

COVID-19 and the Adaptive Role of Educators: The Impact of Digital Literacy and Psychological Well-Being on Education—A PLS-SEM Approach

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Abstract

Mobility restrictions during the COVID-19 pandemic raised mental health consequences. This paper examines the triangulation of Digital Literacy (DL), psychological well-being, and effectiveness of remote teaching and learning during the pandemic. Survey responses collected from 518 schoolteachers in Sri Lanka are analyzed with Partial Least Squares – Structural Equation Modeling (PLS-SEM) method. Results indicate that Remote Education (RE) has twisted a stressful life for educators. DL negatively affects the psychological well-being of the teacher. The effectiveness of teaching and learning and teacher engagement depends upon their DL level. Educators' stress and depression status mediate the outcome of remote teaching and learning mode. Moreover, digital skills count more than the accumulated teaching experience. We emphasize the *adaptive role* of the teacher for sustainable digital education. The results indicate that augmented education success could be obtained by investing in digital competence. It suggests that upgrading DL is an urgent role and

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alarms the policymakers and education managers to mitigate the potential mental health and social capital crisis.

Keywords

COVID-19, online education, stress, digital, Sri Lanka

Introduction

In response to the health threats caused by COVID-19, Sri Lanka's school education paused first, then shifted to online remote teaching accepting that it was the best alternative avenue to reach the student with all the obstacles. Teachers, students, and schools are adopting Remote Learning (RL) education. It appears that the education environment has lost its focus due to educators, technology, and pedagogy-related obstructions. Together with the change in instructional technologies, a new digital pedagogy has been in effect creating new learning environments. However, teachers' digital skills lead to different experiences for students (Greenhow et al., 2021) and unfamiliar educational technologies have created an environment of teaching more and learning less.

Consequently, the educator is stressed and the parental responsibility for managing children's learning has been triggered. The evidence that RL outcomes are affected by parental psychopathology symptoms like stress and depression (Mcfayden et al., 2021), and that the RL burdens students (Greenhow et al., 2021) from low-income families pose a serious threat to the expectations of equal education opportunities (Guvercin et al., 2021) to each and everyone in the society. Evidence also suggests that educators' personal lives are being disturbed (Watermeyer et al., 2021) by COVID-19 persuaded online migration. Educators do struggle to smooth out the impact of dysfunctionalities in pedagogical roles on the student's progress, which is significantly affected by tutors' skills in delivering virtual lessons (Brain et al., 2020).

The pandemic has been a testing drug for the success of eLearning in Sri Lanka. Consistent with Zaw et al. (2021) disparities in access to Remote Education (RE), rural residence, and family wealth (Gutierrez & Tanaka, 2009) among others have become critical determinants. The situation is stressful for Sri Lanka's community as it enjoyed "Free Education" since 1944 while the British ruled the then country "Ceylon." Free education, not only education for free but with equitable access to every child, has been successful over decades. For instance, Sri Lanka has maintained a national youth literacy rate of 99% (while the countries in the region stay at 89%) and a transition rate into secondary at 96% (82% Region) (UNESCO, 2019). Social and economic inequality has been brought to the stage by RE, and tensions arose between digital pedagogy, digital skills, and symptoms of underdeveloped infrastructure. Most of the school services delivered during the pre-COVID-19 were not continued during RE for at least rural areas of the country where internet connections are unreliable as also observed by Mcfayden et al. (2021) in Western Virginia and Cahyadi et al. (2021) in Indonesia. Consequently, educators demanded extra wages and reimbursements, training, and digital support initially.

Later, teacher unions stressed the government by pausing remote teaching (August 2021) indicating it was a distress for the educator community. Taken together, it raises the doubt about the sustainability of school education in the digital and RL phases, as the pandemic has left no alternative for teaching and learning.

Studies have highlighted a significant rise in mental health cases due to the COVID-19 outbreak (Mia & Griffiths, 2021) in South Asia. It has been true for other regions too, for instance, COVID-19-related psychological distress directly affected depression, and social media addiction in Turkey (Karakose et al., 2022). Managing physical as well as mental health during the pandemic is challenging as pointed out by Shukla and Manohar (2021), especially in countries like Sri Lanka where the total number of mental health workers per 100,000 population is around 7.14 (World Health Organization, 2018). Growth of stress, depression, and anxiety among individuals due to economic repercussions (Mia & Griffiths, 2021) provide evidence for the incalculable societal impact (Watermeyer et al., 2021) caused by COVID-19. Social distancing, isolation, and lockdowns may cause mental health issues in general, however, repercussions would run for the generations in the case when the profession of educators becomes a vulnerable section of society. It calls for need-based interventions in protecting the mental health of the education workers as well because innovations in education today are the future of mankind.

Motivated by these observations, this paper aims to examine the impact of the pandemic on school-based education. Especially, it investigates the repercussions of the remote mode of teaching and learning implemented during home confinements for COVID-19. Educator's role in the fight against the epidemic is significant because the educational aspect of the epidemic has a generation effect. It necessitates more investments in education as digital pedagogies substituted the traditional face-to-face teaching. Therefore, we examine the influence of Digital Literacy (DL) of teachers on teaching effectiveness and the mediation role of psychopathological symptoms on teaching and learning effectiveness. It explores how the coronavirus swigs the education of the digitally underdeveloped societies in the adaptation process to a remote teaching and learning mode. The study contributes to the limited literature on the psychological state of teachers during the pandemic (Karakose et al., 2022a) focusing on the educator's *adaptive role* to improve the effectiveness of remote mode teaching and learning.

The remainder of the paper is organized as follows: Literature Review discusses critical literature on the topic, and Materials and Methods describes the sample and the methods. Results and Discussion reports the analyses, results, and discussion while the remainder concludes.

