97	56.1
Total	173	100.0

4.4. Digital Learning's Experience

According to the eigenvalue rule greater than 1, and in line with the scree plot and the percentage of total variance explained, the relational structure of the original variables is explained by 4 latent factors which, in total, explain 68.5% of the total variance. Table 5 shows the factorial weights of each item in each factor, the communalities of each item, the eigenvalues of each factor, and the respective Cronbach's values.

The first factor explains about 34% of the total variability and high internal consistency ($\alpha = 0.88$). The variables that saturate this fact are: "I felt comfortable with online classes", "Online teaching allows me to save time", "The execution of asynchronous tasks is useful for consolidating the learning of the contents of the Curricular Units.", "The execution of asynchronous tasks between synchronous classes facilitates concentration in class" and "Online teaching is more functional in terms of schedules" all with very high factorial weights. This first factor was designated as "Characteristics of online classes". The second factor explains about 118% of the total variability and presents high internal consistency ($\alpha = 0.89$). The variables that saturate this factor are: "Professors have been available to help me", "My higher education institution has been available to help and support me", "My professors have always sought the best for all students" and "My higher education institution has always sought the best for all students", all with very high factor weights. This factor was designated as "School and Professor support". The third factor explains 10% of the total variance and also presents high internal consistency ($\alpha = 0.83$), the variables that saturate in this factor are "I learn better with classes in the online format", " I believe I learn the same in the online format as I do in face-to-face classes ", "I prefer the face-to-face

classes format" and "Most people believe that online teaching is more effective than the usual classroom teaching methodologies" with medium to high factorial weights. Finally, the fourth factor accounts for about 7% of the total variability and presents a high internal consistency (α = 0.80). The variables that saturate this factor are: "My family has been concerned about the general situation of my studies", "I have had the emotional help and support I need from my family", "I have had the support of my friends", "I have had someone with whom I can share my joys and sorrows" and "I have had the support of my friends", all with medium to high factor weights. This factor was designated as Support from family and friends.

Table 5. Factor weights (greater than 0.5) of each item in each of the retained factors, Communalities of each of the items in the 4-factor solution, Eigenvalues, % of variance explained, and internal consistency of each of the retained factors.

	Factors				**Communalities ***
	Characteristics of Online Classes	**Support from the School and Professors**	**Online Classes vs. Face-to-Face Classes**	**Support from Family and Friends**	
I felt comfortable with online classes	0.726				0.712
I learn better with classes in an online format			0.691		0.729
Online teaching allows me to save time	0.810				0.730
The execution of asynchronous tasks is useful for consolidating the learning of the contents of the Curricular Units	0.802				0.689
The execution of asynchronous tasks between synchronous classes facilitates concentration in class	0.729				0.625
Online teaching is more functional in terms of schedules	0.792				0.703
I believe I learn the same in the online format as I do in face-to-face classes			0.654		0.675
I prefer the face-to-face classes format			−0.778		0.751
Professors have been available to help me		0.795			0.722
My higher education institution has been available to help and support me		0.821			0.739
Most people believe that online teaching is more effective than the usual classroom teaching methodologies			0.606		0.481

Table 5. *Cont.*

	Factors				Communalities *
	Characteristics of Online Classes	**Support from the School and Professors**	**Online Classes vs. Face-to-Face Classes**	**Support from Family and Friends**	
My family has been concerned about the general situation of my studies				0.799	0.704
I have had the emotional help and support I need from my family				0.823	0.717
I have had the support of my friends				0.700	0.634
My professors have always sought the best for all students		0.870			0.801
My higher education institution has always sought the best for all students		0.849			0.736
I have had someone with whom I can share my joys and sorrows				0.791	0.630
Online learning requires significant changes for the student			−0.654		0.548
Explained Variance	33.99%	17.82%	10.00%	6.67%	
Eigenvalue	6.199	3.207	1.800	1.200	
α-cronbach	0.887	0.891	0.830	0.802	

* Communalities: The commonality of items or variables corresponds to the fraction of the variance of each variable that is explained by the retained factors. This statistic is a good indicator of how each variable or item is "well explained" by the retained factorial solution (ideally the closer to 1 the better, however it is considered acceptable when the commonality is greater than or equal to 0.5—which means that the percentage of item variation that is explained by the factor solution found is greater than or equal to 50%.

Logistic regression with all predictors (Enter method) and the Forward LR method led to similar regression models. The results obtained showed that the significant predictors were: factor 1 -"Characteristics of online classes ($b_{fator1} = 1.636$; X^2_{Wald} (1) = 33.479, $p < 0.001$); factor 2-"Support from the School and Professors ($b_{fator2} = 0.553$, X^2_{Wald} (1) = 6.072; $p = 0.014$); factor 3-"Online classes vs. face-to-face classes" ($b_{fator\ 3} = 1.594$; X^2_{Wald} (1) = 28.532, $p < 0.001$) and the gender (bgender = 0.343; X^2_{Wald} (1) = 2.027, $p = 0.018$). The final Logit model showed a good fit to the data ($G^2(4) = 96.916$, $p < 0.001$; X^2_{HL} (8) = 7.553, $p = 0.478$, $R_{CS} = 0.431$; $R^2_N = 0.577$, $R^2_{MF} = 0.441$). Table 6 summarises the model coefficients and their significance.

The odds of choosing the online format (Y = 1) increase if Exp(B) > 1. Thus, the probability of choosing to keep online classes increases exponentially with the characteristics of online classes ((5.134−1) × 100 = 413.4%), with Support from school and teachers ((1.738−1) × 100 = 73.8%); Online classes vs. Face-to-face classes ((4.923−1) × 100 = 392.3%). Keeping factors 1, 2, and 3 constant the probability if a man chooses the online format compared to a woman is higher (4:1, i.e., 334.4%). The percentage of correct classifications is 82.6% which is considerably higher than the proportional percentage of correct classifications by mere chance (49.25%) demonstrating the usefulness of the model in classifying new observations. The model also presents a high sensitivity (83.3%) and specificity (81.6%), as well as a very good discriminant ability (AUC = 0.895, $p < 0.001$).

Table 6. Logit Coefficients of the Logistic Regression model of the variable "Maintaining the online format in the next school year" as a function of the characteristics of online classes, School and Professor Support, Face-to-face classes vs. online classes, and Gender (results obtained by the Forward LR variable selection method).

Variable	B	S.E.	X^2_{Wald}	d.f.	*p*-Value	Exp (B)	95% C.I. for Exp(B)
Characteristics of online classes	1.636	0.283	33.479	1	<0.001	5.134	]2.950, 8.935[
Support from the School and Professors	0.553	0.224	6.072	1	0.014	1.738	]1.120, 2.698[
Online classes vs. face-to-face classes	1.594	0.299	28.385	1	<0.001	4.923	]2.739, 8.849[
Gender (1)	1.469	0.241	5.635	1	0.018	4.344	]2.739, 8.849[
Constant	0.343	0.241	2.027	1	0.155	1.409	

5. Implications of the Research

5.1. Practical Implications

The research has some practical implications, as:

(1) Promoting digital education insights from the students for the educational leaders to focus on their main concerns, namely, to facilitate the adaption of universities to the specificities of digital learning.
(2) Contributing to developing new learning practices present in the literature and that deserve to be tested in other contexts.
(3) Promoting flexibility of digital learning considering the diversity of the students, and the numerous digital learning technologies and learning platforms.
(4) Pointing out the need for digital competencies development regarding the students and the teachers.
(5) Creating awareness of new pedagogies and methodologies to facilitate innovations in digital education.
(6) Contributing to elaborating scenarios regarding the sustainability of digital education in the near future.

5.2. Societal Implications

The research has some social implications, as focusing on the promotion of new digital educational models, based on a new economic and social paradigm, framed by the public health context. A new concept of digital learning occurs at students' homes for safety reasons and focused on promoting positive learning outcomes in complex contexts, where students need to deal with their emotional and spiritual well-being as necessary elements to their educational development.

The inevitability of learning new competencies to face a new learning situation mediated by technology, and to be open to new learning situations, that leads them to be more autonomous and become more responsible for their learnings, and outcomes.

5.3. Research Implications

The study has also some research implications as it is a new avenue for researchers to analyze in different perspectives, regarding the technological evolution regarding digital learning, the study of new digital competencies and skills for students and teachers, and the dynamism and flexibility of the learning contexts will lead to new possibilities for educational research. Also, new pedagogies and learning models need to be studied and created or adjusted to the new contexts and needs for the student's development and also their engagement in the learning process. The characteristics of digital education are also changing, with the introduction of artificial intelligence in the creation of learning content, leading to new research possibilities regarding ethics in digital education, use of holograms in substituting the teachers, and studying the digital transformation of digital education, maintaining the quality standards of the learning process.

6. Limitations and Future Research

The main limitations regarding the systematic literature review were the reduced number of studies purposing innovative solutions, and also there is a lack of consistency regarding the future sustainability of digital education, as Universities are changing continuously from face-to-face to online learning according to the direction of the pandemic, without a clear vision of the higher education strategy. Also, there is a lack of studies regarding the professor's and students' digital competencies, and also focused on feasible assessment methodologies. In respect to the empirical study, the size of the sample is a limitation, also being a convenience sample, and also the context of a specific country—in the future would be a good research strategy to enlarge the sample including other geographies to make comparisons on the students' perceptions about the digital education experience, and the sustainability of digital education in the near future. Also, could be important to do a longitudinal study to understand the evolution of the perceptions of the students regarding the several mandatory moments of digital education during the COVID-19 pandemic. The adoption of digital education technology in developing countries and the impact of its use in online classes should also be researched, as the digital relationship between students and professors.

7. Conclusions

COVID-19 pandemic has pushed the Universities from presential education to digital education, which was seen till then as education without quality, having numerous barriers and resistances.

The field research was applied in two sections: the first was during the COVID-19 blocking period, including 18 items referring to the digital learning experience. The second section dealt with a group of sociodemographic and academic characterization. The total sample of respondents was university students, predominantly female, single, with an average age of 24 years. The majority of respondents study in public universities, from scientific areas of Law, Social Sciences and Services, Health and Economics, Management, and Accounting. The students represent all the years of the first and second cycle of studies (Bachelor and Master's degrees), being only 26.6% working students.

The questionnaire was structured in several sections, and the questions were focused on four main topics: Preparation and adaptation of higher education institutions, Satisfaction with digital learning, Intention to maintain the online format, Digital learning experience.

Regarding the preparation and adaptation of higher education institutions, namely, satisfaction with digital learning, the students responded that their universities were not prepared for digital education at the beginning of the pandemic. However, nowadays the level of adaptation increased, and according to their perception, the universities are very and fully adapted to the specificities of digital education. Although this perception of the students regarding the fast adaptation of the universities to digital education, the reduced studies regarding the digital competencies' of both students and faculty, shows that there is still a high level of preparation needed, as digital education includes the technology and the infrastructures, but also and mainly the sharing of knowledge and the relationships among those actors, and there is a lack of pedagogical models focused on all the digital educational process, from the learning design process to the courses planning, the creation of digital learning content, the learning activities, and the assessment methodologies, leading to effective learning.

As for satisfaction with digital learning, the student's responses show that they are satisfied with online learning and open to the possibility to maintain the online format, (56.1% of the students). The main reasons for the positive approach to digital education are associated with safety reasons because of the public health situation decurrent from COVID-19, and the flexibility of time and location gave by the use of digital technologies in education.

Respondents explained that the digital learning experience was very positive because, it saves time, adds to the execution of asynchronous tasks are important to consolidate the learning process. In addition, teachers are more available to help with activities, facilitating very positive learning outcomes. The majority of the respondents believe that online teaching methodologies are more effective than traditional face-to-face teaching methodologies. However, the learning process during the beginning of the pandemic was a complex process of adaptation, but the students had the support of their family and friends, sharing with them their anxieties, joys, and sorrows.

The research concludes that the chances of choosing the online format increase due to the benefits of online classes, and because of the support from the universities and teachers. The result pointed to the maintenance of the online format, as it allows the use of different teaching strategies that motivate students and the use of different technological resources. However, to make digital education sustainable the higher education institutions need to define programs of digital competencies development for students and, mainly, for teachers. They also need to invest in the creation of pedagogical models for digital education, including all learning cycles. For the sustainability of digital education. the higher education institutions need to change and adapt the curricula to meet the needs of new social and scientific challenges.

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Learning in Troubled Times: Parents' Perspectives on Emergency Remote Teaching and Learning

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Abstract: The COVID-19 pandemic triggered profound social consequences, affecting all aspects of human activity, including education. The process of remote teaching that was implemented in response to this crisis is known as emergency remote teaching and learning (ERTL). The present study focuses on Portuguese parents' perspectives about this process. Data were gathered through an online questionnaire, answered by 203 parents of preschool, basic, and secondary education students (ages 3–18), focusing on self-perceived digital competence, satisfaction with ERTL, and pedagogical activities developed with their children. Parents were moderately satisfied with ERTL but expressed a marked increase in their workload, particularly those working from home. Parents of children in the second cycle of basic education (ages 10–12) were less satisfied with the process. A variety of activities was promoted, responding to different educational levels' characteristics. Results show the importance of promoting parents' digital competence and directing support policies, particularly to parents of younger children (ages 3–12), and raise concerns about equity.

