



# Is the best option still in low adoption? An investigation on factors affecting the adoption of online school education in rural areas in Sri Lanka

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## Abstract

This research investigates rural area students' online adoption during the fourth wave of the coronavirus 2019 (COVID-19) pandemic. The main objective of this study was to identify the factors affecting the adoption of online education in rural areas in Sri Lanka. This case study was carried out based on data gathered from the online survey during the pandemic covering 16 districts in Sri Lanka. Using the ordered probit regression model through the stepwise technique, the study investigates the factors affecting the adoption of online education in rural areas in Sri Lanka. According to the results generated, attitude, perceived use, awareness, and new technology adoption have a positive impact on student adoption of online education in Sri Lanka. Online education so far is one of the effective and feasible solutions for providing education in a pandemic situation in any country. These findings are helpful for responsible educational institutions to address and contribute to key issues such as low perceived use, poor attitude, low awareness, and poor technology adoption. The study will also assist policymakers in preparing a roadmap, at the policy level with the perceived benefits of online education during similar future crises in Sri Lanka.

**Keywords** Student adoption · Online education · E-learning · Ordered probit

## Introduction

The World Bank states that because of the restrictions imposed during the COVID-19 pandemic situation more than 1.7 billion students have faced complete or partial school closures in 190 countries (The World Bank, 2020a). As a result, Electronic Learning (e-Learning) has become a popular and effective way of learning today without interruption,

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especially in a situation where intermingling with people in public places are restricted. Online education is one such successful remedy with a high level of outreach that can be used to mitigate the impact of COVID-19 on conventional educational systems by maintaining social distance and health guidelines during pandemic times.

Massive innovations in modern Information Technology (IT) have opened new doors of opportunities in the field of education (Churi et al., 2022). However, little progress has been achieved so far since the inception of online education facilities in Sri Lanka. Extensive research conducted on the non-adoption of online education is limited. At the same time, it is observed that government and educational institutes have no option other than to be satisfied with the prevailing status of education delivery despite their efforts to promote online education. The minimum requirements for online learning are device availability, high speed internet connection, computer literacy (Antee, 2021), internet literacy, and good motivation (Churi et al., 2022) to succeed in developed educational systems. Online education will be a success if it is accepted by students, teachers, and parents who are keen on quality education delivery (Luu, 2022). Hence, acceptance comes from the awareness of technology, availability of required resources and a positive outlook about this sudden new change.

Due to the COVID-19 pandemic situation, online education has been a relatively newer concept to the Sri Lankan education sector, which has been so far based on traditional education delivery via physical classroom-based education. Though online education is prevalent today, some issues arise when rural areas adopt online educational systems. The student population in schools in Sri Lanka is reported as 4,063,685 (Ministry of Education, 2020). Sri Lanka is new to online education platforms such as Zoom, Microsoft Teams (MS Teams), and Google Meet, etc. However, the post-COVID-19 environment has had an impact on the adoption and usage of online education globally. But, it is still a puzzle why these facilities fall behind expectations in Sri Lanka.

Hence, this study will be of significance in this era. The main objective of this study is to identify the factors affecting the adoption of online education in rural areas in Sri Lanka. As this ontological area is highly neglected in rural areas, researchers' efforts will offer a new epistemological stance in this subject area. Here, the attention of relevant parties will be captured for online adoption in rural areas. The findings of this study are helpful for educational institutes to address and contribute to key issues such as low perceived use, negative attitude, minimum awareness, and vulnerable technology adoption.

The present research differs from existing studies to date and contributes to the literature in four ways. Firstly, no prior relevant research study has been conducted in this area under the local context. Secondly, this study will help understand a model suited to Sri Lanka that can also be used in other developing countries. Thirdly, the study will benefit academic researchers from different countries with the developed research framework. Finally, the study will also guide and assist the policymakers in preparing a roadmap at policy level with the perceived benefits of the use of online education in the event of a similar crisis in Sri Lanka in the future.

For the first time in Sri Lanka, online education has gained a significant presence due to the COVID-19 pandemic and social distancing practices. But, some issues have arisen when adopting rural areas with online educational systems in Sri Lanka. The adoption of online education has been observed to be minimal in rural areas. Some families in rural areas were found to be lacking a smart device to log in to an online session. Though some families only have a single smart device, this is insufficient when there is more than one student in the same family depending on a single device. As such, some will be losing the chance to join online education. Sometimes even though students have a device and

connectivity, they might not be able to adopt online learning due to a lack of technological knowledge. Students with insufficient levels of computer/internet literacy will be widely affected by this problem area. They probably face problems when dealing with online learning applications. Most of these challenges are not well managed by educational organisations. Hence, the expected learning outcomes will not be achieved due to this reluctance to online education. Hence, this research will focus on factors that affect the adoption of online education in Sri Lanka, considering the above observations.