Literature Review

Framework

According to the community of engagement framework of Borup et al. (2014), student engagement is determined by the level of teacher, parent, and peer engagement. It

claims that full engagement in learning activities requires affective, behavioral, and cognitive engagement. It is no doubt that the pandemic has lowered engagement of all sorts; however, teacher engagement has been affected exceptionally due to the changes from face-to-face teaching to remote mode. Meanwhile, parental engagement has increased making an imbalance in the tri-party community of engagement. Borup et al. (2014) state that a low(high) level of teacher engagement results in low(high) student engagement. This positive impact on the student is a result of three elements of teacher engagement: facilitating, designing, and instructing (Harms et al., 2006). It requires the teacher to help the learner (Boulton, 2008) to use e-learning materials effectively in a virtual environment. Consequently, digital teacher competence is instrumental (Konig et al., 2020) in adapting to remote teaching.

The Adaptive Role

However, expedited digital pedagogy adoption (Ewing et al., 2021) during the COVID-19 pandemic seems a quite disturbance for instructing, and teacher engagement. Leaving no alternative, educators are enforced to change instructional approaches and facilitate learning and performance. This sudden change to online instruction raised concern among many teachers (Lapitan et al., 2021) due to several teachers and learner-related reasons including lack of experience with technology, and socioeconomic background which are key determinants of Information Communication Technology (ICT) self-efficacy (Edvard et al., 2018).

Thus, the effectiveness of RE is associated with (1) several educator-related characteristics, for instance, technical competence (Edvard et al., 2018; Phan & Dang, 2017), teaching experience, gender, geographic location (Alea et al., 2020) and (2) learner related characteristics like student cooperation (Aydin & Erol, 2021). While effective usage of RE platforms depends on the DL of users (Erol & Aydin, 2021), lack of infrastructures like unstable Internet access and limited electronic devices (Pastor, 2020) depreciates educational expectations (Guvercin et al., 2021). Low-quality teaching resources and facilities adversely influence the motivation of educators (Brain et al., 2020; Gokuladas & Baby, 2020) and therefore, affect education, especially in case the ICT infrastructure is relatively underdeveloped.

Despite the many limitations of RE, it also creates opportunities for educators (Hash, 2021) to advance the ICT skills and DL of society. It is futuristic to focus on digital competence though inconsistent with Daniel (2020) who suggests that the teachers work with what they know than trying to learn new pedagogy or technology. The asynchronous digital classroom may be productive. Nevertheless, education is about what should be known than what is known now. It makes no escape but facing the new pedagogy and technology. In terms of Whitley and Smale (2022), what is created by COVID-19 is an opportunity to reframe the approach to curricula and pedagogy through teachers' personal leadership. Teachers can use the pandemic landscape as a gateway rather than a barrier to growth. It may create exciting innovations in a new pedagogy, and opportunities for collaborative online learning

(Laurillard, 2009) in search of new knowledge. New pedagogical approaches assisted by digital technologies and transformations in learning environments (Kalantzis & Cope, 2010) are required for the generations growing up with web-based technologies (Hosen et al., 2021). Thus, we accept that there is an adaptive role for educators in uncertain periods of pandemics or disasters yet to come.

Piaget (1955) asserts that knowledge is internalized through certain mechanisms. In this view, psychological constructivism perceives teachers as facilitators of the reconstruction process. Teachers perform this role through tasks or projects in a nonthreatening atmosphere allowing knowledge discovery. Constructivist believes that knowledge generation is possible only through interaction and discourses between and among individuals (Jha, 2017). However, the remote teaching mode creates “digital” obstructions between teacher and student. DL skills, that is, computing, Information, ICT, and Media literacy are essential for meeting the need of the 21st century (Demirkol & Inozu, 2021) as recognized in the framework of the Partnership for 21st-century Learning. It is acceptable that Internet usage appreciates DL levels (Erol & Aydin, 2021) and benefits more from remote educational platforms.

Edvard et al. (2018) show that socioeconomic background, gender, and self-efficacy explain the ICT literacy of students. Sri Lanka has an internet penetration rate of 34% (Department of Census, 2020) with a 32% overall computer literacy. It creates a digital equity (Greenhow et al., 2021) issue within the society, where among the affected, are the low-income families and societies with no or low-quality internet access. The framework of Ng (2012) illustrates three dimensions of DL: (1) technical dimension possesses the technical and operational skills to use ICT for learning and in everyday activities, (2) the cognitive dimension is about the ability to think critically in searching and evaluating digital information, and (3) social-emotional dimension involves being able to use the Internet responsibly for communicating, socializing, and learning. Hence since upgrading the DL of the educator shall be a significant goal of the national education policy, we formulate the first hypothesis accordingly.

H1. Digital literacy of the educator affects the perceived effectiveness of RE

Reviewing many articles, Podolsky et al. (2019) state that teacher effectiveness depends on accumulated experience. The productivity of the teacher with great benefits to the student comes with time as they continue to learn. However, the digital pedagogies demand differently defined teacher experiences than that of traditional face-to-face mode, which is prominent in the school system of Sri Lanka, thus the unexpected shift to online-remote teaching raised several issues for educators, school management, and students. Distance education’s inherited limitations including lack of interaction and limited learner engagement (Pregowska et al., 2021) are among the top. The technology could be like a double-edged sword (Ewing et al., 2021) enabling, constraining yet not engaging. Higher engagement requires high interaction (Greenhow et al., 2021) where teachers need new skills in dealing with technology interfaces. Education fundamentals require that teachers or learners should never feel that they are left alone

(Huang et al., 2020), instead of developing the interaction. Nevertheless, teachers or students in traditional teacher-centered systems are not equipped to go online appropriately. They suffer from insufficiency in terms of digital skills, devices required, network access, teaching material (online teaching content), and operational costs, hence almost all teachers would prefer to be in the classroom at school.