Keywords: COVID-19; emergency remote teaching and learning (ERTL); educational consequences; parents' perspectives; Portugal; preschool education; basic education; secondary education

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1. Introduction

Since the turn of the millennium, there was considerable worldwide advancement towards universal access to basic/primary education for all children. Ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all is the fourth sustainable development goal—Quality Education (SDG 4)—included in the 2030 Agenda [1]. The training and empowerment of individuals, based on the principles of human rights and sustainable development, is the core of SDG 4, which aims to expand the opportunities of the most vulnerable people on the path to development.

In this regard, it should be emphasized that Portugal attaches central importance to lifelong education, training, and qualification, seeking to reverse historical delays and exclusions, with direct impacts on people's wellbeing, economic performance, fighting poverty, promoting equality and social cohesion, citizenship, and the environment. Therefore, SDG 4-Quality Education is recognized as a priority goal and a transversal pathway to achieve several other Sustainable Development Goals [2].

However, by the end of 2019, SDG 4 of the 2030 Agenda was far from being achieved worldwide, since, according to UNESCO [3], it was expected that by 2030 one in six citizens between 6 and 17 years old would still be out of school. This situation was worsened by the worldwide dissemination of the COVID-19 virus, which led to the physical closure of schools all over the world (from preschool to higher education) as a way to mitigate the spread of the COVID-19 pandemic, thus placing SDG4 of the 2030 Agenda further from being achieved. As the COVID-19 pandemic forced schools into lockdown, affecting the

majority of children in schooling [4], education was one of the many aspects of social [5] life which had to adapt swiftly to dire and unexpected conditions [6–8]. In the specific case of Portugal, the physical closure of all schools was determined on 13 March 2020, and implemented on 16 March 2020, which led to the rapid transition from education designed entirely for face-to-face delivery to digitally mediated education, in order for Portuguese children and youth to be able to continue their education and training processes, even if confined to their homes [9].

This vast experiment of transition to digitally mediated education is now known as emergency remote teaching and learning [10,11]. We have argued before that the use of the expression "distance education" to refer to these practices [9], which were implemented under very limited conditions, can lead to further stigmatization of quality distance education, which requires appropriate planning, teacher training, curriculum adaptation, among other conditions that were impossible to meet in the situation educational systems met when faced with the lockdowns [9,12]. Instead, in a situation where the priority was simply to maintain some form of continuity of education [13], despite all the challenges and limited resources, governments, schools, and teachers rose to the occasion, quickly implementing ERTL.

A vast number of studies around the globe have considered the emerging educational challenges posed by the COVID-19 pandemic. Even considering the Portuguese reality, several studies have already been produced [9,14–20]. However, those studies have focused mainly on the perspective of teachers and schools, which, albeit fundamental, leaves out the fundamental role played by the other denominator in this complex equation: students and parents' perspectives. We also consider a contextualized analysis to be valuable, given the fact that not only the pandemic affected different parts of the world at different times and intensities, but also that national and local educational responses to schools' closings were not universal.

This is also an underexplored point of view in international studies [21–24]. Additionally, there is a lack of research concerning online learning in the early years [25–27]. In the present study, we intend to address some of these limitations by presenting the perspectives of Portuguese parents of children between the ages of 3 and 17 about emergency remote teaching and learning that took place in an initial stage of the response to schools' closings.

In the face of this situation, our study intended to answer the following question: what are the perspectives of parents of children involved in ERTL during the COVID-19 pandemic regarding this experience? We intended to describe parents' perspectives of ERTL, including a broad age range of the children in question. In particular, we were interested in understanding parents' levels of satisfaction with the process of ERTL and in characterizing the types of teaching practices that were taking place with their children during the period in question—an early stage of the implementation of ERTL. We also gathered data concerning parents' demographic characteristics, work situation, and self-perceived levels of competence, since even at such an early time into this unprecedented educational experience, we understood those aspects might make a difference in how parents perceived and faced this challenge. We believe having a more detailed knowledge of how this process took place and how it was perceived by parents may be useful, not only in understanding the current situation and the challenges the "new normal" still poses to education, but also to better prepare for future periods of school lockdown due to this pandemic, or any other emergency, and how better to support parents through them.

To contextualize our study, we will present a brief analysis of the concept of emergency remote learning and how it has been implemented in Portugal during the COVID-19 pandemic, present a brief literature review of studies focusing on parents' perspectives concerning emergency remote teaching and learning, and analyze works focusing on younger children in ERTL, as they present challenges to implementing this methodology, which are particularly demanding to parents.

1.1. Emergency Remote Teaching and Learning

ERTL is fundamentally different from online learning [11], since it is an impromptu response to extraordinary circumstances, rather than a planned decision, taking advantage of all the features online learning has to offer. The choice to avoid applying the expression "online learning" to this experience is also one with political implications, as a tendency to assess these experimental and unprepared approaches as such may cast a detrimental light on online learning practices. Effective online learning requires several complicated and balanced decisions about several aspects, including modality, pacing, student-instructor ratio, pedagogy, the role of online assessment, instructor role online, student role online, online communication synchrony, and source of feedback—all of which require planning. Unlike online learning, ERTL emerged as a hasty and necessary response to a crisis, shifting activities and curricula planned for face-to-face education to distance environments, without the necessary planning or conditions, including infrastructure or teacher training [9].

The Portuguese educational system responded to COVID-19 in a way that is fundamentally similar to other European countries. As a result of the rising concern amongst families and public opinion, the Government decreed the closing down of all educational institutions starting on 16 March 2020. Following that swift decision, several exceptional family support measures were immediately put in place. This support was due in cases of assistance to children or other dependents under 12 years old, or, in the case of assistance to children or dependents with disabilities or chronic illness, without age limit. It should be noted that this support reached as many as 201,000 families in 2020 [28].

At the same time, educational institutions had to undergo a dramatic shift and implement ERTL. From one moment to the next, parents and teachers were confronted with a totally new scenario. Just a few months earlier, many were discussing banning the use of mobile devices in classrooms. Now, they had rapidly moved to ask for more digital devices and broadband Internet connections for their children. In fact, the educational communities were confronted for the first time with the implications of digital exclusion in the networked society.

The literature identifies four phases in the educational response to COVID-19 [29,30]. The first phase can be described as a rapid transition to remote teaching and learning. In Portugal, educational institutions were given only four weeks to ensure that all regular teaching activities planned for being delivered in person would be transferred to an online learning environment.

Aware of the level of unpreparedness of the institutions for this rapid transition and upon the pressure of School Boards, the Ministry of Education created the website "Support for Schools", providing valuable information and documents, teaching materials, and learning resources to all stakeholders. In addition, the document "Guiding Principles for the Implementation of Distance Education at Schools" [31] was issued. Based on the suggestions and recommendations presented in the official guidelines, schools were asked to design Distance Teaching Plans, implementing the principles according to their learning contexts. As a result, many communities of teachers at the school level emerged, playing a significant role in organizing the process [9].

These efforts, however, could hardly meet the complexity and scope of the transition process. Firstly, institutions and families were confronted with a shortage of digital devices and insufficient access to broadband Internet connection [32]. According to a study conducted by the education's national council, almost every school manager (92%) agreed with this claim. Most of them (80%) concluded that this factor affected the quality of the work done [19]. Nevertheless, although transversal, this element did not affect the institutions equally, depending on each geographic, social, and economic context. Local institutions and organizations across the country helped alleviate this situation providing students in need with resources—such as computers and Internet hotspots—which allowed them to participate in ERTL [9].

Secondly, it became clear how the low level of digital competences both of teachers and educators and of students and their parents affected the quality and efficiency of

education. For about 41% of school managers and 47% of teachers, emergency remote teaching has been affected by the inadequacy of teachers' digital competences. Likewise, the majority of school managers (79%) and teachers (80%) indicate that remote emergency education was affected by the lack of adequate training of students and families in the use of digital resources [18].

This explains the predominance of synchronous video communication in ERTL [29,30,33], a phenomenon identified globally and referred to as "zoomism" [15]. For most Portuguese teachers, the synchronous sessions were an effective way to deliver content without having the time, the means, or the knowledge to apply a more elaborate learning design. In fact, few teachers used these sessions to promote discussion, interaction, and socialization [18].

The literature describes a second phase in the implementation of ERTL, under the title "(re)adding the basics" [29,30]. This relates to a more mature moment in the process when concerns with quality, such as course design, equity and accessibility, or academic integrity (re)emerge into the ERTL practices already in place [29,30]. In the Portuguese case, this latter phase coincided with several actions taken both at the official level by the Ministry of Education in alliance with other public institutions, and at the unofficial level by the educational communities, professional associations and other non-governmental organizations acting independently. Worth mentioning the joint initiative of the Government and the Universidade Aberta (Open University, Aberta, Portugal) which delivered a massive open-access course (MOOC) to 2300 teachers from the basic and secondary education on distance education [9]. Similarly, the Government together with the public television network provided educational content through television, an initiative dubbed "Study at Home". This was intended to reach the most isolated student populations which were experiencing difficulties in accessing a computer and broadband Internet.

Even though the reaction to the pandemic was swift [34], the otherwise very centralized educational system responded by adopting decentralized policies that relied on schools' capacity for decision and self-organization and were meant to promote contextual adaptation. Still, this attitude may have led to a lack of coordination and inequality, even if some schools rose to the challenge with creativity and innovation [9]. However, the general feedback about the experience was positive, and stakeholders highlighted how ERTL has reinforced the importance of reflective teacher practice, how it has led to renewed attention to assessment models and practices, and how it has contributed to bringing the relationship between educational institutions, families, and communities closer.

Two subsequent phases of ERTL have been described, namely phase 3—Extended transition during continued turmoil and phase 4—Emerging "new normal" [29,30]. During these phases, activities become increasingly more planned and supported by teacher training and even infrastructure, as more time goes by, enabling schools to not only react to a crisis but respond on the basis of (some level of) acquired experience, training, and reflection. However, at the moment of data gathering, Portugal had not yet reached these levels of consolidated response.

Although ERTL has been described early into the onset of this phenomenon, we believe our paper may add to its discussion by including the perspectives of parents, who, as we will later see are underrepresented in studies of this period, and also because each country has developed different responses, has different populations, educational levels and even levels of access to equipment, and therefore, contextualized studies portraying the reality in different contexts, worldwide, are a valuable contribution to the study of this educational experience. Previous studies of ERTL in the Portuguese context, to our knowledge, have not taken parents' perspectives into consideration.

1.2. Parents and Emergency Remote Teaching and Learning

Davis and colleagues [35] referred to parents during the COVID-19 pandemic as proxy educators. These proxy educators were placed under tremendous strain, as they had to accumulate their previous responsibilities with teaching and caring for the children's individual needs. This was a USA-based study.

A qualitative study of parents of children previously on face-to-face education carried out one month after schools' closing [23] found that parents agreed with school closures and were satisfied with the support they were given. However, they struggled with balancing responsibilities, keeping their children motivated to learn, learning outcomes, and accessibility. Balance referred to balancing work and parenting demands, but also the demands of different children, personal needs, and feeling overwhelmed. The concerns related to learner motivation were often, but not always specific to the online context in which they occurred. Concerns with access were linked to children with special needs, parents' lack of content specific as well as pedagogical knowledge, technological barriers and need for more communication with teachers as well as resource organization. Lastly, parents' concerns with learning outcomes included academic achievement, socio-emotional development, and concerns with the quality of the curriculum.

Parents were concerned with their children's learning [22,36] and distrustful of the educational institutions' capacity to address the situation with competence [36]. The perceived support and abilities of teachers were acknowledged, through a longitudinal study, to be the main predictors of parents' school satisfaction during the lockdown period [24].

A study of parents' attitudes carried out in Kazakhstan [37] found older parents, parents with a higher educational level, and parents who assessed their children's teachers' competence level more favorably were more satisfied with online learning. In contrast, those with a larger family were less satisfied. The readiness of switching to online learning activities was also associated with greater satisfaction.

A Dutch preliminary study [38] found that despite unanimous concern with children's schoolwork, there were critical social differences in how parents coped with this new "homeschooling" task. Children from advantaged backgrounds receive more significant support and have access to more resources. Parents with higher education feel better equipped to support their children. There were also differences in perceived school support between parents of children in academic track vs. pre-vocational secondary education.

Through a literature review, Lateef and collaborators [39] were able to identify four recurring themes. Namely, (i) the reciprocal influence of each family member's emotions, (ii) the higher level of psychosocial stress during lockdown experienced by parents in comparison with adults without children, (iii) the need to provide parents with formal and informal support, and (iv) the need for further research on the psychosocial consequences of pandemics on children.