The remaining sections are organised as follows. Sect. “[Literature review](#)” describes the literature review, Sect. “[Data and methodology](#)” presents data and methodology, Sect. “[Results and discussion](#)” assesses the empirical results, and the discussion and Sect. “[Conclusion and policy implications](#)” presents the recommendations and conclusion, respectively.

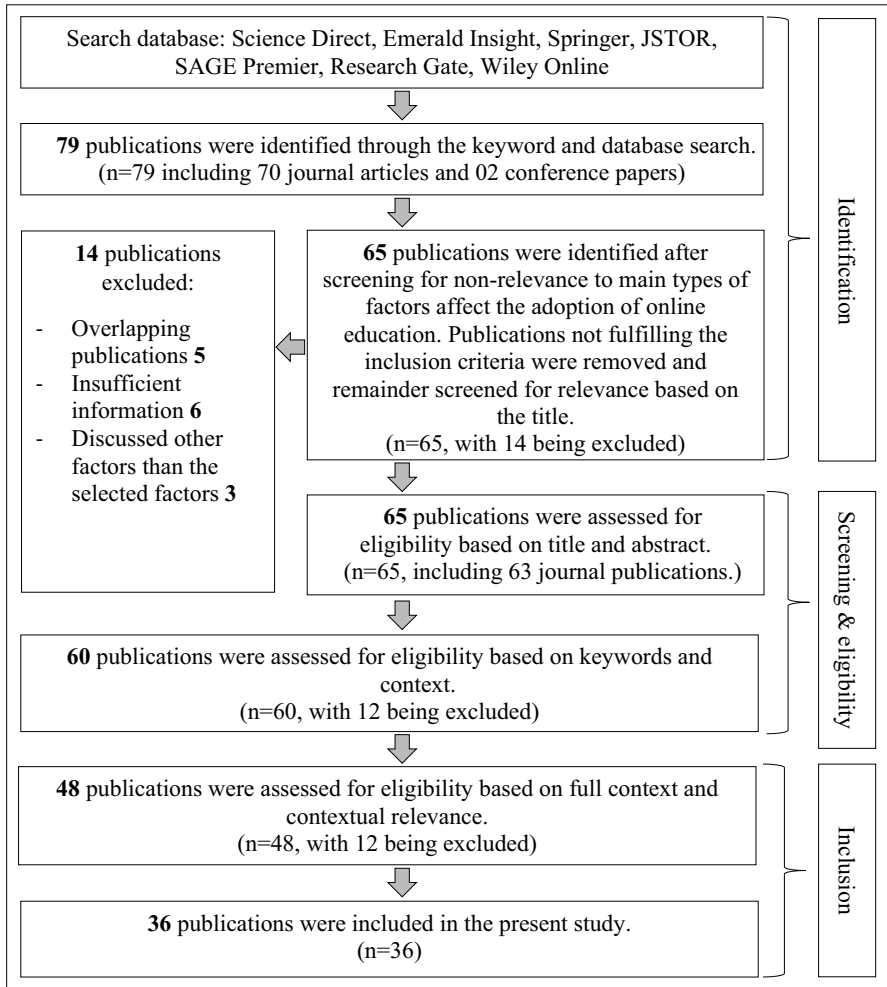
## Literature review

Studies relating to online education published from 2006 to 2022 have been referred for this empirical study. The authors of this study accessed many reputed electronic research databases such as Science Direct, Emerald Insight, JSTOR, Springer, SAGE Premier, Wiley Online, Public Library of Science, Hipatia Press, Sri Lanka College of Paediatricians, Open Science Center and Research Gate to search literature published in the English language. Search strategies applied were depicted in summary format in Fig. 1 and 79 full text publications were identified as available online sources. Both titles and abstracts were examined to select articles suitable for this study. Irrelevant articles were excluded, as indicated below and finally, 39 articles were selected for the present study.

Previous studies in this regard point out many factors that influence the adoption of online education. These factors can be of many differences based on the technological developments and literacy of the population of each country. The proposed research framework will address the factors affecting the adoption of online education in rural areas in Sri Lanka.

## Perceived usefulness

According to Davis (1989), perceived usefulness refers to “the degree to which a person believes that using a particular system would enhance his or her job performance”. In a previous study, researchers used the Technology Acceptance Model (TAM) to measure students’ acceptance of web-based learning tools (Tarhini et al., 2013a). This study reveals perceived usefulness as a significant factor in student adoption. Data collection was based on 569 undergraduate and postgraduate students in Lebanon. The structural equation modelling technique based on AMOS methods and multi-group analysis were used for data analysis. In a research study conducted in the United Kingdom (UK) which is a developed country, the findings of Tarhini et al. (2013b) revealed that perceived usefulness has a positive effect on the adoption of e-learning platforms. Hence, perceived usefulness can be considered crucial explanatory variable in a developing country like Sri Lanka, where many are unaware of online education’s perceived usefulness. Yan et al. (2021) study involving 1,170,769 Chinese students from the Guangdong province of China emphasised the perceived benefits received by online education. This research has used cross-tabulation and Chi-square analysis to interpret results. Another study carried out in Jordan



**Fig. 1** Literature search flow diagram, source: based on authors' observations

from a developing country perspective revealed that high social trust and high perceived ease of use lead to high perceived usefulness (Alshurafat et al., 2021). Considering the above explained facts, it is evident that perceived usefulness is an essential factor in student adoption.