In addressing a major problem of online education during COVID-19, the preparation of online teaching content, China moved to Open Educational Resources (OER) policies (Huang et al., 2020) and Open Educational Practices (OEP). Openly licensed teaching material, reports, presentations, or videos may remove several of the limitations of online teaching and learning. For instance, it maintains consistency and uniformity of lessons and saves time. Nevertheless, barriers to the integration of ICT, for instance, teacher beliefs (Ertmer, 2005), fear of change, and lack of technological assistance (Gokuladas & Baby, 2020) make the educators feel reluctant to progress with online teaching. Studies show that educators experience psychological problems (Guvercin et al., 2021) during the periods of home confinements due to the pandemic. Among others, feeling of restraint, stress, reluctance, and lethargy are significant mental health symptoms. Psychologists have raised concern over a possible rise (Shukla & Manohar, 2021) of such problems owing to COVID-19. Recent studies (Karakose et al., 2022a) offer consistent evidence that the psychological distress, burnout, and depression have increased over the period of the pandemic and show an affinity to social media addiction. Moreover, the findings that the less educated are more exposed to depressive symptoms (Gupta & Sahoo, 2020) draws the attention of educators in the ICT literacy-based new digital pedagogies. DL contributes largely to working from home, nevertheless, it can create anxiety, exhaustion, and a decrease in job satisfaction (Carabel et al., 2018) and cause negative impacts on online education. Prior studies (Karakose et al., 2022; Mia & Griffiths, 2021) warn of potential pandemic-triggered mental health crises. Using Depression Anxiety and Stress Scale-21 (DASS-21) scale, Etxebarria et al. (2021) report that teachers are highly affected and showed psychopathological symptoms, stress, depression, and anxiety during the pandemic. Consequently, the added professional role in digital pedagogy may affect the psychological well-being of the teachers depending on the ICT skills they possess. On this ground, we hypothesize several relationships as follows.

H2. Digital literacy level affects the psychological well-being of the teacher

H3. Stress and depression negatively impact the effectiveness of remote education, and;

H4. Stress mediates the impact of DL on ERE

The discussion above elucidates a clear threat to the education of the next generation. Remote mode limits dissemination (Clausen et al., 2020) of knowledge where parent involvement becomes an important input. Children connected via a computer lack learning through peers (Pregowska et al., 2021) nevertheless adopted more in the family sub-

culture. It may harm the equal opportunity for education, especially in a period where depressive disorders have been increased due to pandemics (Shukla & Manohar, 2021) leading to additional socioeconomic crises around the world. It develops regional and cross-sectional variations in the socioeconomic status (Zaw et al., 2021) dimension of the societies in similar countries. Etxebarria et al. (2021) argue that the mental health of teachers should be secured to improve the quality of learning as well as the mental health of students. Hence, we consider the future of the society could be vulnerable due to education and ill health, thus we directly survey the teachers in this study.

Materials and Methods

Sample

We examine information communication literacy among the educators, their psychological well-being, and the quality of education as experienced through online remote teaching. A cross-section of schoolteachers was surveyed in June 2021 from the population (N) of 246,592 schoolteachers (Education Ministry, 2019) in Sri Lanka. An online structured questionnaire was administered within the educator networks, groups, and associations meant for schoolteachers formed by their own social and cultural identifications and belongings. For instance, we reached teachers connected with the national institute of education in Sri Lanka, through university alumni groups. It commenced collecting online responses on June 15, 2021. The questionnaire directed the submission of anonymous responses by schoolteachers, and we closed accepting submissions on 1st July 2021 deciding on the sample adequacy for the structural model. The data were collected electronically through Google Forms, with 530 participants, and 17 data forms were subsequently excluded from the dataset as some data elements were missing. Hence, the final sample represents 518 worthy responses out of the first 530 received at the closure. The descriptive profile of the sample is summarized in Table 1.

The sample's higher percentage of the female category is on par with the population, where 75% of the population is female (Education, 2019). Most of the respondents are graduates and others include trained, or diploma certificate holders. The respondents included 26 private school teachers, and the rest (about 95%) are from government-managed schools. Of all the respondents, approximately 82% were married (Table 1). About 55% of the respondents were teaching for less than 10 h a week, and about 10% spend more than 20 h a week online teaching. They stated their English proficiency as excellent (45%), good (39%), satisfactory (14%), or poor. Approximately, 47% of respondents indicated their teaching experience as less than 10 years, and 104 (about 19%) were senior teachers with more than 20 years of teaching experience.

Instrumentation

The survey instrument includes items that reflect DL, psychopathological symptoms, that is, Stress and Depression levels, and teachers' perception of the ERE.

Table 1. Descriptive Profile.

Gender	Civil Status		Age			Education			Experience	
	..	Single	87	Below 30	89	Masters	73	Below 10	246	
Female	419 (81%)	..	87	Below 30	89	Masters	73	Below 10	246	
Male	099 (19%)	Married	421	31-40	177	First Degree	306	11-20	168	
		Other	10	41-50	173	Other	139	21-30	72	
Total	518		518	Above 51	79		518	Above 31	32	
					518				518	

Note. This table reports descriptive statistics of the sample of 518 respondents. Sri Lanka's teacher population is N = 246,592 which consists of 75% (i.e., 184,125) females. Age and experience are reported in number of years.