Parents' stress levels during lockdown increased [22,35,40,41], and their increase continued throughout the day and during weekdays, once again relating to the need to juggle child-care and work demands [42]. Mothers, younger parents, parents of children in emotional distress, among others, were found to be particularly at risk [41].

Nevertheless, the quality of the parent-child relationship was considered to have increased, particularly for girls' parents [22]. However, parental stress during COVID-19 was found in another study to increase the risk of reduced parent-child relationship closeness [43], which may, in extreme cases, lead to child maltreatment [44].

Charland and colleagues [45] considered curricular impacts of this situation, including how parents were involved. They recognized parents and families are often forgotten in curricular analyses and therefore saw the ERTL as an opportunity to rethink their roles in curriculum conceptualization. Parents were expected to take on a role as co-educators without any preparation, and often while maintaining their professional duties. Their educational level and need to continue working were considered crucial to understanding their perspectives on this matter. Lastly, the authors highlight the schools' roles in supporting and training parents, recognizing their unique needs and possibilities, and establishing effective school-parent partnerships. In the same line of thought, Iyengar [46] proposes COVID-19 to be an opportunity to rethink the role of the community in education, including parental involvement, thus contributing to enriching the curriculum.

In summary, the studies of parents' perspectives on ERTL thus far have shown this to be a relevant matter, with implications concerning education, mental health, and family.

They have also revealed that parents are concerned with this situation and that their perception is influenced by educational variables, such as the type of support given during lockdown, but also by personal characteristics of the parents and children themselves. Concerns about equity are also raised in this context. As no data were found regarding the perspectives of Portuguese parents, our research may contribute to increasing the knowledge of this process in this national context, as well as establishing dialogues with previous research, as we propose in the discussion section.

1.3. Emergency Teaching and Learning and Younger Children

Before the COVID-19 pandemic forced the majority of the worlds' children to leave brick-and-mortar schools, there were already decades of research and experimenting with distance learning with k-12 children, focusing on effectiveness, student readiness, and description of concrete experiences. Students' motivation, readiness, access, accreditation, and retention were acknowledged as challenges while expanding access and providing opportunities for high-quality education were portrayed as potentials of this modality. However, research on k-12 distance education was still limited [47]. We will now focus on summarizing some previous studies concerning parents' perspectives about the ERTL experience with younger children.

Analyzing Chinese parents' beliefs and attitudes towards online learning, specifically parents of children in early childhood education during the COVID-19 pandemic, ranging between the ages of three and five years, revealed their children were predominantly engaged in online education for short periods—mostly under 30 min, with frequencies ranging from once a week to multiple times a day. These parents were critical of online learning's quality and effectiveness. Difficulties such as lack of contact with peers, lack of self-regulation, lack of a learning atmosphere, and inability to focus were mentioned. This led them to express concerns about the negative consequences online education could have on their children's development. Another critical aspect they uncovered was the high demands this experience placed on the parents themselves, namely in terms of time and of professional knowledge [27].

Similarly, Mangiavacci and collaborators [22] posited the impact of confinement on children disproportionately affected not only those from lower-income and lower educational status but also younger children. Parents' concern about their children's educational attainment differed significantly according to the child's school level and whether the school provided online activities.

Spiteri [25] adds to these concerns by arguing studying at home affects younger children more than their older peers and may have more detrimental consequences for this age group, particularly as early childhood education, which is fundamental for the achievement of the United Nations 2030 goals of sustainable development [48], relies extensively on hands-on activities, direct experiences, and face-to-face interaction and care.

Yi et al. [49] carried out a study with parents of kindergarten and primary school students three weeks after lockdown. They found most children were unable to independently respond to the activities schools asked of them, and experienced difficulties with motivation and related to the home environment. Online learning activities were appreciated by parents, who valued online interaction and support, as well as flexible work arrangements and government subsidies to help them address their children's needs.

Studies carried out with parents of younger children highlight particular challenges faced by this demographic and encourage their inclusion in our sample. We believe having encompassed a broad range of children's ages is a relevant contribution of the present study.

The studies analyzed in this section help in better understanding one of the critical dimensions of ERTL, as they highlight the mediating role of parents of children and adolescents during the global school closure in the first phase of lockdown. The digital divide in the access and the use of technologies and the Internet in families with lower technological, economic, and educational capital; the overburdening of families with

younger children and with special educational needs during the lockdown; as well as the need for further research on the role of families as privileged partners in the educational process in schools, are dimensions of the complex, multi-faceted, and specific reality experienced by parents of younger children in this critical period.

2. Materials and Methods

Data were gathered between 13 April and 14 May 2020, approximately one to two months after the schools' closing, through an online questionnaire including closed and open questions. The questions analyzed in the present article are replicated in Appendix A. In the present article, we focus exclusively on the closed questions, which were subject to statistical analysis using SPSS 37. Due to the novelty of the situation, and lack of previous studies at the time of data gathering, the authors opted for an exploratory study, aiming to describe the situation as it was unfolding, rather than testing previous hypotheses.

The respondents were 203 parents or caregivers of children enrolled in preschool, basic, or secondary education (ages 3 through 18) in Portuguese schools. The sample was derived by convenience, by disseminating the questionnaire online on Facebook groups related to parenting and education. The resulting sample includes parents from all the countries' regions, including the archipelagos. However, it seems to include a disproportionate number of mothers and older parents with post-secondary education, which needs to be considered when analyzing data. The characteristics of participants and their children's schools are described in Tables 1 and 2.

Table 1. Respondent's descriptive statistics.

		Frequency	Percentage
Gender	Male	27	13.3%
	Female	174	85.7%
	Rather not answer	2	1%
Age	Under 25	14	6.9%
	26 to 35 years old	20	9.9%
	36 to 45 years old	121	59.6%
	46 to 55 years old	42	20.7%
	56 years and older	5	2.5%
Educational level	Secondary or lower	33	16.3%
	Post-secondary	117	57.6%
	Post-graduate	52	25.6%
Work situation	Not working	61	30%
	Working from home	119	58.6%
	Working outside the home	22	10.8%
Another caregiver in the same household	Yes	170	83.7%
	No	33	16.3%

The questionnaire gathered socio-demographic and education-related indicators, access to the Internet and a personal computer, self-assessed digital competence, satisfaction with educational activities during the lockdown, work methods implemented by the teachers, and pedagogical changes after moving online.

Self-assessed level of competence was assessed by two items on a 4-point scale ranging from no knowledge or experience and high level of knowledge or experience, pertaining to both distance education and the use of information and communication technology (ICT) for education.

Table 2. Schools' and children's descriptive statistics.

		Frequency	Percentage
Type of school	Public	159	78.3%
	Private	36	17.7%
	Both *	8	3.9%
School context	Urban	113	55.7%
	Demi-Urban	50	24.3%
	Rural	40	19.7%
Children in preschool	Yes	71	35%
	No	132	65%
Children in the 1st CBE	Yes	85	41.9%
	No	118	58.1%
Children in the 2nd CBE	Yes	40	19.7%
	No	163	80.3%
Children in the 3rd CBE	Yes	64	31.5%
	No	139	68.5%
Children in secondary school	Yes	42	20.7%
	No	161	79.3%
Total number of children	1	92	45.3%
	2	88	43.3%
	3	15	7.4%
	4 or more	6	3%

* Selecting the option "both" implies the respondent has one or more children in public school and one or more children in private school, and therefore checked both private and public as type of school. [1] Preschool includes children aged 3–5; 1st Cycle of Basic Education (CBE) 6–10; 2nd CBE 10–12; 3rd CBE 13–15; secondary 16–18.

Parents' satisfaction was assessed on a five-point scale ranging from not at all to very much. Although the first version of the scale was a four-point scale, like the one used for self-assessment of digital competence, during the instruments' validation, some respondents expressed the need for an intermediate level. A five-point scale was adopted in response to the respondents' expressed need. Items concerned how the parents valued the transition process on the following dimensions: efficiency, simplicity, equitability/fairness, organization, and increase of workload for the parent (negative parameter). The first four dimensions were considered a satisfaction scale, ranging from 4 to 20, and with a Cronbach's Alfa of 0.737. This scale was computed by adding the results of the four positive satisfaction parameters (efficiency, simplicity, equitability/fairness, and organization).

A variety of pedagogical strategies, both synchronous and asynchronous, were assessed on how frequently they were implemented. Answers ranged from never to daily or more than once a day on a 4-point scale.

Finally, parents were asked whether there had been pedagogical changes subsequently to moving education online (dichotomic answer).

The study follows international guidelines for ethics in educational research [50], including voluntary participation, anonymity, and informed consent. Research procedures and instruments were approved by the ethics committee of the Laboratory for Distance Education and E-Learning (LE@D) of the Open University, Portugal, in April 2020.

3. Results

The vast majority of respondents had access to the Internet at home (99.5%). However, a non-negligible percentage (26, 12.8%) only had access to mobile Internet, which is usually limited and can be an impediment to accessing online educational activities, particularly those relying on video.

Concerning access to one device (computer, tablet, or smartphone) per person in the household in education or working, an even more concerning minority of respondents must share a device with another person in the household (37, 18.2%). Only four respondents

did not have at least one computer at home, which limits the types of activities the students can perform.

Parents self-assessed their levels of competence more positively concerning the use of information and communication technology for education than concerning distance education, as shown in Figure 1.

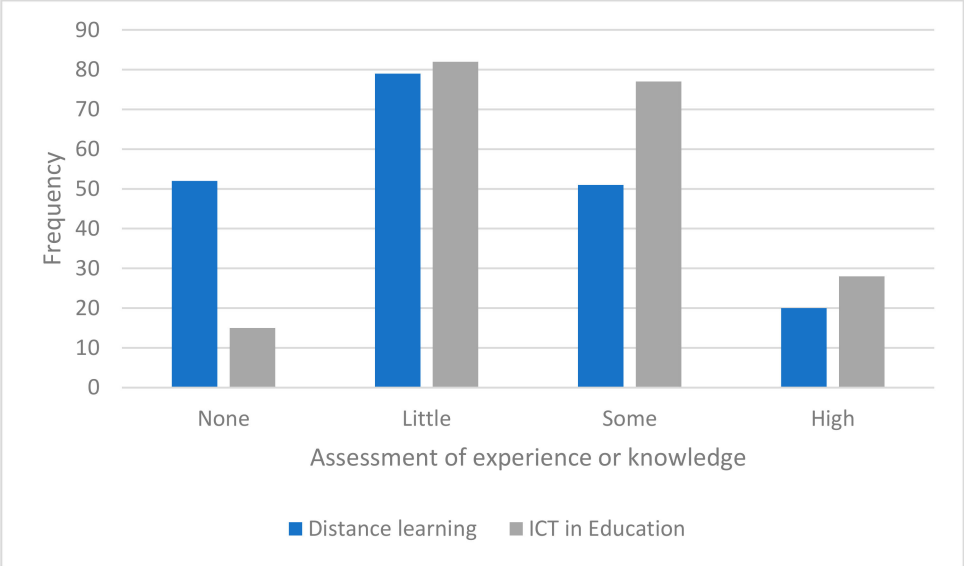

Figure 1. Self-assessment of competence in distance education and information and communication technology (ICT) for education.

These self-assessed levels of competence correlated with each other ($r = 0.696$, $p < 0.01$) and with the respondent's level of training (distance learning 0.292 $p < 0.01$ and information and communication technology for education 0.320 $p < 0.01$) but did not correlate with any other descriptive variable. Kruskal-Wallis test confirmed significant differences between groups, with significance in the 0.000 range.

Parents' levels of satisfaction with the process ranged from a minimum of 4 points and a maximum of 18 points on a four to 20-point scale ($M = 11.3$, $SD = 2.98$). Given that the scales' mid-point is 8, the results show moderately positive levels of satisfaction, despite considerable dispersion.

The satisfaction scale showed a significant negative correlation with the number of children in the second cycle of basic education (ages 10–12) ($r = -0.196$, $p < 0.01$), and parents' age ($r = -0.183$, $p < 0.05$). There were also significant differences in satisfaction according to the type of school frequented by the children, in favor of private schools (Kruskal-Wallis test shows $p < 0.05$).

Looking into specific individual aspects within satisfaction, older parents ($r = -0.257$, $p < 0.01$), parents with more children in the third cycle of basic education ($r = -0.157$, $p < 0.05$), and secondary education ($r = -0.166$, $p < 0.05$) tend to find the process was less well-coordinated, whereas parents of children in the first cycle of basic education ($r = 0.200$, $p < 0.01$) find it better coordinated.

Parents who self-assess their information and communication technology competences for education better also tend to find the process slightly simpler ($r = 0.174$, $p < 0.05$). On the contrary, parents with more children under their care ($r = -0.157$, $p < 0.05$) and especially those with children in the second cycle of basic education ($r = -0.300$, $p < 0.01$) found the process less simple.

Interestingly, parents who were not working considered the process more equitable (Kruskal-Wallis test revealed $p < 0.05$).