### Perceived ease of use

According to Davis (1989), perceived ease of use is defined as “the degree to which a person believes that using a particular system would be free of effort”. During the literature review, it was found that perceived usefulness positively impacts the adoption of online education, which is a highly significant indicator. In controversy, Chesney (2006) concluded that the perceived ease of use did not significantly impact the intention to use the

system. In a study carried out in Lebanon, researchers used the TAM to measure students' acceptance of web-based learning tools (Tarhini et al., 2013a). In a similar study in the UK, the findings of Tarhini et al. (2013b) revealed that the perceived ease of use positively affects the adoption of e-learning platforms. Affirming the importance of this variable, Naveed et al. (2020) recommended that a user-friendly environment should be the developers' aim will result in easy adoption. Hence, perceived ease of use can be considered a crucial explanatory variable in a developing country like Sri Lanka where many are unaware of it.

### **Resource availability**

Online education can be delivered and accessed via computers, laptops, tablets, iPads, and smartphones. Most rural population cannot afford to have any of these devices. Within the available literature, resource availability is an important factor. Resource availability is one of the most critical concerns to be addressed in evaluating the success of e-learning in both developing and developed countries. Al-Huneini et al. (2020) stressed the importance of introducing tablets as devices to a rural school; the findings indicated that resource availability directly influenced learner motivation and engagement is the most relevant for Sri Lanka. During the research conducted by Dube (2020), participants expressed the nonexistence of devices to connect with online lessons. Lucas (2020) argued that while digital technology holds great promise in providing learners with access to top quality learning, education systems should ensure that technology doesn't further amplify existing inequalities in access and quality of learning. Hewagamage et al. (2020) stated that providing laptops and uninterrupted high speed internet access with reasonable pricing for students in rural areas is crucial to ensure equal access to tertiary education. This statement is valid in any form of online education. The study of Zhang et al. (2022) identified the lack of access to technical resources as a major unexpected challenge to the adoption of online education. Based on the above findings, resource availability can be considered another influential factor for online education.

### **Connectivity**

Stable connectivity is an important factor in the success of online education. Research by Li and Ranieri (2013) used nine hypotheses on internet inequality indicators involving 658 students in China. The findings revealed that rural area students had scored low marks for all the indicators of internet inequality. Connectivity has been considered an important factor in most models in developing and developed countries. Dube (2020) asserted that one of the best ways of learning during the COVID-19 period was online learning but the unavailability of connectivity in some rural areas had brought negative results. In a study conducted in Sri Lanka, Jesuiya and Priyadarshani (2020) found that 50% of the respondents were due to network issues and students broadband internet access as a key resource in online learning. The study conducted by Yan et al. (2021) concluded that poor internet connection was experienced by 50% of students in K-12 students in China. Although a very large sample size was selected for this research with 1,170,769 Chinese students, the sample was restricted only to a single province was the drawback of this study. Ndzinisa and Dlamini (2022) identified internet connectivity as a core requirement for the adoption of online education. Similarly, Churi et al. (2022) proved that internet connectivity is a basic need of online education and families staying in remote locations were found to have lower

chances of getting a reliable internet connection. The literature review revealed that stable access to the internet and power is critical to adopting online education.

## Computer literacy

Sri Lanka is a developing country with a literacy rate of 91.71% (UNESCO, 2018) and ranks in 86th place. About 81% of the population lives in rural areas and the poverty head-count ratio is 0.90. Internet penetration in Sri Lanka stood at 50.8% as of January 2021. During 2020–2021, access to the internet significantly increased by 800,000 (+7.9%) and 10.90 million users in January 2021 (DATAREPORTAL, 2021). This remarkably increased access to the internet allowed the Sri Lankan population to access various IT-related services. Out of the many IT-related services offered over the internet, online education now has a significant presence.

Lack of computer skills is another issue students face when using computing devices. Hence, this can be considered another main factor for students, parents, and teachers to reject the adoption of online education. Conducting another study, Naveed et al. (2020) affirmed that lack of training will shrink the effective usage and he further stated that it would be a barrier to achieving the benefits of eLearning. Providing proper training was recommended for teachers and students to acquire online teaching and learning skills to achieve the expected benefits. Bordoloi et al. (2021) revealed that live online classes helped more than 50% of teachers and students to develop computer literacy during the pandemic in India. Less than 3% of students and teachers disagreed on this factor. The digital divide is one of the main drawbacks of the successful implementation of online education in India, regardless of the limitation of the study's low sample size (120). Findings proved that computer skill was essential for online education adoption.