Measurement items were adopted from different sources, and a pretest and a pilot study of 30 respondents were conducted with samples from targeted respondents. The pilot study was useful for refinements in the local language, Sinhalese, used in the instrument. The questionnaire included twelve (12) 5-point scale (strongly agree [SA] to strongly disagree [SDA]) statements that reflected two (2) of the constructs: DL and Effectiveness of Remote Education (ERE). Measurement of two (2) other constructs, Stress and Depression follows the DASS-21 non-equidistant 4-point scale. However, two (2) items were redundant and have been excluded from the measurement model following the analysis of PLS outer loadings. Figure 1 explains the Partial Least Squares – Structural Equation Modeling (PLS-SEM) with the four (4) constructs.

Digital Literacy

Following Ng (2012) DL is measured, using three (3) statements for the technical dimension, one (1) for the cognitive, and one (1) statement for the social-emotional dimension. For example, we offered a statement “I have good ICT skills to solve my technical problems” under the technical category. These statements offered SA to SDA 5-point scale status. Hence, a “Strongly Agree” response to the offered statement reflects the highest level of DL. All the items, notations, and constructs are reported in the Appendix. The technical dimension tested the respondents’ ICT skills in problem-solving, understanding of online teaching platforms, and skills in software applications. The cognitive dimension statement asked about the respondent’s abilities on searching and evaluating web-based activities. Social and emotional statement tested their usage of social media and the web for learning activities.

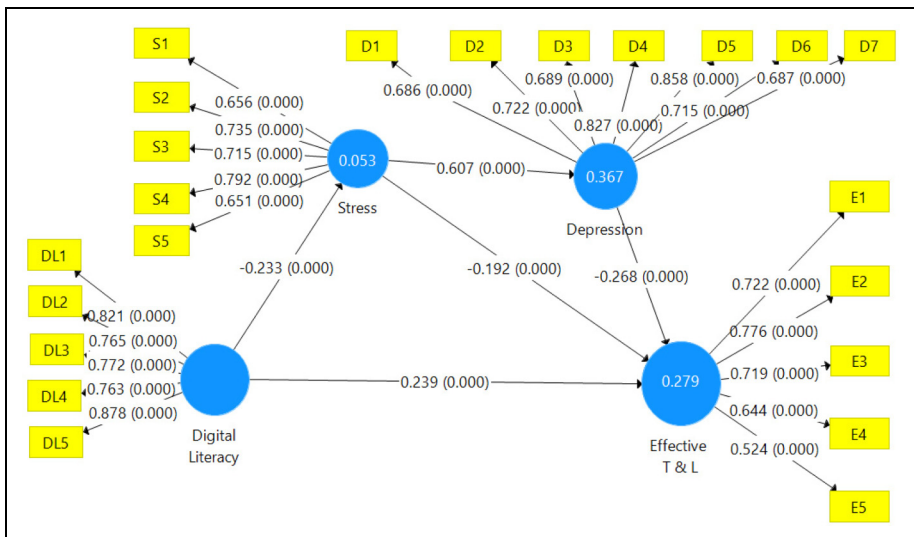


Figure 1. Structural model with coefficients (p-values) and r-squared.

Effectiveness of Remote Education

We use four statements to construct ERE as witnessed by the teachers themselves. This is consistent with teachers' engagement (Borup et al., 2014) which refers to their perceptions of engagement with students (Ewing et al., 2021). First, it observes teachers' experience concerning the students learning, based on the ability to provide themselves with necessary ICT devices, and network connectivity. Second, it assesses the teachers' opinion on the meaningfulness of remote teaching due to students' technical understanding. This is consistent with Butnaru et al. (2021) who documented that the student's reaction is based on proficiency in using online tools and ability to access technically. These statements are measured by SA to SDA 5-point scale status. Third, it measures the student's self-motivation for RL as observed by teachers, relative to experience in the on-school classroom. Fourth, it measures the teachers' perceptions on reflection of learning, and the effectiveness of assessment of student performance. Next, we measure perceptions on developing creativity in the learner, and attitude perspective of education as a requirement of acculturation. This is based on the evidence that the teacher cannot assess the problems of a child studying at home, the child has no peers, and skills development through workshops becomes impractical (Pregowska et al., 2021). Confirmatory Tetrad Analyses (CTA) (Table 2) confirmed that these constructs are all reflective than formative in assessing the measurement model.

Ethics

The respondents of the survey were volunteers, and all the responses were anonymous. The specific objective of this study was mentioned before proceeding to take part in the survey. Participants were not offered any payment for taking part in the survey, and

Table 2. Confirmatory Tetrad Analyses (CTA).

	Tetrad	Original Value	P-value	CI low adj.	CI up adj.
Digital Literacy (DL)	DL1, DL2, DL3, DL4	0.005	.150	-0.006	0.015
	DL1, DL2, DL4, DL3	-0.021	.040	-0.039	0.003
	DL1, DL2, DL3, DL5	0.004	.127	-0.004	0.012
	DL1, DL3, DL5, DL2	-0.143	.008	-0.179	-0.109
	DL1, DL3, DL4, DL5	0.002	.356	-0.009	0.012
ERE	E1, E2, E3, E4	0.055	.043	-0.019	0.132
	E1, E2, E4, E3	-0.002	.482	-0.083	0.081
	E1, E2, E3, E5	-0.034	.191	-0.125	0.056
	E1, E3, E5, E2	0.029	.223	-0.060	0.117
	E1, E3, E4, E5	0.085	.038	-0.026	0.197

Note. CTA results for the DASS-21 adopted constructs, that is, Stress and Depression, are not presented in this table in view of space and are available on request. ERE = Effectiveness of Remote Education.

they were able to complete the survey only once and could terminate the survey at any time they desired. Data were securely stored with access to the researchers only. This study has been reviewed by and received ethics clearance through, the Ethics Review Committee for the Research in Humanities and Social Sciences (ERC-HSS) of the Faculty of Social Sciences and Humanities of the University of Sri Jayewardenepura, Sri Lanka.