Most parents considered this experience to provoke an increase in their workload, as depicted in Figure 2. Nevertheless, this increase was different according to the parents'

work situation, with parents who were working from home during this period considering this increase had been greater (Kruskal-Wallis showed $p < 0.01$).

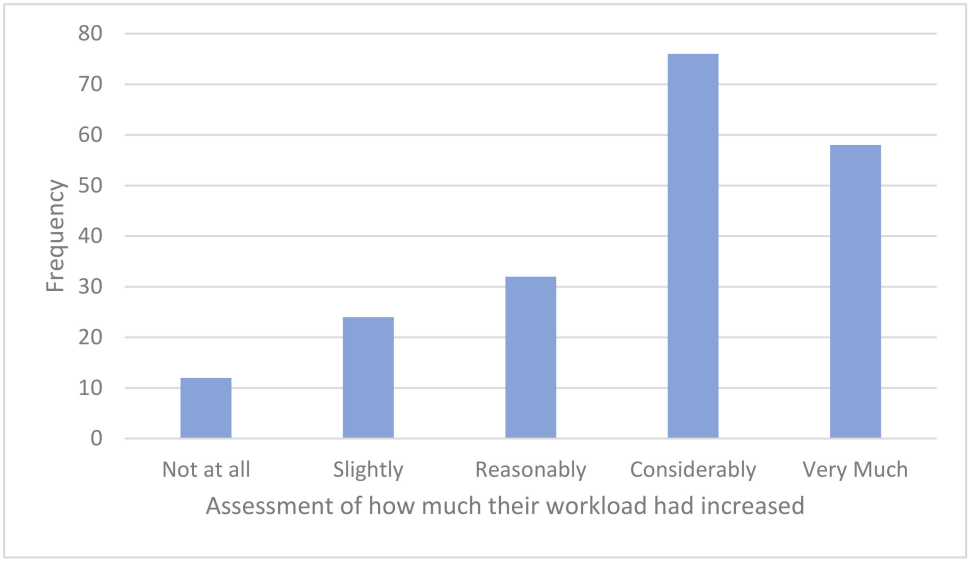

Figure 2. Degree to which the transition to schooling from home increased the parents' workload.

Parents with a higher degree of training ($r = 0.188$, $p < 0.01$-Kruskal Wallis confirms differences among groups, with parents with post-secondary but undergraduate education revealing a steeper increase ($p < 0.05$)), more children in their care (r = 0.273, $p < 0.01$), more children in preschool ($r = 0.168$, $p < 0.05$), more children in the first cycle of basic education ($r = 0.286$, $p < 0.01$), and more children in the second cycle of basic education ($r = 0.144$, $p < 0.05$), expressed having felt a greater increase to their workload.

Concerning the types of synchronous activities more frequently used, live video lectures were the most frequently mentioned, followed by group real-time debate. Real-time one-on-one tutoring was the least used synchronous strategy (Figure 3).

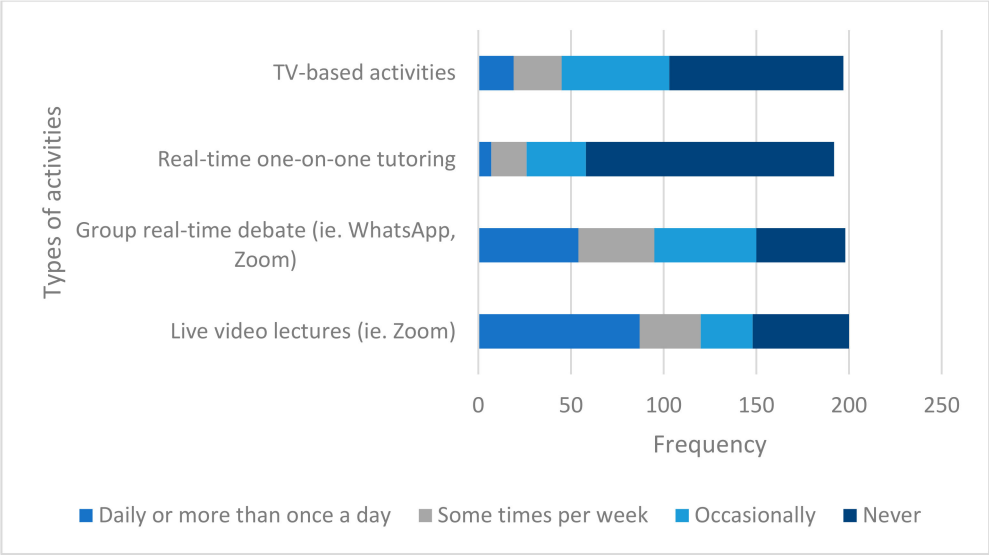

Figure 3. Synchronous teaching methods frequency of use.

The tasks for students' individual resolution, tasks requiring parental support, reading proposals, differed video lectures, and use of resources in virtual platforms, such as those provided by some schoolbooks' editorial labels, were the most frequently used. On the

contrary, group-work among students and inter or trans-disciplinary work were the most seldom used (Figure 4).

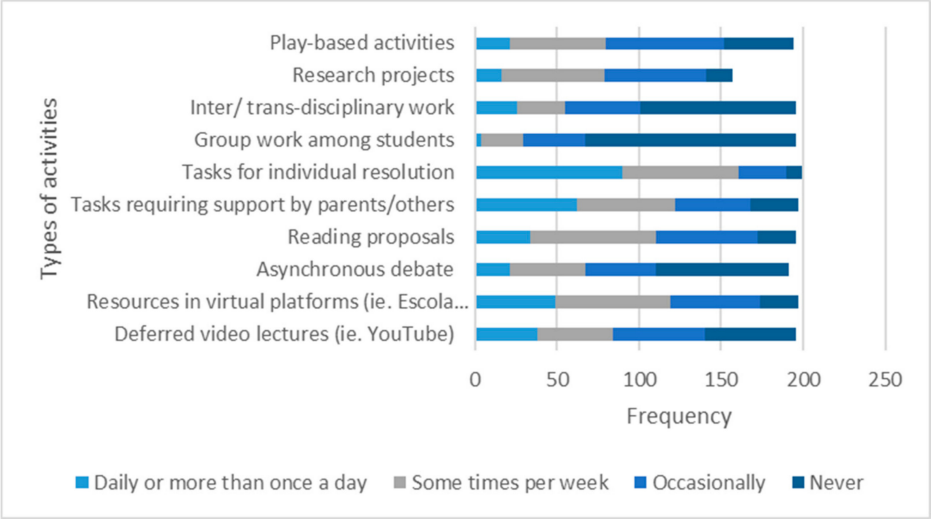

Figure 4. Asynchronous teaching methods frequency of use.

Correlational analysis, as presented in Table 3, show significant correlations between the number of children in each of the levels of education and the types of pedagogical activities used by teachers.

Table 3. Correlations between the children's levels of education and pedagogical activities.

	Children in Preschool	1st CBE	2nd CBE	3rd CBE	Secondary
Live video lectures	−0.250 **	0.196 *		0.152 *	
Group real-time debate	−0.162 *			0.154 *	
Deferred video lectures	−0.121 *			0.140 *	
Resources in virtual platform	−0.254 **			0.243 **	
Asynchronous debate	−0.237 **			0.169 *	0.200 **
Tasks requiring parental support	0.205 **	0.235 **			−0.323 **
Group−work		−0.235 **		0.297 **	0.187 **
Research projects		−0.230 **		0.147 *	
Play−based activities	0.278 **		−0.156 *	−0.212 **	

[1] Preschool includes children aged 3–5; 1st Cycle of Basic Education (CBE) 6–10; 2nd CBE 10–12; 3rd CBE 13–15; secondary 16–18. * $p < 0.05$; ** $p < 0.01$.

Finally, parents were asked if subsequently to moving pedagogical activities online there had been changes to teaching or evaluation practices. A slight majority considered there had been no changes (52.2%).

4. Discussion

Access to distance education has been a concern historically associated with pre-secondary education mediated by technology [47] and one of the concerns expressed by parents with ERTL in the context of COVID-19 [23]. In our sample of parents, access to the Internet was almost universal but sometimes restricted by internet providers, which poses access concerns for part of the students involved. An expressive minority did not have one device (computer or mobile device) for each person in education or working from home within the household. This can pose added difficulty in managing limited resources and raise issues of equity, which have been acknowledged as a primary concern in the context of ERTL [10,32,51]. Our sample, as we have acknowledged in the methodology section, may be favorably skewed as data were gathered through an online questionnaire,

and demographic data indicate relatively older and well-educated participants. This leads us to question whether a representative sample might reveal even more relevant issues with access to ERTL.

Parents' self-assessed competence with distance learning reveal this was a relatively novel experience for most. They self-assessed more positively concerning their knowledge or experience with technology for education. Self-assessed competence with the use of technology also correlated with how simple they considered the transition to ERTL to have been. Parents' level of education had been shown in other studies [38,45] to impact how well-prepared to support their children in learning activities they may feel, once again raising the matter of equity to awareness. This may also point to the need to invest not only in children's and teachers' digital competences [33,52] but also those of parents, who, as proxy educators [35], had to take on a fundamental role in ERTL.

This is also clearly the case of the parents in our sample, who acknowledge a significant increase in workload, as reflected in other studies [21,23,39], which may result in adverse psychosocial consequences, including parental stress [35,40,41]. Interestingly, parents with a higher degree of training reported a more significant increase in workload, which may reveal a greater involvement in supporting their children through the process [38].

Parents with more children in their care and parents of younger children (preschool, first cycle of basic education, and second cycle of basic education—3 to 12 years old) also felt a greater increase in their workload. This may be the case because of younger children's lesser autonomy [49] and due to the characteristics of childhood education [22,25,27], which require a high level of support from parents. This idea is reinforced when we analyze the types of activities more frequently promoted with each level of education—as is understandable, activities that require parental support are more frequent for children in preschool and the first cycle of basic education. Therefore, not only do younger children seem to be disproportionately affected by ERTL [25], but their parents also seem to require more intense support. Similarly, parents who were working from home experienced a differentially high level of increase in their workloads. The policies implemented at the time did not allow parents who were in a home-office situation to apply for the state support to care for children, even if only one of the parents was in that situation, and regardless of the nature or flexibility of the work carried out or of the children's ages. Later in the pandemic response, this would be changed, as working parents expressed their inability to respond to all that was asked of them without support. Our findings recommend that, in future lockdowns, parents who are working from home, particularly those with children under 12 years of age, be given the possibility of benefiting from the family support measures. This is a crucial indication for schools and policymakers and validates the support policies later implemented in Portugal [28].

As had been the case with the study of Garbe and collaborators [23], parents in our study were relatively satisfied with the process. Parents with more children in the second cycle of basic education (ages 10–12) showed less satisfaction with the process. This is a novel result and may point to specific needs of children in that age range, which should merit further investigation. Older parents were slightly less satisfied, which contrasts with what was found in another study [37]. Parents of children in private schools were also more satisfied, which may reflect differences in support [38], as well as issues concerning equity. This too is an area that merits further research.

Parents with more children under their care found the process less simple, as was the case with another study [37]. Once again, parents of children in the second cycle of basic education considered the process particularly complex.

Parents who were not working during this period seem to have been less aware of problems concerning equitability in ERTL, which is also a novel finding.

The analysis of the types of activities which were promoted during the lockdown reflects a wide variety of practices expressing the freedom enabled by the deconcentrated approach based on each school developing their own distance learning plan [31] and contradicting Barbour and collaborators' description of the first phase of ERTL as having a

strong reliance on synchronous communication, simply transposing classes to an online platform [29]. Nevertheless, and while asynchronous activities were also prevalent, there seems to be a predominance of "traditional" activities, such as individual work assignments or reading proposals. The diversity of activities also seems to reflect the educational levels being taught.

The lack of changes to pedagogical practices since the implementation of ERTL reported by a significant number of parents helps to situate the data gathering in the transition between the first and second phases of ERTL as described by Barbour and collaborators [29], as it seems the types of activities and processes underway had remained unaltered since the beginning or the ERTL experience. This is in contrast with teachers' perspectives on this matter [9].

5. Conclusions

During the 2020 lockdown, parents with school-age children were active ERTL mediators, as they added to their everyday family routines the role of proxy teachers-educators [10,11,35]. Even though the role of parents in the schooling process of children and youth was previously recognized by the educational communities, the value of this partnership was often downplayed in practice contexts. Experiences with ERTL in preschool, basic, and secondary education transformed this state of things and brought this issue into the public space, the educational communities, as well as in the research agendas. Considering a new reality, it was important to know the parents' perceptions about this teaching and learning emergency solution in Portugal.

The empirical study presented here was based on a sample consisting mainly of women between 36 to 45 years old and with a post-secondary educational level. Since it is not a representative sample, the conclusions to be drawn from this research not only cannot be generalized but must also consider the specificity of this group of respondents [38,45].