## Awareness

Students and teachers are the main stakeholders of the online education system. Students being illiterate in using computers and the internet, their fears in adapting to such technologies, lack of access, and lack of experience have contributed to the non-adoption of online education. Hence, practical measures are to be taken to educate all stakeholders and thereafter transfer them from physical learning to online education. The World Bank states that a few students with less online learning experience difficulties in online education (The World Bank, 2020b)\_ENREF\_25. However, this area has been addressed by many researchers in the Western world regardless of its high computer literacy rates. The same was tested widely within the Asian context as well. The research conducted in India by Bordoloi et al. (2021) tested the research participants' awareness level. The limitation of this study was the relatively small sample size (120) when considering a large country like India. This has not been tested widely within the Sri Lankan context. Considering the above facts, awareness can be considered an important factor for student adoption.

## Attitude

The study by Dündar and Akçayır (2014) in Turkey with 206 high school students revealed that participants had a positive attitude towards tablet computers. Naveed et al. (2020) stated that the trainer's attitude is an important factor in the productive implementation of online

education. In contrast, attitude towards e-learning (0.0906) ranks in the third significant place based on the global weights in Saudi Arabia. However, based on the Fuzzy Analytic Hierarchy Process, the attitude factor (0.077) has been ranked as the second significant value. Moreover, Boateng et al. (2016) revealed a direct impact on the attitude towards e-learning adoption. This study was performed in Ghana from a developing country perspective, with 337 university students and six out of nine hypotheses were accepted. Furthermore, Ismaili (2021) stated that it is mandatory for students to change their negative attitudes and reluctance towards the new educational mechanism. The accessibility to platforms and utility ability will play a significant role in future educational planning. Thus, a shortfall in the attitude of any student can have consequences on the adoption of online education.

### **Teacher's support**

According to a statement of Taber (2011), the teachers' role is to support the students whenever needed. It is a sustainable statement where teachers' support is significant when teaching complex lessons. Teachers should provide clear examples of subjects in the curriculum to help students grasp these easily. Li and Ranieri (2013) commented that teachers play a vital role in providing required support and opportunities to students. It is an explanatory variable for both conventional and online modes of learning. Furthermore, Gunawardana (2017) stated that motivation is provided by tutorial materials, whereas teachers should provide guidance. Aderibigbe (2021) cited implications for instructors to provide clear guidelines to students regarding class activities and results. The above statements showed that clear guidelines by teachers would motivate students towards online education. The World Bank (2020b) stated that due to the pandemic, classroom teachers had not received online training prior to school closure. It was recommended that teachers should be provided with ample prior training to conduct online sessions. The study results by Luu (2022) are helpful for teachers to understand their students, adjust their teaching methods and provide instructions accordingly.

### **Teacher encouragement**

The study results by Li and Ranieri (2013) revealed that teachers are more likely to have a positive influence on students' digital skills. This finding is highly significant as the teacher is the main stakeholder in both conventional and online education. Li has used seven-point Likert scale to measure the teacher encouragement from Chinese students with an overall 0.8 internal reliability. Likewise, Escobar Fandiño and Silva Velandia (2020) commented in their qualitative study that teachers must create motivating environments which affects student performance. Although the above-mentioned study sample has been selected through the convenience sampling method, the results can be biased. Luu (2022) revealed that some students still expect teacher's control and presence in the online environment whether the study is qualitative or quantitative, teachers' encouragement has been discussed in the literature.

### **Technology adoption**

The adoption to digital technology is an important factor for any automation. The research conducted by Li and Ranieri (2013) proposed that on a global level, the adoption of digital technologies in schools has not kept pace with the technology used at students' home. This research conducted in China indicated the difficulties of integrating new media into

school practices. Furthermore, Boateng et al. (2016) state that many extensive studies on E-learning adoption have been conducted in developed countries. E-learning adoption is at a higher rate in developed countries with the remarkable evolution of the newest technological experiences. Western countries like the United States were rated as number one in technology adoption whereas Sri Lanka was rated as the 91<sup>st</sup> country (CISCO, 2019). According to the CISCO digital readiness index 2019, Sri Lanka ranks in 90<sup>th</sup> place among 141 countries in the world. Findings of the study by Yan et al. (2021) state that students in countries with low digital readiness may experience technology-related problems compared to developed countries. The researchers argued that a country should concentrate on digital readiness to promote online education and acquire its benefits. Findings of the study of Antee (2021) disclosed that the ICT infrastructure of the country and personal income are critical factors of the mobile technology adoption.