Psychological Symptoms

Widely used (Francisco et al., 2017) measurement of emotional symptoms, DASS-21 (Lovibond & Lovibond, 1995) was utilized in developing the survey instrument in this study. Accordingly, depression is reflectively measured by the seven assessment items as described in DASS-21, and stress is similarly measured by five DASS-21 assessment items. The changes in these observed variables among the respondents determine the level of depression and stress of each respondent. Hence, the application of variance-based Structural Equation Modeling is justified (Hair et al., 2019). These are 4-point scales in which responses at the time “t” shall be based on respondents’ experience during the recent past. The 4-point scale is directional, where “zero”, the lowest possibility, means no stress/depression, and “three” means extremely severe stress/depression. It should be noted that there are no negative possibilities of these values for stress or depression, hence the two constructs are measured with a positive and non-equidistant scale. Additionally, we use directional hypothesis in the structural equations model, thus the interpretations are not impaired. Based on prior evidence that the DASS-21 has good psychometric properties in different languages (Francisco et al., 2017), we used the scales in the local language, the Sinhalese version, where the respondents were asked to state how much some negative emotional states applied to them during the online teaching period. The teachers rated each item using a DASS 4-point scale (defined as: 0 = did not apply to me at all, 3 = applied to me very much or most of the time).

Results and Discussion

We first assess the mental health status of the teacher sample by calculating the scores manually following the DASS-21 scale. It allowed us to examine the severity of the growing distress, and mental well-being of them during home confinements and lockdown periods. Table 3 shows a gender-classified sample, based on DASS-21 scores. The scores calculated for each respondent indicate stress and depression status (i.e., none, mild, moderate, severe, and extremely severe) of him/her. We observed that a substantial proportion (about 39%) of the respondents in the mild to extremely severe categories of psychological symptoms, both stress, and depression. The observation is consistent with Gopal et al. (2020) who report a rise in stress and symptoms of depression during the lockdown period. Additionally, it revealed that the female teachers are more stressed. The normal stress level for males is 73% (i.e., 72 out of 99 males

Table 3. Classification of the Sample Based on DASS-21 Scores.

Status	Stress				Depression			
	Male	Female	Total	%	Male	Female	Total	%
Normal	72	244	316	61	62	251	313	60
Mild	13	79	92	18	14	61	75	15
Moderate	09	66	75	15	16	70	86	17
Severe	05	27	32	06	05	23	28	05
Extremely severe	00	03	03	-	02	14	16	03
Total	99	419	518	100	99	419	518	100

Note. The table reports gender-classified samples based on DASS-21 scores. Normal to extremely severe stress and depression levels are defined in DASS-21. The possible range for each scale is from 0 to 42, with higher scores indicating more depression and stress. DASS-21 = Depression Anxiety and Stress Scale-21.

in the sample) while it is 58% (i.e., 244 out of 419 females in the sample) for females, supporting Gopal et al. (2020) who found a higher rate of increase in anxiety and stress symptoms in females. However, there seems no gender difference in depression status. We tested the relationship between stress level and civil status, family size, and other demographic characteristics, and we do not report the results as these relationships are found insignificant.

In view of the directional effects hypothesized and formed in this study, we use PLS-SEM in the current study. It follows a two-step analytical procedure approach (Anderson & Gerbing, 1988). Structural Equation Modeling that constructs a path linking stages of psychological impact and effectiveness of online remote teaching is used, and the processes are represented by a set of structural equations explained in Figure 1. The image was created through SmartPLS 3.3 version.

The study revealed that teachers enrolled at least 30 students for an online session, with a maximum of 120 participants. Prior evidence suggests that the size of the class is significant for effective learning in face-to-face teaching (Eichler & Peeples, 2016). Similarly, or more increasingly, large enrollments in online education can create more obstacles for teaching and learning process as low student interaction, anonymity, and passivity are apparent. Our study revealed that about 90% of schoolteachers use Zoom meetings, and the rest use MS Teams, and Google Classrooms for remote teaching. School management rarely finances premium versions of these, and consequently, the sessions are time and size constrained. It interrupts the teaching flow and works as a stressor for the teacher. Of the sample, about 30% of respondents appeared to use virtual whiteboards, and none use any online assessment and evaluation systems. Almost all use WhatsApp for delivering notices, messages, and lesson materials in PDF, PPT, images, and document formats. These observations are parallel to the findings of Rahiem (2020) who reports that Zoom meetings, Google Meet, WhatsApp, and other Social Media are commonly used in Indonesia, a southeast Asian country. Respondents commonly agreed that the students suffer from the unavailability of

appropriate electronic devices, audio and video equipment, poor network connectivity, and information communication and technology skills in general. The situation is worst in rural areas of the country, where the network coverage is poor. Thus, the students need technical assistance from the family, and thus many of the students do not achieve the intended learning outcome.