In line with other studies, this study highlighted how parents with children between 3 and 12 years of age and with children with SEN managed their professional activities and their roles as family caregivers and as proxy educators in the same space-time [35]. Therefore, they lived a greater physical and emotional workload during this period. Our data also reveal that being responsible for more children seems to be associated with a less positive perception of this process [37], and working from home is associated with a higher perception of an increase in their workload.

The uniqueness of parenthood in families with younger children and in a context of crisis seems to highlight the need for differentiated educational and social responses appropriate to the greater physical and emotional investment of parents with children. On the other hand, it gave a voice to parents, particularly mothers, allowing a better understanding of the value of the partnership between parents and teachers in ERTL, with important lessons for the future. Finally, and as this is an exploratory study, there is a need to further explore this issue with larger and more diverse samples so that we can identify more sustained trajectories for the achievement of the SDG-4 goal [2].

6. Limitations and Suggestions for Future Research

One of the most important limitations of our study relates to the fact that the sample is relatively small and is overly representative of older and more educated parents. This may be a reflection of the fact that we used an online questionnaire, which at the time was the only way to reach parents since schools were closed. Parents with more difficult access to technology or less familiar with its use may have been less likely to answer the questionnaire. We believe future studies might better represent the perspectives of all parents, now that schools have reopened and therefore data gathering through written forms is again possible, by trying to be more inclusive and therefore representative.

Another limitation derives from the choice not to ask for separate answers in relation to each child in education when the respondents were parents to more than one child. This was a difficult and pondered decision we arrived at because we considered subdividing the

questionnaire would make it too lengthy, which might deter parents of multiple children from answering the questionnaire in full, particularly during a time when they were already so overburdened. We risked losing some precision in favor of greater inclusivity and a sample that may resemble the population more closely. As an exploratory study, we believe this was a wiser decision, and consider that the present study now leaves open a possibility of further exploration by more focused studies. Studies directed to families with multiple children, parents who worked from home during the schools' lockdown, parents of children in different school settings, or children with special needs are still needed to help us understand ERTL and better plan for future school closings.

Our questionnaire highlighted the importance of parents throughout this process, as well as a subjective perception of increased workload. Future studies may move forward by gathering more in-depth information about the roles that parents assumed as proxy educators. How much time did they invest in this role? What kinds of support were they called to provide?

The fact that parents with children in the second cycle of basic education (10–12 years of age, in average) seem to be less satisfied should also be researched and eventually verified by other studies. A deeper analysis of the situation of those parents could reveal the reasons behind this lower satisfaction and eventually point to ameliorating actions.

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Appendix A

Supplementary Material—Excerpt from the questionnaire applied to parents (questions analyzed in the present article)
Characterization:
Your child's school is (check all that apply)
__ Public
__ Private
In what context do you reside (check only one box)
__ Urban
__ Demi-urban
__ Rural
In what region of the country do you reside (check only one box)
__ Autonomous region of the Azores
__ Autonomous region of Madeira
__ District of Oporto, Braga or Viana do Castelo
__ District of Aveiro, Coimbra or Leiria
__ District of Lisbon, Santarém or Setúbal
__ District of Évora, Beja or Faro

__ District of Bragança or Vila Real
__ District of Viseu, Guarda, Castelo Branco or Portalegre
How many children are under your care, in each of the following levels of education and teaching? (Mark only one box per line.)

	1	2	3	4 or More
Preschool education				
1st Cycle of Basic Education (1st to 4th grades)				
2nd Cycle of Basic Education (5th and 6th grades)				
3rd Cycle of Basic Education (7th to 9th grades)				
Secondary education				

Sex (Check only one box)
__ Male
__ Female
__ Rather not answer
Age (Check only one box)
__ 25 and under
__ 26 to 35
__ 36 to 45
__ 46 to 55
__ 56 or more years
Higher degree of education completed (Check only one box)
__ 1st Cycle of basic education (4th grade)
__ 2nd Cycle of basic education (6th grade)
__ 3rd Cycle of basic education (9th grade)
__ Secondary education (12th grade)
__ Post-secondary education (Non-higher education technological specialization degree)
__ Professional technical higher education
__ Bachelor's degree
__ License degree (Undergraduate degree)
__ Master's degree
__ Doctoral degree
In what situation are you currently? (Check all that apply)
__ At home, supporting my children
__ At home, working from home
__ working outside the home
__ Other
Do you have access, in your home, to (Check all that apply)
__ home broadband Internet
__ mobile broadband Internet
__ I do not have Internet access at home
Do you have access, in your home, to (Check all that apply)
__ Computer
__ Mobile device(s) (tablet or smartphone)
__ Printer
__ Scanner
__ Other _____
At your home, is there one device with Internet access (computer, tablet, or mobile phone) per person in education and/or working from home? (check only one box)
__ Yes
__ No

Considering the moment when the transition to exclusively distance-based teaching processes: (Check only one box per line)

	1. No Knowledge or Experience	2. Little Knowledge or Experience	3. Some Knowledge or Experience	4. Much Knowledge or Experience
How do you self-assess your level of knowledge or experience on distance education?				
How do you self-assess your level of knowledge or experience on the use of technology in educational settings?				

Accelerated digital transition at schools
Considering the process of transition to distance-based education you are living, do you consider it: (Check only one box per row.)

	1. Not at All	2. a Little	3. Reasonably	4. Fairly	5. Very Much
Has been efficient					
Has been simple					
Has been equitable/fair for students and children in general					
Has caused an increase in your workload					
Teaching practices are coordinated and coherent among teachers					

What work methods have been used with the children under your care? (Check only one box per row.)

	Never	On Occasion	Some Times a Week	Daily or More than Once a Day
Deferred video lectures (i.e. YouTube)				
Resources in virtual platforms (i.e. "Escola Virtual")				
Asynchronous debate				
Reading proposals				
Tasks requiring support by parents/others				
Tasks for individual resolution				
Group work among students				
Inter/trans-disciplinary work				
Research projects				
Play-based activities				
Live video lectures (i.e. Zoom)				
Group real-time debate (i.e. WhatsApp, Zoom)				
Real-time one-on-one tutoring				
TV-based activities				

Since the start of the distance-based activities due to school closing motivated by the COVID-19, were there changes in teaching or assessment practices? (Check only one box.)
__ Yes
__ No

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Factors Affecting the Efficiency of Teaching Process in Higher Education in the Republic of Serbia during COVID-19

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Abstract: From the moment the Republic of Serbia declared a state of emergency in the summer semester of 2019/2020, higher education institutions (HEIs) used various teaching models from Distance Learning Systems (DLS), online platforms and modern information and communication technologies (ICT), to sending materials via student e-mails and notifications via faculty portals. Using survey research as a method, the paper describes the experiences of teachers and associates at HEIs in Serbia (780 respondents) regarding the efficiency of provided education services. In this article, we used the method of content analysis and participatory observation, as well. We analysed the attitudes of teachers and associates apropos the efficiency of providing educational services through the work from home (WFH) model and distance learning (DL) and other models used in response to COVID-19 epidemiological measures in education. During the WFH setup, we looked for factors that affect educational efficiency. When it comes to the statistical technique, factor analysis was selected. Technology, managerial support, and work–home conflict are all expected to impact process efficiency, so these were the first criteria considered when selecting potential factors. Principal Component Analysis (PCA) was used as the extraction method, and the Varimax rotation method was also used. We discarded all factors with eigenvalues below one. Four factors caught our attention: School management support, Family–work conflict, Home infrastructure, and Technology choice. The results showed that F1 (School management support) is positively correlated to F2 (Family–work conflict) and efficiency and negatively correlated to F3 (Home infrastructure). Conversely, F2 is negatively correlated to F3 and positively correlated to efficiency. The F4 factor shows no significant correlations to other factors.

Keywords: distance learning systems (DLS); higher education institutions (HEI); work from home (WFH); human resource management (HRM); COVID-19; principal component analysis (PCA)

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1. Introduction

The COVID-19 pandemic forced many countries to take urgent measures, but it also caused an explosion in the online education system, which emerged as a necessary response to the health crisis [1]. One month after the official declaration of the COVID-19 pandemic, over 1500 research papers dealing with the topic of online education in the circumstances of the newest health crisis had already been uploaded to the Web of Science database. The majority of these papers put emphasis on describing different practices around the world regarding the implementation, but they also highlighted the corrections of the education system under these new, extraordinary conditions. In April 2020, it was estimated that 91.3% or approximately 1.5 billion students from different countries would be prevented

from participating in regular activities, i.e., attending and listening to lectures (traditional instruction) because of the COVID-19 virus [2]. A noticeable shift from traditional to online education, without any prior preparation, certainly marked the first but also the second year of the global pandemic [3]. The confirmation of the pandemic forced many students to return to their homes or home countries and to attend lectures via digital means. Online teaching and learning are the only alternative solutions in the implementation of teacher and student activities from the teaching activities set that have not undergone a reduction or interruption, and that is the main reason why this form of teaching was most widely used. Numerous issues regarding WFH in the education sector have become the subject of research from different demographic, psychographic and behavioural aspects in a short time [4].

The COVID-19 pandemic caused major disruptions in the work of educational institutions and visibly affected the work of students, teachers and educational institutions because, in certain periods, complete or partial closure of schools, colleges and universities around the world was imposed [5]. Due to the lack of information about the potential duration of the pandemic, many educational institutions quickly resorted to online teaching using various technological tools to maintain teaching continuity [6]. It is interesting to note that before the beginning of the COVID-19 pandemic, very few educational institutions had functioned exclusively or partially on the principles of online education. The latest health crisis has, in a short time, forced many educational institutions to adapt their activities to online teaching. Nevertheless, it is not always easy to successfully digitalise teaching [7].

During the 2019/2020 summer semester, from the moment of declaring a state of emergency in the Republic of Serbia, teaching in higher education institutions was implemented through different teaching models, from online platforms, modern information and communication technologies (ICT), to sending materials to students via e-mail, and notifications via faculty portals during the 2020/2021 winter semester, and finally, the latest transition to an online and blended teaching model. Different teaching methods and educator approaches had varying effectiveness and student acceptance. As there is certain research on students' attitudes [8] regarding the educational services received in this period [9], but not the attitude of educators, the contribution of this research lies in the fact that the paper examines the attitudes of educators, i.e., teachers and associated in higher education institutions (HEI) in Serbia.

It was necessary to draw on a wide range of academic, scientific and public sources in order to get a complete picture of the research topic. A survey was conducted in Serbia among teachers and assistants in higher education institutions (HEIs) during the pandemic to gather data and information on how teachers and assistants perceive the efficiency of the teaching process they performed, along with various factors and variables. The results will be presented within the result chapter, while in the discussion chapter, those findings of the secondary and primary research will be summarised.

The main assumption this paper starts from is that there is a relatively small number of measurable factors that affect the effectiveness of the teaching process. Factor analysis was used for testing these assumptions, as well as other derivatives.

2. Literature Review

2.1. COVID-19 Impact on Higher Education in Serbia

The COVID-19 pandemic has not only caused health problems but has also given rise to numerous economic challenges. The governments of most countries in the world implemented the so-called social distancing in the form of corrective societal measures, which had the greatest implications on people's mobility [10]. As a result, in a short period of time, the general manner of social and professional life has been irreversibly changed. For the first time in modern history, due to lockdown measures, high-skilled workers were mostly forced to work from home, and some encountered technological performance challenges unprepared for the first time. It is important to note that in this case, we do not have traditional WFH but enforced work from home during the pandemic, which requires

a far more complex analysis compared to regular working conditions [11]. In this sense, it is very important to examine the urgency of the transition to online teaching based on the quality criteria that will be presented in the paper.

The cancellation of fairs, festivals and various music and sports events, as well as educational activities, had far-reaching consequences at the global level, in addition to health challenges [12]. The three industries with the lowest share in WFH activities are: (1) agriculture, forestry and fisheries; (2) tourism and the hospitality industry; and (3) construction, as opposed to (1) finance and insurance; (2) information and communication technologies; and (3) education—the three industries with the largest share in WFH jobs [13].

The President of the Republic of Serbia declared a state of emergency on March 15, at a time when, according to official data, there were 48 confirmed cases of infection with COVID-19 and no deaths [14]. On Monday, 16 March, all schools, universities and preschool institutions were closed due to the state of emergency, while all sports events and public gatherings were banned.