## Geographical location

Many researchers have considered geographical location as a factor affecting the e-learning system's adoption. Regardless of the geographical location, whether urban or rural, there is an impact on student adoption. Li and Ranieri (2013) pointed out that urban area students have more resources than those in rural areas. The study considered two rural and two urban area schools in the provincial city of China with 658 samples. Here, urban area students were stronger and ahead of rural area students in every aspect, probably due to urbanisation and the higher facilities available in urban areas. When reviewing the existing literature, geographical location too can be considered an important variable for student's online adoption irrespective of the country's status as developed or developing. In another Asian context study conducted in Nepal, Acharya and Lee (2018) recommended linking urban and rural areas with internet infrastructure facilities. For analysis of this study, 298 responses were obtained.

Eleven independent variables have been identified during the literature review. No prior research has used a similar approach using many variables. Such an approach is critical when considering a developing country like Sri Lanka, as using many variables can unveil a bigger picture. All relevant factors should be investigated to get an accurate picture of online education.

## Data and methodology

### Data

The SLIIT Business School and the SLIIT ethical review board reviewed and approved this study. The study investigates the factors affecting the adoption of online school education in rural areas in Sri Lanka based on the quantitative data gathered from an online survey. The cross-sectional deductive research approach will be considered as this research focuses on the quantitative aspect. Data were collected using a structured questionnaire (Supplementary Information S11). Information was gathered related to the adoption of online education, the level of student satisfaction in the school online education. The survey was conducted online focusing on local schools' education delivery/learning methods due to the COVID-19 pandemic while adopting health measures and maintaining social distance. The sample size was determined using the *raosoft* online sample calculator. The



margin of accepted error was taken as 5% and the confidence level of 95%. The sample size was determined according to the Annual School Census of Sri Lanka report published by the Ministry of Education (MOE). According to the Ministry of Education (2020) in Sri Lanka, the student population consists of 4,063,685 grade one to thirteen students. The recommended sample size was 385. But the collected sample consists of 414 data which is a strong factor in the reliability and validity of the study. For the level of significance,  $\alpha = 0.05$  was considered.

The questionnaire adequately covered all the twelve variables indicated in the conceptual framework. A minimum of one question to a maximum of six questions covered one dependent variable and eleven independent variables in the conceptual framework. The ordered probit model was used to test the impact of selected variables and the mean value of the variables derived was used to analyse the responses. The method of questionnaire design and the regression formula is explained as follows.

### Questionnaire design

The sample included rural area students with 414 respondents, covering 16 districts in the country and aims to investigate the factors affecting the adoption of online education in rural areas in Sri Lanka. This survey was conducted during the period from August to October 2021. The questionnaire was provided in English, Sinhala, and Tamil languages with the consideration of the research participants' language skills. A simple, understandable questionnaire was designed to capture data from all participants, which is designed by taking into consideration the research objectives and the conceptual framework as the base. The questionnaire was designed from the existing well-tested models adopted in the previous studies as described in the literature review. The questionnaire was designed in five sections and focused on the respondent's demographic details and identifying the factors that enabled a student to adopt online education. Further, the questionnaire in *Sinhala*, *English* and *Tamil* languages was designed to capture data from primary, ordinary, and advanced level school students in Sri Lanka. A seven-point Likert scale with extremes "Strongly Disagree—1" to "Strongly Agree—7" was used for the fourth section of the questionnaire. Since the survey is based on primary data, validity and reliability tests were done for the data collected.

### Research framework and hypothesis

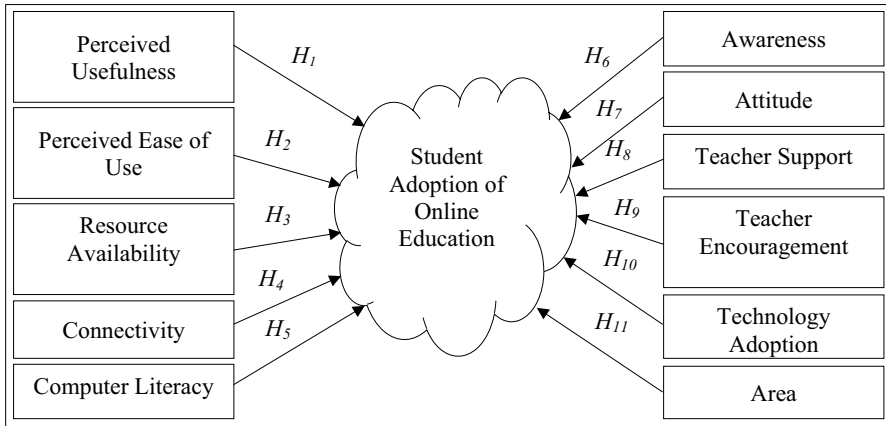
The research framework was developed based on the literature review (Fig. 2).

The following eleven arguments have been developed based on the research framework.