Measurement Model

It is quite natural that the digital skills and experience become more important for remote teaching than face-to-face mode. Mean scores for the DL scale stood in the direction of above-average literacy (Table 4: Mean: 2.95–3.60), and the ERE scale shows the mean (Mean: 2.19–2.47) toward the ineffective direction. The highest stress level indicated for the statement was four on the scale, indicating that the respondents work under tension. Demographics observed, age, and gender showed no impact on stress level or ERE. Nevertheless, marital status showed a significant negative coefficient (Coefficient: -0.099 ; p -value: $.003$) to stress status, indicating that the married are exposed to mental health risks than the bachelors. Furthermore, tests concluded that the teaching experience has no direct or indirect impact on the ERE (Coefficient: -0.005 ; p -value: $.454$) or stress (Coefficient: -0.038 ; p -value: $.162$). This observation is inconsistent with the US evidence that the teaching experience has a significant influence on education (Podolsky et al., 2019) and the students perform well with teachers' accumulated experience; however, it is important to note that we do not measure effectiveness absolutely, but as the teachers perceived. Therefore, the cause of lower-than-expected outcome of online teaching may be an occupational dissatisfier based on the DL of the teacher. Consequently, the fact that teacher education is instrumental in adapting to remote teaching was also pointed out by Konig et al. (2020).

The measurement model was examined in terms of construct reliability, convergent validity, and discriminant validity. Table 4 shows the statistics of convergent validity of the constructs observed by the measurement model. Each of these items is described in the Appendix. Factor loadings, Cronbach's Alpha (CrA), RhoA, Composite Reliability (CR), and Average Variance Extracted (AVE) are presented in Table 4. CrA values for all constructs are above the standard value of 0.7 indicating internal consistency (Hair et al., 2020). The factor loadings of items are greater than the 0.70 thresholds (Hair et al., 2020) except for two DASS-21 adopted items of which the minimum is 0.69, indicating that the constructs' validity is convergent. Values reported for Variance Inflation Factor (VIF) are less than two for all Stress and ERE items. However, DL and Depression items include items with VIF less than 3 indicating moderate correlations. Additionally, we observe that the convergent validity of all variables had been established as the CR values fall above 0.7 benchmarks (Hair et al., 2020; Liu & Wang, 2016). Moreover, AVE is greater than 0.50 for the same constructs indicating the convergent validity (Hair et al., 2020) of the model estimations. Heterotrait-Monotrait ratio of correlations (HTMT) method is more reliable in assessing the discriminant validity (Ghasemy et al., 2020) and the guidelines suggest that the

Table 4. Measurement Model Assessment: Validity of the Constructs.

Constructs	Items	Mean Score	Outer Loadings	VIF	CrA	RhoA	CR	AVE	HTMT		
									Stress	Depress	ERE
Digital Literacy (DL)	DL1	3.05	0.821	2.685	0.864	0.896	0.899	0.642	0.273	0.278	0.393
	DL2	3.46	0.765	2.514							
	DL3	2.95	0.772	2.871							
	DL4	3.60	0.763	1.781							
	DL5	3.26	0.878	2.366							
Stress	S1	0.72	0.756	1.302	0.755	0.759	0.836	0.507		0.745	0.532
	S2	0.74	0.735	1.426							
	S3	1.09	0.715	1.470							
	S4	1.37	0.792	1.660							
	S5	0.81	0.751	1.369							
Depress	D1	0.74	0.786	1.450	0.863	0.874	0.896	0.553			0.519
	D2	0.58	0.722	1.590							
	D3	0.66	0.693	1.521							
	D4	0.67	0.827	2.410							
	D5	0.65	0.858	2.650							
	D6	0.31	0.715	1.728							
	D7	0.64	0.697	1.683							
ERE	E1	2.42	0.722	1.796	0.714	0.695	0.811	0.566			
	E2	2.46	0.776	1.957							
	E3	2.19	0.719	1.699							
	E4	2.47	0.744	1.303							
	E5	3.27	0.724	1.026							

Note. The table shows the mean score for the observed items, item loadings, and validity statistics. AVE = Average Variance Extracted; CrA = Cronbach's Alpha; CR = Composite Reliability; Depress = Depression; ERE = Effectiveness of Remote Education; HTMT = Heterotrait-Monotrait ratio of correlations; VIF = Variance Inflation Factor.

Table 5. Direct Results.

Path	Coeff	SD	P-value	S/N	Conf. Intervals		VIF	F ²	R ²	Q ²
					5%	95%				
DL> ERE	0.239	0.035	.000	S	0.173	0.291	1.083	0.073	0.279	0.118
Stress> ERE	-0.192	0.048	.000	S	-0.271	-0.111	1.600	0.032		
Dep> ERE	-0.268	0.044	.000	S	-0.337	-0.193	1.622	0.062		
DL> Stress	-0.233	0.042	.000	S	-0.296	-0.157	1.000	0.057	0.053	0.049
Stress> Dep	0.607	0.031	.000	S	0.549	0.653	1.000	0.584	0.367	0.050

Note. The table reports results for direct relationships. All coefficients are significant at the 1% level. DL = Digital Literacy; ERE = Effectiveness of Remote Education; SD = standard deviation; S/N = supported or not; VIF = Variance Inflation Factor.

HTMT value should be less than 0.85 for conceptually distinct constructs. Table 4 also presents discriminant validity test results where HTMT ratios range from 0.273 to 0.745 indicating all constructs are independent of each other and the model is strong in terms of discriminant validity (Henseler et al., 2015) of the construct’s scale.

Structural Model

We test the significance of our directional hypotheses using one-tailed Bias-Corrected and Accelerated Bootstrap procedure based on a sufficiently large number of bootstrap subsamples (10,000 subsamples) (Ghasemy et al., 2020; Hair et al., 2017). The decisions on the hypothesis, supported (not supported) and the confidence intervals are presented in Table 5. The SEM with the coefficients (*p*-values) of the relationships is included in Figure 1. Three of the relationships show VIF below 1.05, and the rest goes up to 1.64 indicating no issue of collinearity. Supporting the hypotheses (H1), the outcomes display that the ERE could be explained by the DL level of the educator ($\beta = 0.239, p < .000$). It also revealed that a good (poor) level of DL causes low (high) stress among the teachers ($\beta = -0.233, p < .000$).