Different higher education institutions in the Republic of Serbia reacted to the state of emergency with different levels of alacrity. Those few among them that possess distance learning platforms and software for communicating with students, as well as lecture archives, were able to respond quickly and provide their students with quality materials and an adequate alternative to face-to-face lectures in classrooms and lecture rooms. Some faculties succeeded in organising some form of "teaching" such as sending presentations and other materials to students, where the organisation itself fell on the shoulders of teachers, but most did not manage even that, as evidenced by student statements and comments on various forums and portals, as well as survey results [9,15,16]. The combined (blended) model of teaching implied traditional instruction combined with elements of online instruction. Some faculties promptly informed students about these changes on their official websites. All forms of direct teaching (lectures and practical classes), as well as consultations with students, were realised through the means of electronic communication. The colloquia and exams at all levels of study were postponed at all higher education institutions in the Republic of Serbia until the conditions for their realisation were met [17]. Various surveys examining student satisfaction with the educational services received during the state of emergency were conducted. The OECD report on the effects of the COVID-19 pandemic on the economic development of Serbia shows that in late March 2020, as many as 67,000 workers already worked from their homes [18]. In the Republic of Serbia, teachers are elected to different academic titles according to the Law on Higher Education (assistant professors (docents), associate and full professors, professors of applied studies, senior instructors and instructors, as well as skills teachers and language teachers) [19]. This was indicated, given that all aforementioned categories were subsequently included in the online survey.

One of the first surveys was published on the NajStudent.com website (in the period between 21 April and 27 April), where 1447 students answered questions about the effects of the pandemic on their studies. The results of this survey indicate that the reactions of different faculties to the pandemic varied, sometimes greatly, and that the choice of a communication channel with students often fell on teachers. Some professors sent different materials in PDF and ppt format to their students via e-mail or uploaded them to the faculty websites, while one-third of the professors held online lectures, and 16% held consultations on fixed dates. The majority of students (70%) declared that these changes negatively impacted their knowledge acquisition, almost one-quarter did not feel that there was a big difference compared to regular lectures, and only 8% stated that they acquired knowledge more easily this way.

Another significant piece of research in the same organisation was conducted on a sample of 1955 respondents in August 2020, and it was concluded that, in addition to the organisation of online studying, the pandemic also greatly affected the students themselves. Judging by the respondents' answers, more than half lost their study sense, and the other effect of the pandemic was that they needed more time to master the material due to the

lack of lectures and practical exercises. Two-fifths of the respondents stated that they miss contact with their fellow students, while only 21% stated that this situation gave them more time for studying.

2.2. Human Resource Management in Education and Work from Home

Human resource management in educational institutions has become particularly complex since various factors now affect individual behaviour. The productivity of teachers and associates largely depends on their educational and pedagogical capacities [20].

Human resource management as a scientific discipline and practice provides valuable advice and guidelines regarding the organisation of functions and processes. If the organisations follow this advice and guidelines, combining them with the best practices and lessons learned, they increase their success in achieving organisational goals and specific business goals. Human resource management in education must consider different variables in developing an optimal model of functions and processes due to different models of financing their operations, management models, regulatory constraints, etc. [21].

The complexity of human resource management and its significance for modern business demand that all activities related to human resources must be carefully planned and planned in detail. Any human resource plan must be aligned with organisational strategies and aimed at achieving and maintaining long-term competitive advantage [22].

In the Republic of Serbia, teachers are elected to different academic titles according to the Law on Higher Education (assistant professors (docents), associate and full professors, professors of applied studies, senior instructors and instructors, as well as skills teachers and language teachers) [19].

The quality of the teacher workforce should be increased in order to improve the educational standard. To achieve a higher educational standard, it is important to define the factors that improve teachers' work. In order to efficiently achieve the goals and tasks of quality educational standards, teacher performance management plays a crucial role because it represents a continuous process of identifying, evaluating and developing teacher performance. It is also well known that human resources play a decisive role in the performance of educational organisations [20]. In order to improve teacher quality, a good system of performance management, i.e., planning, monitoring and supervising the needs of schoolteachers, is necessary [23].

According to the Cambridge Dictionary, teleworking is "the activity of working at home, while communicating with your office by phone or e-mail, or using the internet" [24]. Teleworking is also commonly called telecommuting, remote work, future of work, telework, teleworking, working from home (WFH), work from anywhere (WFA), flexible workplace, mobile work, remote job, etc. [24].

Work from home (WFH) is a type of employment where an employee fulfils their basic work duties while staying at home and using information and communication technologies (ICT). It requires the shared responsibility and commitment of both the employer and the employee in order to ensure the continuity of business and employment. "Work from home" is a phrase that has been used extensively since the beginning of the COVID-19 pandemic and generally refers to the situations in which employees perform their work tasks outside the company's offices. Savić points out the basic postulates of WFH: (1) a person is an employee of the given company or a member of the given organisation; (2) the person carries out business activities given by the company or specific business tasks; (3) business operations are carried out outside the company's offices, and (4) the employees use telecommunications to communicate with their superiors [25].

With the emergence of the COVID-19 pandemic, human resource management in many organisations has been given new responsibilities, from dividing employees into essential and non-essential workers to taking care of the physical and mental health of employees who were forced to take up the telework model.

The development of ICT has enabled and facilitated alternative forms of employment, including WFH or teleworking. These expressions are often used interchangeably and refer

to new models of employment outside the employer's offices or one's workplace. However, there are certain differences between these terms. For example, some refer to temporary arrangements, whereas others refer to long-term arrangements. WFH refers to telework from one's home, and the difference is that telework may involve different locations away from the primary workplace or the company's offices (such as mobile work). Long-distance travel refers to the replacement of telecommunications with travel [26].

In teleworking, it is necessary to create flexibility in order to balance work and private life. In most cases, thanks to the available technology, employees who work from home can now more easily meet their deadlines and communicate with the world of work outside their office. Many companies, especially during COVID-19, realised that many workers, primarily white-collar workers, can work from any location, although this form of employment brings numerous challenges.

Employees need to look at all aspects of their job and find a way to remain productive, as well as learn how to collaborate with colleagues with whom they have no personal contact. Telework may influence mental and emotional health because employees are often exposed to stress, fatigue, isolation and burnout. Employees need to carve out a place for themselves and become indispensable even when they are out of the office, to cope with a burnout in a healthy way, to be focused despite the distractions at home, to set boundaries between their job and personal life, to harmonise the demands of parenthood, build partnerships with their virtual teams and superiors, be productive, help other associates who work from home, and manage conflicts [27].

The global COVID-19 pandemic has caused physical distancing primarily for health-care purposes. Many companies were forced to reduce their business activities or adapt to the new situation by having their employees work from home. For some activities and workers, this was easy, but many areas of work are faced with the complex problem of the impossibility of dislocating work. For those whose basic work activity is working from home, it is extremely important to evaluate both the benefits and the virus containment policies [28].

The transition from office work to working from home was much more noticeable among those workers with higher education and better income. It was also more visible among clerks than labourers, national minorities, unskilled workers and those with lower income in the first wave of the pandemic. Titan et al. [29] also pointed to the previous claims, adding that women (30%) were more likely to switch from traditional to work from home jobs during the pandemic than men (25.6%). The same group of authors noticed that the industries that recorded the largest increase in the transition from traditional to work from the home model are IT, financial/insurance companies, companies that provide architectural services, and managerial jobs. For many workers who, due to the nature of their job, were offered the possibility of working from home, in addition to avoiding physical contact to a significant extent in order to protect themselves from COVID-19, it was also possible to continue with their business activities without salary reductions, which is a significant advantage over those workers who perform traditional jobs, such as traditional sales, services (doctors, dentists, hairdressers, beauticians, etc.), and various transport services.

2.3. Distance Learning and e-Learning

When it comes to the use of ICT in education, and given that the world of the 21st century is undergoing sudden changes, there is a strong need for the use of information and communication technologies (ICT) in education. The use of ICT in educational processes is still at a very low level in many countries, and it is, therefore, necessary to train teachers in ICT so as to prepare for skill-based re-engineering of society. ICT is the most efficient tool for rapid dissemination of information and knowledge transfer, decentralisation of work, and development of the workforce; however, it is also expensive. With the help of ICT, a teacher becomes a facilitator, supervisor, and leader in classroom teaching. However, the mandatory acquisition of ICT skills by teachers should be a priority despite the fact

that, in many countries, teachers do not even possess the basic knowledge of hardware and software, i.e., information technology [21].

In terms of the evaluation of distance education, the most optimal element is the Community of Inquiry (CoI) theoretical framework and its significance for remote education [30]. This model is useful for designing blended learning environments that redefine today's higher education. According to Garrison, the Community of Inquiry is a group of individuals who collaboratively engage in purposeful reflection in order to personal meaning and confirm mutual understanding. The Community of Inquiry theoretical framework represents a process of creating a deep and meaningful (collaborative-constructivist) learning experience through the development of three interdependent elements—social, cognitive and teaching presence [31].

Social presence represents the student's ability to identify with the community (e.g., course of study), communicate purposefully in a trusting environment, and develop interpersonal relationships by way of projecting their individual personalities. Teaching Presence is the design, facilitation and direction of cognitive and social processes for the purpose of realising personally meaningful and educationally worthwhile learning outcomes. Cognitive presence is the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse [31].

Distance learning is a relatively new learning concept in higher education in the Republic of Serbia, where information technologies are a kind of mediator between the instructor and students who do not have to be physically present on the premises of the educational institution. This form of learning can be a supplement to traditional learning, or it can replace it completely, which is something we are all witnessing in the pandemic conditions of business, but also in education. Starting from March 2020 until the present day, distance learning has been implemented in most higher education institutions in Serbia, with the exception of education of study programs that require instructors to be physically present in the classroom in order to hold practical classes/exercises.

There is a difference between distance learning and online learning (e-learning). While completing their digital lessons and assessments in the classroom with an instructor, students can be together with online learning (eLearning). Students who have enrolled in distance learning courses complete assignments and check in digitally while working online from home.

As a result of their ability to facilitate distance interaction via virtual networks, social networks, forums, and virtual reality (VR) facilities, e-learning and distance learning have become a necessity in today's hectic society. Virtual reality simulations can be used in distance learning and e-learning in the future to place students in realistic situations. They can use a gaming platform where the action is not performed using the mouse but by structuring and procedurally editing comments in a way that ICT students can use [32].

There is no doubt about the importance of the distance learning system, where students do not lose anything when it comes to teaching quality, but they are able to adjust it to their own rhythm, time and location of attendance. Reports indicate that only a few higher education institutions in Serbia have applied for accreditation of distance learning programs and courses [33], giving the impression that there is more than enough room for their implementation in the near future. Certainly, the biggest challenges exist in the field of organisational activities, which are predominantly rooted in the traditional (face-to-face) approach to teaching.

Universities must embrace new technologies and develop new methods of training and teaching to meet the expectations of millennials and the technological revolution [34]. Research from Romania conducted among students showed that students find that immersion of Virtual Reality (VR) and Augmented Reality (AR) in the process of presenting the information and knowledge acquisition can be considered as a method of improving the quality of higher education [35].

3. Materials and Method

3.1. Method

The data required for the study will be gathered through the use of content analysis, participatory observation and survey research. The observed changes that served as the basis for developing the questionnaire will be recorded based on the analysis of the content and observations with participation.

There are two time periods covered by this study: summer 2019/20 semester, during which the COVID-19 pandemic was declared and schools, faculties and preschools in the Republic of Serbia were closed, and the winter 2020/21 semester, during which most higher education institutions used an online or combined teaching mode. Participants in the study shared experiences with distance learning and work-from-home scenarios, and the results of a comprehensive survey that looked at the experiences of other teachers and colleagues in Serbia are an essential part of the study. The 780 respondents to the survey were faculty teaching staff from Serbian higher education institutions. The questionnaire was distributed via the ResearchGate community, the business social network LinkedIn, and the education e-mail addresses of all Serbian higher education institutions. The survey's results will be analysed with descriptive statistics and the SPSS program. The Likert scale was used for the questions, with answers ranging from one to five [36].

We examined teachers' and colleagues' perceptions of the efficiency of providing educational services via the work from home (WFH) and distance learning (DL) models, as well as other models. During the WFH setup, we looked for educational efficiency factors. When it comes to the statistical technique, factor analysis was selected. Assuming that technology, managerial support and work–home conflict would all impact process efficiency, these were the first criteria considered. The extraction methods were PCA and Varimax rotation.

We sought to ascertain which factors affect the educational process's efficiency in the WFH setting. The statistical technique chosen was factor analysis. The items that could be considered factors were chosen with the expectation that technology, managerial support, and work–home conflict would all have an effect on the process's efficiency.

Principal Component Analysis was used for extraction, and Varimax with Kaiser normalisation was used for rotation. We discarded all factors with eigenvalues less than one. Four factors have been identified: (F1) School management support, (F2) Family–work conflict, (F3) Home infrastructure and (F4) Technology choice.

We have formulated four hypotheses:

Hypothesis 1. *Academic workers endured WFH during the COVID-19 pandemic more efficiently thanks to the support of their school management.*

Hypothesis 2. *Academic workers have efficiently harmonised their private life and worked from home during the COVID-19 pandemic.*

Hypothesis 3. *Academic workers efficiently used the existing home IT logistics/infrastructure for WFH during the COVID-19 pandemic.*

Hypothesis 4. *Availability of IT resources for WFH did not threaten the effectiveness of academic workers during the COVID-19 pandemic.*

The research hypotheses are based on examining the balance between the instructor's work and private life, experiences related to the effectiveness of online student learning (seen from the standpoint of the instructor), and support of the higher education institution's management where the instructor works, i.e., selection of the necessary DL technology and home infrastructure needed for work from home.