**Hypothesis 1** Perceived usefulness has a positive impact on the adoption of online education in rural areas in Sri Lanka.

**Hypothesis 2** Perceived Ease of Use has a positive impact on the adoption of online education in rural areas in Sri Lanka.

**Hypothesis 3** Resource availability has a positive impact on the adoption of online education in rural areas in Sri Lanka.



**Fig. 2** Research framework for adoption of online education

**Hypothesis 4** Connectivity has a positive impact on the adoption of online education in rural areas in Sri Lanka.

**Hypothesis 5** Computer Literacy has a positive impact on the adoption of online education in rural areas in Sri Lanka.

**Hypothesis 6** Awareness of the students has a positive impact on the adoption of online education in rural areas in Sri Lanka.

**Hypothesis 7** Student attitude has a positive impact on the adoption of online education in rural areas in Sri Lanka.

**Hypothesis 8** Teachers' support has a positive impact on the adoption of online education in rural areas in Sri Lanka.

**Hypothesis 9** Teachers' encouragement has a positive impact on the adoption of online education in rural areas in Sri Lanka.

**Hypothesis 10** Technology Adoption has a positive impact on the adoption of online education in rural areas in Sri Lanka.

**Hypothesis 11** Area has a positive impact on the adoption of online education in rural areas in Sri Lanka.

The above hypotheses were arrived at based on the research framework which is an author's construct.

## Methodology

Cronbach's alpha method was used to measure the internal reliability of the responses and tabulated. Descriptive statistics of eleven independent variables and the dependent variable in Eq. 2 were calculated prior to hypothesis testing. The researchers used ordered probit regression model which Aitchison and Silvey introduced in 1957 to model categorical response data and later used it in many studies according to the past literature in achieving similar research objectives. Hence, it is reasonable to assume that the model is effective in this study and the validity of findings are reliable.

Ordered probit regression is a way of performing regression as a generalisation of the widely used probit analysis for more than two outcomes of an ordinal dependent variable (Aitchison & Silvey, 1957). In this case, having three possibilities such as low, moderate, or high to categorise the respondent's adoption of online education. The ordered probit model was developed with three categorical groups ( $k=3$ ) as follows based on the student adoption of online education.

Group 1 ( $y = 0$ ): low = mean value of the student adoption less than 3.5 (mean value of Student Adoption  $< 3.5$ )

Group 2 ( $y = 1$ ): moderate = mean value of the student adoption greater than or equal 3.5 and less than 5 ( $3.5 \leq$  mean value of the Student Adoption  $< 5$ )

Group 3 ( $y = 2$ ): high = mean value of the student adoption greater than or equal 5 (mean value of Student Adoption  $\geq 5$ )

The general equation of the ordered probit is mentioned below.

$$y_i^* = x_i' \beta + \varepsilon_i \quad (1)$$

where  $y_i$  is the dormant variable measuring the impact of  $i$ th adoption of online education;  $x_i$  is a vector of independent variables,  $\beta$  is a vector of the unknown parameters and  $\varepsilon_i$  is a random-error term assumed to be normally distributed with zero mean. We estimate  $\beta$  such that  $\Pr [y_i = 1 | x_i] = \phi[x_i' \beta]$ , where  $\phi$  is the cumulative distribution function, by applying the maximum likelihood technique. Thus, the detailed specification of the ordered probit model is as follows.

$$Y(SAdo = 0, 1, 2) = X_i (\beta_0 + \beta_1 PUSse + \beta_2 PEOU + \beta_3 RAva + \beta_4 Conn + \beta_5 CLit + \beta_6 Awar + \beta_7 Atti + \beta_8 TSup + \beta_9 TEnc + \beta_{10} TAdo + \beta_{11} Area) + \varepsilon_i \quad (2)$$

Definitions of the above equation were indicated in Table 1 with the expected sign and include technology characteristics, adopter characteristics, infrastructure facilities, skills, support and location variables.

## Results and discussion

Analysis packages SPSS and Stata were used to analyse the collected data statistically. The reliability statistics of responses are presented in Table 2. Since the analysis is based on primary data, it is necessary to calculate reliability for internal consistency. Cronbach's alpha value is the most common measurement of reliability which assists researchers in