Mediating Effect

We test mediation effects of stress and depression on the relationship between the perceived ERE and DL. Table 6 shows the mediation effect results obtained through PLS bootstrapping. Accordingly, Stress shows a significant partial mediation ($\beta = 0.045, p < .000$) on the relationship between DL and ERE supporting H4 of the study. It reveals that there exists a low level of DL among the teachers, because an excellent DL means no Stress, because the DL and Stress showed a negative association. In other words, RE is affected by low DL and is worsened by increased stress. Additionally, partial mediation of depression explains that teachers who develop depression worsen the negative relationship between stress and teaching and learning effectiveness ($\beta = -0.163, p < .000$).

Table 6. Mediation Analysis.

Path	Coeff	SD	T Stat	Confidence Intervals (Bias Corrected)		Total Effect	VAF	Result
				5%	95%			
DL> Stress> ERE	0.045	0.014	3.181	0.024	0.071	0.322	0.140	Partial
Stress> Dep> ERE	-0.163	0.028	5.961	-0.209	-0.119	-0.355	0.459	Partial

Note. The table reports indirect results, that is, Coeff: Total Effect. DL = Digital Literacy; ERE = Effectiveness of Remote Education; VAF = Variance Accounted For.

Table 7. PLS Predictive.

	PLS			LM			PLS-LM	
	RMSE	MAE	Q ²	RMSE	MAE	Q ²	MAE	Q ²
E1	1.053	0.861	0.027	1.056	0.871	0.021	-0.010	0.006
E2	0.968	0.792	0.022	0.972	0.800	0.021	-0.008	0.001
E3	1.049	0.821	0.047	1.010	0.828	0.038	-0.007	0.009
E4	1.122	0.943	0.017	1.126	0.949	0.011	-0.006	0.006
E5	1.477	1.281	0.096	1.058	0.866	0.154	0.445	-0.058

Note. PLS = Partial Least Squares.

Table 7 presents the results of the blindfolding procedure assessing the model’s predictive power by looking at the coefficient of determination (R squared) values. The mean squared error of four out of the five items in the endogenous latent variable, ERE, is less than zero while Q² values are marginal. We omit the predictive results for other variables such as stress and depression in this table. The prediction error of the PLS-SEM results is smaller than that of the linear model. It suggests that a PLS-SEM model exhibits a marginal predictive relevance.

Digital technology has been the primary mode for RE during home confinements across cultures, economies, and differently developed societies. Effective use of digital technologies may contribute to individual life in many ways such as providing cognitive and career development (Erol & Aydin, 2021). However, we experience that the quality of education is being compromised in digitally discriminated societies. It leads to unrest among the teachers, and occupational dissatisfaction due to computer and technology illiteracy, consequently a substantial impact on the education of the next generation. The test results support the first hypothesis, DL of the educator influences the perceived ERE. Hence, educators must rethink future work as the social distancing rules are eased following widespread vaccination campaigns. In search of flexible ways to restore COVID-19’s interruptions to education, Daniel (2020)

proposes asynchronous digital classrooms where learning is not restricted by place and time. We understand that educators are passing through a golden landscape with windows of opportunity (Whitley & Smale, 2022) to grow in the spirit of teaching and learning.

Tests confirm the relationship as expected in the second hypothesis (H2) that the low (high) level of DL causes higher (low) stress status, which describes that RL environment has contributed to a stressful life for teachers in Sri Lanka. Perhaps, the availability of ICT equipment including audio, video, and other input devices, network access and connectivity, costs, and computer literacy of the community are the close contributors to the problem. Additionally, digital leadership (Karakose et al., 2021) of school managers is essential to realize digital transformation and establishment of a digital learning culture in schools. The SEM analyses show that high (low) level of stress has caused high (low) level of depression among teachers ($\beta = 0.618, p < .000$). It suggests that the respondents are developing stress and falling into depression status consequently. This is consistent with prior evidence including that of Kurebayashi et al. (2012) and Manpreet and Maheshwari (2015) where a positive relationship between stress and depression is reported. DL of the teacher contributes negatively to the stress level indicating that the low DL would trigger mental health problems. Nevertheless, it shows a low R-squared, indicating that other factors may contribute to the stress level. Finally, both stress ($\beta = -0.330, p < .000$) and depression ($\beta = -0.210, p < .000$) cause teaching effectiveness negatively. The results support the hypotheses (H3) of the study. Our analyses of moderating the role of demographics, gender, civil status, age, and education of teachers were not supported. These results are consistent with no-zero confidence intervals reported. Overall, our analysis suggests the adapting role for teachers, and fostering the development of teacher digital competence as discussed in Konig et al. (2020) who also insist on teacher professional development.

Limitations and Future Research

This study keeps eyes closed with no observations from other stakeholders, for instance, learners might have different RE experiences. The ERE may be better explained by student-oriented studies than teacher-oriented ones. This separation between teacher engagement and student engagement complies with the community of engagement framework (Borup et al., 2014). Furthermore, peer engagement may produce different results, and thus, we recommend further studies thereon. Additionally, school management and local governments may have limited resource allocations that limit the ICT involvement and thus the effectiveness of remote teaching. In view of the technology opportunities seen, new RE may be worth material for future studies.