In the following subsectors of this chapter, we will explain the factors that we have observed and the hypotheses that we have formulated.

3.2. School Management Support

The COVID-19 pandemic has caused significant changes in the activities of all educational institutions. The importance of prompt reaction of the school management in such situations was extremely important [37]. The senior school management was expected to successfully handle various regulations in a short time, as well as business procedures in emergency situations, while also communicating internally with the employees and externally with students and their families. For school managers, the main focus was adaptation aimed at a safe, shared and efficient work zone during the pandemic. Given the strategic task that schools and their administrators normally have during the pandemic, it was raised to an even higher level [38,39].

In the conditions of the COVID-19 pandemic, school managements had a decisive role in overcoming the hardest first weeks and months during the complete lockdown, when the potential duration and scope of the health crisis were uncertain. The leaders of academic establishments had to handle the conditions and manner of work carefully, as well as continuous and up-to-date communication with their instructors carefully and like good hosts [40]. Pandemic conditions forced school managements to enforce a stronger hierarchical discipline to ensure that the effectiveness of teaching was not seriously disrupted [41]. It is believed that the management of higher education institutions that managed to increase the motivation and engagement of their teachers in online instruction during the COVID-19 pandemic has made a genuine sustainable contribution to education [42].

The role of management of higher education institutions during the COVID-19 pandemic largely refers to the technical-technological infrastructure on which online teaching is based and which was either missing or insufficient in certain situations. In addition, management support was sometimes lacking because the information on distance education was not conveyed in a clear and timely manner [43]. Notwithstanding the above, it is believed that most teachers had visible support from their employers [44], usually in the form of intensive workshops and training courses that trained them for implementing online teaching in a short time.

When it comes to management support, it is certain that many educational institutions in the early months of the COVID-19 pandemic were faced with the impossibility of conducting traditional instruction in laboratories and specialised classrooms, which is necessary for certain professions that require face-to-face contact (medicine, dentistry, acting, chemistry, electronics, etc.), unlike many other fields with so-called social orientation that experienced positive effects of online learning (foreign language learning, journalism, law, media, etc.) [45].

3.3. Family–Work Conflict

In the period since March 2020, when the global COVID-19 pandemic was declared, WFH did not imply daily work from home [46]. In the past year and a half, many workers were suddenly forced to work from home on a daily basis, which greatly threatened their work–home balance [47]. As a result of numerous changes that arose due to the emergency situation, there has been a marked decline in the efficiency of workers who switched to work from home [48]. The biggest imbalance caused by WFH seems to arise from a smaller or narrower workspace at home, i.e., the fact that the kitchen or the living room often represented one's workspace [49]. Moreover, we should not overlook the fact that several family members often shared the same space for their private, educational or professional activities. The fact of the so-called shared roles, i.e., situations when an academic worker working from home performed the role of a teacher, cook, cleaner, etc., in addition to their professional role, should also be taken into account [50]. All these things have been and still are potential triggers for stress, reduced satisfaction with work performed, increased exposure to negative news, etc. [51,52]. It is evident that the preparation of online classes in a relatively short period of time was more time-consuming than traditional instruction [53]. There is an interesting study that points out how female instructors in higher education

institutions decreased their publication of scientific papers by 50% due to, it is believed, additional responsibilities in the work-from-home conditions [54].

3.4. Home Infrastructure and Technology Choice

High-skilled workers and clerks were suddenly forced to use technology they had largely never used before in their work and which, in many cases, they were encountering for the first time. Due to the fact that entire companies were literally sent home to do their jobs, it is important to examine how employees, especially those in higher education institutions, accepted the challenges with online learning as "business as usual" with the support of existing technology. Universities with their managerial and teaching staff always represent the basis of available knowledge and skills provided through the use of new digital technologies as an effective pedagogical tool [55].

A recent study [56] showed that there are several elements that affect the quality of online teaching. They include efficiency (ease of access to necessary information), student–teacher interaction (use of different discussion forums), inclusion (special attention is paid to individual student needs) and self-learning (maximum support to students to prepare independently for exams, but with well-prepared exam materials).

Other authors note that previous experience of both teachers and students is crucial for online teaching [57,58]. Popa et al. [59] examined factors that can improve online teaching, concluding that more adaptable instructors were able to seek the improvement of digital support, which they later used to improve their teaching practice in pandemic conditions.

Other researchers [60] underline the importance of personal skills of both teachers and their students, and in addition to the interaction between them, they focus on the availability and accessibility of learning resources, as well as external conditions of teaching and learning that can leave quite a mark. Given the present pandemic conditions that resulted in online instruction, instructors were often forced to change the way they communicated with their students, which was often mentoring and advisory in nature, even when it comes to the traditional adoption of the material [61]. Despite numerous benefits, there are researchers who also examined the disadvantages of online teaching, primarily emphasising poor technical-technological requirements that have to be met [62,63].

4. Results

4.1. Research Process and Design

A survey questionnaire was created using Google Forms software in order to conduct the research. We distributed the survey to members of the scientific community via ResearchGate and the professional community via LinkedIn. Additionally, teachers and associates received an e-mail with a link to the survey's electronic form. The questionnaire was sent to all of the faculties' and universities' publicly available e-mail addresses, as well as to all of the faculty and university websites. Teachers' and associates' satisfaction with various aspects and agreement with cognitive attitudes were assessed using a five-point Likert scale and a numerical assessment scale [36].

In the following subsegments of this chapter, we will present data and variables that we gave gathered. We will examine the adequacy of the sample and its representativeness. The socio-demographic characteristics of the sample will be presented, after which the results of the factors analysis will be provided.

4.2. Data and Variables

According to the data of the Statistical Office of the Republic of Serbia for 2019/20, there were 122 public higher education institutions and 62 private higher education institutions, or 184 in total. Eighty-two faculties were public, whereas 84 were privately owned. When it comes to colleges, there were 54 in total, 40 of which were public and 14 private ones [64,65].

In the Republic of Serbia, during 2019/20, 16,201 teachers and associates were employed in higher education institutions, so the size of the population was 16,201 (11,823 teachers and 4378 associates [64,65], as shown in Table 1.

Table 1. Teaching staff in the Republic of Serbia in 2019/20 [64].

Category	Teachers		
	Total	**Male**	**Female**
Total	16,201	11,823	4378
Doctorate holders	11,024	10,372	652
Masters and specialists	3098	1041	2057
Without an academic title	2079	410	1669

Regarding sample adequacy and representativeness, in 2019/20, in the Republic of Serbia, there were 16,201 teachers and associates, so the size of the population is 16,201 [64,65], the sample comprises 780 respondents, the confidence level is 95%, the confidence interval is 3.6%, and therefore, the sample is adequate. When it comes to sampling representativeness, the entire sample consisted of teachers and associates from Serbia who worked at faculties and colleges in the Republic of Serbia during the two observed semesters, so the sample adequately represents the entire population. Thus, it can be said that the sample is representative, i.e., that it realistically reflects the actual structure of the population. It can also be argued that the sample is adequate because it is large enough.

With the confidence interval of 0.95, the risk of error is $\alpha = 0.05$. The confidence interval of 95% was chosen because it provides the highest confidence and relative accuracy of the assessment at the same time. Thus, we make claims with the confidence of 95%, i.e., there is a 5% risk of error.

A total of 780 respondents participated in the survey—466 male (59.7%) and 314 female (40.3%), which indicates a marked dominance of the answers given by male respondents at higher education institutions in the Republic of Serbia. The age distribution of respondents shows a dominant group of career-pursuing respondents in the 31–45 age group, consistent with the professional status of the research group. The majority of the respondents are doctorate holders (63.7%), followed by graduate (21.5%), postdoc (5.8%), master's (5.6%) and finally undergraduate (3.3%). The major fraction of respondents is doctorate holders (63.7%), as expected in higher education. Table 2 shows the academic rank distribution that allows as to register that the majority of respondents are university professors (55.3%), followed by teaching assistants (24.0%).

Table 2. Academic ranks distribution.

	Academic Rank	
	Frequency	**Percent**
University professor	431	55.3
College professor	87	11.2
Instructor	39	5.0
Senior Instructor	6	0.8
Teacher	12	1.5
Language instructor	18	2.3
TA	187	24.0
Total	780	100.0

The previous table demonstrates that little changed in what could be labelled as "classic ranks distribution in 20th century higher education." University professors, both tenured and non-tenured, accompanied by their teaching assistants, are still making up

the dominant cohort (close to 75%) of all respondents. The work experience of respondents indicates a fairly balanced distribution, with an evident drop in the 15–20 years of experience group.

Table 3 displays differences in the scientific expertise distribution of respondents. A vast majority (over 40%) comes from the realm of humanities, which may be important in understanding the final results. Only a small fraction of respondents are from medical and artistic areas.

Table 3. The scientific expertise of respondents.

Scientific Expertise		
	Frequency	**Percent**
Natural sciences, math	124	15.9
Technology	240	30.8
Humanities	335	42.9
Medical	45	5.8
Art	36	4.6
Total	780	100.0

Table 4 shows a very high dominance of universities towards colleges (approximately three-quarters of respondents come from universities).

Table 4. Type of the respondents' institutions.

Institution				
		Frequency	**Percent**	
Valid	University	599	76.8	76.8
	College	181	23.2	100.0
	Total	780	100.0	

The questionnaire comprised a large number of questions, but for the purpose of rationality, the paper addresses only questions relevant to the research subject. Table 5 shows questions and variables of interest.

Table 5. Questions and variables analysed.

Q No.	Variable	Code
Q16	Choice of IT devices in WFH for online learning and communication with students and fellow teachers	WhichDev
Q17	Adequate Internet speed at home	IntFast
Q18	Own IT device for WFH	OwnDev
Q19	Technology and software for online teaching used by the higher education institution where I work are of high quality.	TechQual
Q20	Possessing adequate IT technology in the form of software, hardware, and high-speed network (by both educators and students) is very important for the process of online teaching.	ITech
Q21	Support was provided by the management of the higher education institution, as well as the necessary resources for online teaching and WFH during the COVID-19 pandemic.	ManSupp
Q22	Usefulness of technical-administrative and other staff in aiding in online teaching during WFH	Useful
Q23	Management of the higher education institution organised an online staff meeting during the pandemic with clear instructions on how classes should be held in emergency circumstances.	Instructions
Q24	Style, frequency and manner of online communication with the management, technical support and other teachers influenced the effectiveness of team cooperation during the COVID-19 pandemic.	Efficient
Q25	During occasional visits to the school, the management ensured a safe stay in the facility.	MasksDisinf
Q26	HR department informed us about relevant news during the pandemic.	News
Q27	Online work with students during the COVID-19 pandemic was more stressful than traditional instruction.	Stress
Q28	Satisfaction with the results of online teaching during the COVID-19 pandemic	RUSatisf
Q29	The balance between work and private life was maintained while I worked from home.	Balance
Q31	The conditions for uninterrupted work from home during communication with students were provided.	Terms

We tried to determine which factors influence the efficiency of the educational process in the WFH setup. Factor analysis was chosen as a statistical tool. The items that might represent factors were chosen to start from the idea that we expect technology, managerial/organisation support and work–home conflict to influence the efficiency of the process.

4.3. Factor Analysis

The extraction method used was Principal Component Analysis, and the rotation method was Varimax with Kaiser normalisation. All factors with eigenvalues of less than one were discarded. We detected four factors, later identified as: (F1) School management support, (F2) Family–work conflict, (F3) Home infrastructure and (F4) Technology choice.

Detected factors, as described in Table 6.

Table 6. Items per factors.

	Rotated Component Matrix			
	Component			
	1	**2**	**3**	**4**
Q21	0.786	0.114	−0.118	0.008
Q23	0.780	0.100	0.068	−0.046
Q22	0.739	0.122	0.009	0.098
Q24	0.698	0.121	0.118	0.024
Q25	0.631	0.104	−0.123	−0.081
Q19	0.610	0.270	−0.133	0.188
Q26	−0.566	0.084	0.124	−0.028
Q29	0.176	0.735	−0.184	−0.055
Q27	−0.039	−0.720	−0.041	0.057
Q28	0.112	0.674	0.009	0.141
Q31	0.162	0.596	−0.407	0.034
Q18	−0.050	−0.047	0.749	0.051
Q17	−0.046	−0.113	0.727	−0.064
Q20	0.022	0.189	0.030	0.757
Q16	−0.043	0.134	0.042	−0.720

Items constituting factors are listed as follows.

Factor 1 (F1): School management support

Items constituting the factor are shown in Table 7. Items range from direct academic and technical support provided to institutional help regarding coping with pandemics. %nointerlineskip

Table 7. Factor 1: School management support.