**Table 1** Variable definitions

Variable	Description	Expected sign(s)
<i>SAdo</i>	Dummy variable to denote the student adoption to the online education where low is denoted as 0, medium as 1 and high as 2	
<i>PUse</i>	How online education is perceived by the students. Seven-point Likert scale with extremes “ <i>Strongly Disagree-1</i> ” to “ <i>Strongly Agree-7</i> ” will be used	(+)
<i>PEOU</i>	Dummy variable to capture the perceived ease of use of the student. 1 is considered as extremely high; 0 otherwise	(+)
<i>RAva</i>	Dummy variables to capture the availability of resources to join online education. 1 is considered as extremely high availability; 0 otherwise	(+)
<i>Conn</i>	Dummy variable to capture the continuous power availability and a good internet connection to join online sessions. 1 is considered as extremely satisfied with the connectivity; 0 otherwise	(+)
<i>CLit</i>	Dummy variable to capture the computer literacy of the participant. 1 is considered as extremely high literacy; 0 otherwise	(+)
<i>Awar</i>	Dummy variable to capture the awareness of the student. 1 is considered as extremely high awareness; 0 otherwise	(+)
<i>Atri</i>	Seven-point Likert scale variable with extremes “ <i>Strongly Disagree-1</i> ” to “ <i>Strongly Agree-7</i> ” to measure the attitude of the participant	(+)
<i>TSup</i>	Dummy variable to capture the support given by teachers. 1 is considered as extremely high support; 0 otherwise	(+)
<i>TEnc</i>	Dummy variable to capture the encouragement given by teachers to the student. 1 is considered as extremely high encouragement; 0 otherwise	(+)
<i>TAdo</i>	Dummy variable to capture the capability to adapt to new technologies. 1 is considered as extremely high capability; 0 otherwise	(+)
Geographical location		
<i>Area</i>	Dummy variable for urban and rural sectors. 1 for urban sector; 0 otherwise	(±)

The forward stepwise regression technique selects the significant variables

**Table 2** Internal consistency

Item	Observation	Number of items	Cronbach's alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SAdo	414	6	0.875	0.650	0.771
Conn	414	2	0.709	0.524	0.804
PUse	414	6	0.821	0.693	0.765
RAva	414	2	0.444	0.444	0.815
Awar	414	2	0.601	0.580	0.791
Atti	414	3	0.827	0.638	0.774

Source: Authors' calculation based on the primary data

ensuring internal consistency Cronbach (1951). Typically, a reliability coefficient greater than 0.7 indicates significant consistency Tang et al. (2021).

There are eleven independent variables and one dependent variable in the model. Six variables, including one dependent variable and five independent variables with more than one question<sup>1</sup> were tested to calculate Cronbach's alpha. Since the RAva, Conn and Atti variables are different constructs, the study removed those variables and recalculate the Cronbach's alpha which is 0.781 as indicated in Supplementary Information SI2. Hence, it indicated that the data gathered from the survey are reliable to conduct the next level analysis.

Descriptive statistics of the twelve variables, including eleven independent variables and one dependent variable were indicated in Supplementary Information SI3. Results are estimated based on the ordered probit regression model to achieve the key research objective, i.e., the impact of selected variables on adopting online education in rural areas in Sri Lanka. The survey data used for the estimation included 414 students in Sri Lanka. The initial ordered probit model of Eq. 2 was estimated using all eleven independent variables and the results are shown in Supplementary Information SI4.

For the variable selection for the final ordered probit model, the forward stepwise technique was adopted with  $p$ -value  $< 0.10$  and previously selected variables for removal with  $p$ -value  $\geq 0.15$ . Insignificant variables such as resource availability, connectivity, area, teacher support, teacher encouragement, computer literacy, and perceived ease of use were excluded when arriving at the final ordered probit model. The estimated results of the final ordered probit regression model are presented in Table 3. Marginal effects calculated separately for low, moderate, and high groups, provide an interpretation of the substantive effects of independent variables. A goodness-of-fit statistic, the adjusted log likelihood index ratio, and the number of observations are also indicated.

The marginal effects of the attitude reveal that a 1% increase in the attitude of the students leads to a decrease in the probability of being low adoption by 0.16 percentage points for the low group. Furthermore, increase the adoption of moderate students by 0.05 percentage points and 0.11 percentage points in moderate and higher categories, respectively. The student adoption is better (from low to moderate to high) with a high attitude. Marginal effects for the low group reveal that the attitude factor highly contributes to the decrease of the low adoption with a 1% significance level. Considering the students' characteristics,

<sup>1</sup> PEOU, Clit, TSup, TEnc, TAdo, and Area were not tested to calculate Cronbach's alpha.

**Table 3** Final ordered probit regression results

Variable	Estimate	Robust SE	Marginal effects (in percentages)		
			Low (y=0)	Moderate (y=1)	High (y=2)
Atti	0.4643***	0.0559	- 0.1639***	0.0506***	0.1133***
PUse	0.3583***	0.0580	- 0.1265***	0.0390***	0.0875***
Awar	0.2743**	0.1409	- 0.0960**	0.0282**	0.0678*
NTAd	0.2630**	0.1360	- 0.0934**	0.0304*	0.0631**
Ancillary parameters			Marginal effects after stepwise		
Low	3.1841	0.2579	0.3105	0.5287	0.1608
Moderate	4.6699	0.3050			
Pseudo R <sup>2</sup>	0.7975				
Log likelihood	- 316.6141				
Number of observations	414				