Conclusion

The study examines a threat to the education of the next generation growing with global digitalization. It is no doubt that education is one of the significantly affected

sectors due to the pandemic, COVID-19. School education was eventually changed from face-to-face mode to remote online system in Sri Lanka as home confinements were imposed by the government in March 2020. This transition to the online mode was a new experience for all school teachers, consequently creating a working environment of stress as predicted (Mia & Griffiths, 2021) unavoidable in South Asia. The analyses suggest that RL implemented during the COVID-19 pandemic period has affected the psychological well-being of the teacher community of Sri Lanka. A major cause of psychopathological symptoms, stress, depression, and the ERE is due to DL.

The findings of the study emphasized several pertinent insights. First, educational institutes, school management, and departments are cautioned about possible deterioration in educational expectations. COVID-19 home confinements may run for the short to medium term, nevertheless, ill-health of education may sustain in the long run. Hence, managing the occupational dissatisfiers, stressors, and demotivators that affect the performance of school educators (Gokuladas & Baby, 2020; Han & Mahzoun, 2019) is significant for the well-being of society. Second, low levels of DL limit the educator's role in creating an environment of empathy and care (Bozkurt & Sharma, 2020), where, consequently, student engagement in learning is affected. The teachers' readiness (Cahyadi et al., 2021) is significant for the effectiveness of the learning design in a crisis. ICT skills, infrastructure, and availability of resources including Internet access and devices are significant for the implementation of digital pedagogies. Hence, it calls for strategic investments in professional developments for making the benefits of E-learning, blended and RL.

Third, flipping the physical face-to-face class into an online remote class has created a crisis for teaching and learning at schools. Teachers do not find self-motivated students or believe in achieving learning as expected, or creativity improvement from RE. They understand that RE grows passivity and reduces student interaction, and students' learning has become a function of network access, rural residence, and affordability. More importantly, parental involvement is on-demand for managing child education. Equal education opportunity is at risk and socioeconomic dilemmas may be unavoidable. There is a continuous process of evolution in education and pedagogies. In this process, individuals act in their self-interest and adapt to different or changing environments. However, adaptation may be affected by the psychological status of the individual and the external obstacles, for instance, DL. It makes a circular effect, causing ineffectiveness in education. Thus, teacher training and professional developments are essential inputs to meet the requirements of new pedagogies.

Implications

The study explores how teacher engagement would be improved to enhance student engagement in learning. Digital competence is a major input and is instrumental for teacher professional development. During the process of knowledge creation and dissemination, there is an adaptive role for the educator. It requires identifying

occupational stressors and changing responsibilities in the adaptation process in view of sustainable education. Additionally, it is important to identify the urgent role of policymakers. The urgent actions to develop human capital by matching the teacher with the pedagogy may assure the quality of education of the next generation. Harnessing the educator with digital skills, and literacy, and eliminating the discomfort in ICT is important to improve the psychological well-being of the educational worker. Educators need to identify the causes of ill health of education and address the issues of the input for better results through RE mode. Because ICT links the teachers and students in the learning groups cognitively and affectively to transform the knowledge (Jha, 2017), preventive measures are significant in achieving educational expectations and sustainability.

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Author's Contribution

All authors contributed to the study's conception and design. Material preparation, data collection, and analyses were performed by all authors. All authors read and approved the final manuscript.

Declaration of Conflicting Interests

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Ethics Approval

The volunteered respondents were offered the survey, and all are anonymous responses. The specific objective of this study was mentioned before proceeding to take part in the survey. Participants were not offered any payment for taking part in the survey, and they were able to complete the survey only once and could terminate the survey at any time they desired. Data were securely stored with access to the researchers only. This study has been reviewed by and received ethics clearance through, the Ethics Review Committee for the Research in Humanities and Social Sciences (ERC-HSS) of the University of Sri Jayewardenepura, Sri Lanka.

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Appendix

The Survey Instrument: Specific Statements

Construct	Notation	Items
Digital Literacy	DL1 (Tec)	I have good ICT skills to solve my technical problems.
	DL2 (Tec)	I keep up with important new technologies, and I can use communication platforms like Zoom, MS Teams, Google Classroom, etc. for teaching
	DL3 (Tec)	I know to use ICT for teaching/learning and to create presentations, documents, case studies, quizzes, etc.
	DL4 (Cog)	I can search and evaluate information from the Web, and I know issues related to web-based activities like cyber safety, plagiarism
	DL5 (SE)	I use electronic sources of information (from blogs, discussion forums, YouTube, Google Sources, WhatsApp, Facebook, etc.) for learning activities
Stress (DASS 21 Adopted)	S1	I found it hard to wind down
	S2	I felt that I was using a lot of nervous energy
	S3	I found myself getting agitated
	S4	I found it difficult to relax
	S5	I was intolerant of anything that kept me from getting on with what I was doing
Dep (DASS 21 Adopted)	D1	I couldn't seem to experience any positive feeling at all
	D2	I found it difficult to work up the initiative to do things
	D3	I felt that I had nothing to look forward to
	D4	I felt downhearted and blue
	D5	I was unable to become enthusiastic about anything
	D6	I felt I wasn't worth much as a person
	D7	I felt that life was meaningless
ERE	E1	Online teaching is effective as the students have ICT devices and required network connectivity
	E2	I think online teaching and learning are meaningful, as the students have the technical understanding required
	E3	I understand that the students are self-motivated and positive toward remote learning than classroom
	E4	I believe that the assessments of student learning and performance levels are effective and thus remote teaching is effective
	E5	I think a remote system develops the creativity and attitude required for our culture

Note. This table details the survey instrument used. DL 1 to 3 reflect the Technical dimension, DL4 reflects Cognitive dimension, and DL5 reflects Social and emotional dimension. Dep = Depression; DASS-21 = Depression Anxiety and Stress Scale-21; ERE = Effectiveness of Remote Education; ICT = Information Communication Technology.