Q19	Quality technology and software used by the higher education institution	TechQual
Q21	Support was provided by the management of the higher education institution, as well as the necessary resources for online teaching and WFH during the COVID-19 pandemic.	ManSupp
Q22	Usefulness of technical-administrative and other staff in providing assistance in online teaching during WFH	Useful
Q23	Management of the higher education institution organised an online staff meeting during the pandemic with clear instructions on how classes should be held in emergency circumstances.	Instructions
Q24	Style, frequency, and manner of online communication with the management, technical support and other teachers influenced the effectiveness of team cooperation during the COVID-19 pandemic.	Efficient
Q25	During occasional visits to the school, the management ensured a safe stay in the facility.	MasksDisinf
Q26	HR department informed us about relevant news during the pandemic.	News

Factor 2 (F2): Family–work conflict

Items constituting the factor are shown in Table 8. As expected, family–work conflict constituted one separate factor.

Table 8. Family–work conflict.

Q27	Online work with students during the COVID-19 pandemic was more stressful than traditional instruction.	Stress
Q28	Satisfaction with the results of online teaching during the COVID-19 pandemic.	RUSatisf
Q29	The balance between work and private life was maintained while I worked from home.	Balance
Q31	The conditions for uninterrupted work from home during communication with students were provided.	Terms

Factor 3 (F3): Home infrastructure

Items constituting the factor are shown in Table 9. This is the simplest factor regarding the structure and obviously represents the home infrastructure.

Table 9. Home infrastructure.

Q17	Adequate Internet speed at home	IntFast
Q18	Own IT device for WFH	OwnDev

Factor 4 (F4) Technology choice

Items constituting the factor are shown in Table 10. This factor describes the concrete choice for a device to be used in the home-based teaching setup.

Table 10. Technology choice.

Q16	Choice of IT devices in WFH for online learning and communication with students and fellow teachers	WhichDev
Q20	Possessing adequate IT technology in the form of software, hardware and high-speed network (by both educators and students) is very important for the process of online teaching.	ITech

Regarding the efficiency, we have used two items (Q32 and Q30) and calculated their mean.

The factors were averaged over corresponding items instead of z-scores to preserve the original Likert-scale measurement quality for a more straightforward interpretation. The descriptive statistics for factors are displayed in Table 11. It is evident that the original measurement scale was preserved.

Table 11. Descriptive statistics for factors.

	Descriptive Statistics				
	Range	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
F1	3.57	1.29	4.86	3.5223	0.77001
F2	3.25	1.75	5.00	3.7888	0.56793
F3	1.50	1.00	2.50	1.1103	0.29980
F4	3.50	1.00	4.50	2.9942	0.36225

Afterwards, the correlations for four factors and the efficiency measure were calculated. Table 12 displays the results (Pearson correlation coefficients, statistical significance at $p = 0.01$ level was indicated by bold typeface).

Table 12. Correlation coefficients for factors and the efficiency measure.

Correlations						
		F1	**F2**	**F3**	**F4**	**Efficiency**
F1	Pearson correlation	1	0.257 **	−0.123 **	0.060	0.142 **
	Sig. (2-tailed)		0.000	0.001	0.092	0.000
F2	Pearson correlation	0.257 **	1	−0.202 **	0.046	0.150 **
	Sig. (2-tailed)	0.000		0.000	0.196	0.000
F3	Pearson correlation	−0.123 **	−0.202 **	1	−0.047	−0.017
	Sig. (2-tailed)	0.001	0.000		0.187	0.631
F4	Pearson correlation	0.060	0.046	−0.047	1	0.053
	Sig. (2-tailed)	0.092	0.196	0.187		0.139
Efficiency	Pearson correlation	0.142 **	0.150 **	−0.017	0.053	1
	Sig. (2-tailed)	0.000	0.000	0.631	0.139	

** The asterisk symbol indicates statistical significance at 0.01 level.

5. Discussion

The main premise of this article was that there are only a few measurable factors that influence the effectiveness of teaching. These assumptions and derivatives were tested using factor analysis. The study collected data through content analysis, participant observation and survey research. The content analysis and participant observations were used to record the observed changes that shaped the questionnaire. An extensive survey of teachers and colleagues in higher education in Serbia was conducted as part of the study. The survey had 780 respondents from Serbian higher education institutions. The aim of the study was to determine what factors affect the educational process in WFH. Factor analysis was chosen as the Technology, managerial support, and work–home conflict were all expected to have an impact on the process's efficacy. Extraction was done using PCA, and rotation was done using Varimax with Kaiser normalisation.

In addition, the research hypotheses examined the instructor's experiences with online student learning (from the instructor's perspective) and the management support provided by the higher education institution where the instructor works, i.e., selection of the necessary DL technology and home infrastructure needed to work from home.

Firstly, we have identified four factors affecting the efficiency of the process. These factors, (F1) School management support, (F2) Family-work conflict, (F3) Home infrastructure and (F4) Technology choice, are in good accordance with our initial idea, as we expected technology, managerial/organisation support and work–home conflict to influence the efficiency of the process.

Moreover, from obtained results, it was clear that F1 (School management support) is positively correlated to F2 (Family–work conflict) and efficiency and negatively correlated to F3 (Home infrastructure). Additionally, F2 is negatively correlated to F3 and positively correlated to efficiency. The F4 shows no significant correlations to other factors. It seems that the efficiency of the process is predominantly influenced by the first two factors ((F1) School management support, (F2) Family–work conflict).

More hours spent at home with one's family and more time for fun, as well as more opportunities to work with children from home, are just some of the benefits of WFH identified in previous research studies [66]. It is interesting to note that the percentage of workers in the public sector who work full hours from home is generally low [67]. This paper indicates that in higher education institutions in the Republic of Serbia, more than half of academic personnel used the WFH model in the specified period as opposed to the traditional, face-to-face model of education.

The paper confirms the main advantages of WFH from the aspect of academic workers, and they largely refer to more free time (due to the lack of commuting between one's home

and educational institutions) teachers could use for various purposes (not necessarily work-related). The research in this paper confirmed that over 85% of the respondents coped well, both with academic and other obligations, while they implemented the WFH model. Other researchers obtained similar results, reporting a higher efficiency rate in those who worked from home [68], despite the fact that 70% of the respondents went to work when needed. Papers on a similar topic from the USA and Finland show that the longer the commute, the stronger the desire for WFH [69,70].

Contrary to the above, WFH undoubtedly leads to increased working hours in many situations, which can implicitly affect one's work–life balance [71]. The results of our research unequivocally show a relatively balanced relationship between the private and professional life of the teachers who implemented WFH teaching. The results of our colleagues from Slovenia indicate higher stress levels in students compared to their teachers during the COVID-19 pandemic [72].

The core fears of academic workers during WFH teaching referred to whether students would respond adequately and demonstrate enough commitment in the new situation of the COVID-19 pandemic. Reporting in this paper has shown that the educator-respondents expressed a very clear attitude with regard to reduced student interest to get involved in the learning process, which is in opposition with the results of another study [73].

On the other hand, the main disadvantages of the WFH model for teachers in higher education institutions are associated with often limited knowledge of online teaching techniques, lack of traditional practical segments in teaching, as well as the insufficient scope of social interaction. Considering the WFH teaching model and the use of ICT tools, a study has shown that the application of ICT technologies balances out one's private and professional life, which has already been discussed [74]. The implementation of ICT is necessary and fundamental to the functioning of WFH during the pandemic [75].

The paper concluded that a staggering number—two-thirds—of academic workers had no previous experience in the use of the necessary ICT tools for WFH during the pandemic. However, the use of new online teaching platforms in these extraordinary circumstances has brought respondent satisfaction to 75%, and a similar percentage expressed their desire to continue in the same manner in the post-COVID period, thus acknowledging that their subject/course is adaptable to the latest online teaching techniques. Their colleagues, educators from German universities who participated in research in 2020, during the first wave of the pandemic, expressed a similar opinion, confirming that theoretical instruction could largely be covered through online lessons [76]. Professors from Spanish higher education institutions revealed that most of them would happily continue with the so-called blended teaching in the future [77]. Certainly, a full transition to online teaching at universities is very unlikely, just as returning to the way things had been at universities around the world before the COVID-19 pandemic is impossible.

The support of the management of educational institutions in crisis situations is of vital importance [78]. This was confirmed by academic workers who participated in our research, who agreed that in most cases, such support was inadequate, unlike the support of non-academic staff, which was assessed positively. When it comes to guidelines quality, 50% of the respondents assessed them positively, whereas a significant 25% did not.

Satisfaction is of utmost importance in online teaching at higher education institutions. A study has confirmed that there are three factors relevant for examination: student satisfaction, instructor satisfaction and institutional satisfaction [79]. Satisfaction with an online education system is important for all three parties because it strengthens motivation and engagement in all areas of education [80]. In this paper, we focus on a more complex analysis of instructor satisfaction and the effects of the COVID-19 pandemic on online teaching.

6. Conclusions

Academic workers from the faculties and higher education institutions in the Republic of Serbia showed that they were more involved in the WFH teaching model than the traditional model during the COVID-19 pandemic. A small percentage worked exclusively

in the WFH model or in the traditional model, while the majority of the respondents combined both models, going to work (educational institutions where they teach) when necessary. During WFH classes, the respondents mostly stated that they were able to successfully realise both their academic and other daily obligations. The WFH teaching model has inevitably given rise to the problem of family–work conflict. The balance between the two is presented in the paper.

The research was also based on examining the technical (logistical) support to the WFH teaching model. As the majority of university instructors had no previous experience with ICT tools before the COVID-19 pandemic, it is interesting that they still successfully responded to sudden technical-technological changes in the way teaching is implemented and that they expressed satisfaction with the use of online platforms. Moreover, most academic workers believe that their subject or course is entirely suitable for uploading to an online platform.

When it comes to the support of school management, teachers at higher education institutions in Serbia did not assess it very highly. Most of them stated that they did not receive adequate support from the management, unlike the support of non-academic staff. When it comes to instructions for holding online classes, most respondents are satisfied with the instructions they got, although not completely. The communication with the school management was satisfactory.

The situation regarding WFH during the COVID-19 pandemic was particularly pronounced in the field of higher education, where at one point, there was a sudden surge from zero to full engagement of academic staff from their homes. Since in the meantime, the situation with the pandemic continues, with no definitive end in sight, the only certainty is that WFH and online education will continue to be implemented in real time. All data presented in this paper and similar studies will, thus, have a significant impact on future trends in WFH, even more so because, in the early days of the COVID-19 pandemic, it was believed that WFH would be necessary only during the emergency situation, but it is becoming increasingly certain that certain forms of WFH will remain even after this situation has ended.

In the future, it is expected that the WFH model, together with the WFO (work from the office), will continue to be implemented. This model would reduce management costs, save commuting time and increase the efficiency of the available working hours of academic workers, who would be able to dedicate themselves more productively to the creation of a quality curriculum and its implementation. Challenges related to the pandemic situation should not be viewed only from the aspect of threats but also opportunities aimed at redefining teaching effectiveness, as well as presenting new sustainable academic practices.

For future research, other related fields like game-based learning and serious games must be observed (e.g., CMX MMORPG) and how they have been designed using relative design frameworks, evaluated with relative evaluation frameworks, and be utilised using learning analytics. The usage of advanced educational environments to properly train future professionals is essential, and game-based learning has a positive effect on student engagement [81]. This is often one of the explanations why Serious Games has started raising a good amount of interest in instructional settings. Serious Games in education combines the magnified motivation of scholars with the incorporation of all materials at intervals in the games' tasks. As a form of game-based learning, it has been used for learning in science, business, computer science, mathematics and biology [82]. An educational Massive Multiplayer Online Role Playing Game (MMORPG) named CMX in college environments assesses your efficiency in successfully teaching programming elements while entertaining and engaging students in an engaging environment [83].

In our research study, we have identified four factors affecting the efficiency of the process. These factors, (F1) School management support, (F2) Family–work conflict, (F3) Home infrastructure and (F4) Technology choice. By averaging factors to preserve the original measurement scale, we calculated correlations between factors and efficiency. Factors (F1) School management support, (F2) Family–work conflict showed positive and

significant correlation with the efficiency. Thus, we conclude that the first two factors are predominantly affecting efficiency.

Additionally, the test showed that F1 (School management support) is positively correlated to F2 (Family–work conflict) and F4 Technology choice and negatively correlated to F3 (Home infrastructure). Furthermore, F2 is negatively correlated to F3. The technology choice did not show significant correlations to other factors in question. The School management support, Family–work conflict and Home infrastructure are interplaying and influencing the efficiency, so it might be useful to analyse their connection in more detail. A negative correlation between F2 and F3 opens the question of proper management of technical aspects of a home-based working place. Technology choice plays a role but seems to be isolated.

Every study and this one is no exception, has limitations. Our research's limitations are due to social desirability, generalizability, imprecise measures and unasked questions. Keeping in mind that this is an original research paper and not a review paper, acknowledging the past related work in the reference list must be limited. Nevertheless, recommendations for future research that builds on this study's findings must be included. Therefore, future research must be directed at proposing concrete measures for implementing the WFH model of teaching.

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