Authors' calculation based on the primary data

\*\*\*Significant at the 1% level; \*\*Significant at the 5% level; \*Significant at the 10% level

attitude is an important factor in determining the level of adoption. The above findings were similar to the analysis conducted by Naveed et al. (2020) and Ismaili (2021), where student attitude was found to be significantly associated with the student adoption of the e-learning system. Hence, results prove that students should be motivated to improve their attitude to gradually take them towards higher online adoption. Inculcating an optimistic attitude among students will have positive results in higher adoption in online learning. The negative attitudes of the students will result in an unfavourable impact on the adoption of online education (Kisanga, 2016). When considering the results, it is obvious that when attitude improves favourably, it makes a significant contribution to moving them upwards from the lower category to the higher category.

A 1% increase in the perceived usefulness of students leads to a decrease in the probability of being low adoption by 0.12 percentage points for the low group. Moreover, a 1% increase in the perceived use of students leads to an increase in the probability of being high adoption by 0.03 percentage points and 0.08 percentage points for the moderate and high groups, respectively. Student adoption is better (from low to moderate to high) with high perceived usefulness. Marginal effects for the low group reveal that the perceived use of students highly contributes to the decrease of low adoption, which is highly significant at the 1% level. The above findings were confirmed in analyses by Mutambara and Bayaga (2021) and Yan et al. (2021), where perceived usefulness is statistically significant. Results indicate the importance and the need to enlighten the students to enhance their perceived usefulness to enable them to transition to higher adoption gradually. Necessary actions are mandatory to realise the students' perceived usefulness, which is likely to result in higher adoption. When considering Asian countries like Sri Lanka, most students prefer physical classroom-based education, which shows that students are unaware of the perceived use of online education.

Moreover, a 1% increase in the students' awareness leads to a decrease in the probability of low adoption by 0.09 for the low group. Marginal effects for the low group reveal that the students' awareness has a considerable contribution to decreasing the low adoption. Furthermore, a 1% increase in the students' awareness leads to an increase in the probability

of high adoption by 0.02 percentage points and 0.06 percentage points for the moderate and high groups, respectively. The research conducted in India by Bordoloi et al. (2021) tested the awareness level of the research participants on various aspects. This respective study has tested the awareness level of online educational applications, including Zoom, Microsoft Teams, and Google Meet. Findings revealed that necessary training aligned with practical sessions should be provided even during the pandemic. This recommendation was supported by Naveed et al. Moreover, findings revealed that most of the students were not aware of the benefits provided by online education.

Furthermore, a 1% increase in the technology adoption capability of the students leads to a decrease in the probability of low adoption by 0.09 for the low group. Marginal effects reveal that the new technology adoption capability of students has a considerable contribution to the decrease of the low adoption. Furthermore, a 1% increase in the technology adoption of the students leads to an increase in the probability of high adoption by 0.03 percentage points and 0.06 percentage points for the moderate and high groups, respectively. Yan et al. (2021) stated that students in low digital readiness countries may experience problems related to technology compared to developed countries. The researchers argue that to promote online education and acquire its benefits, a country should concentrate extensively on digital readiness.

Online education is a newer concept in most developing countries, including Sri Lanka. Therefore, this study sought to determine the factors affecting the adoption of online education in rural Sri Lanka areas. It is evident from the results of this study that the adoption of online education from factors can bring in strong positive impacts like attitude, perceived usefulness, awareness, and technology adoption. Further, results point out to some key challenges such as negative attitudes, unperceived usefulness, vulnerable awareness, and poor technology adoption among these respondents. Most of these challenges are not taken up at the formal level and are well managed by educational organisations. Hence, the expected learning outcomes will not be achieved due to this reluctance. Thus, appropriate actions should be taken by the responsible government and non-governmental authorities to improve the positive attitudes of the students, acknowledge the perceived usefulness of online education, more effort must be put in to increase awareness of students, and increase technology adoption capabilities of the students.

Interestingly, one participant expressed his ideas in the research conducted by Dube (2020) that this online learning concept is like giving someone the pots to cook without giving them food and expecting that you have addressed their desires. *According to available information, no attempts were taken by the government to promote this successful remedy to face pandemic situations. From a developing country's perspective, disruptions to the education system are not favourable in the long term. Nevertheless, it should be stressed that the current physical classroom-based education has been disrupted due to the pandemic and beyond authorities' control. In this scenario, as noted previously, online education is one of the effective and feasible alternatives to continue education delivery, which is not impeded by the pandemic as well.* Oyedotun (2020) too, affirmed that due to the COVID-19 pandemic, a sizeable transition to online education in developing countries has not just exposed benefits, but also some inequalities and challenges. These inequalities and challenges have created new opportunities in the educational sector of developing countries. Most developing countries including Sri Lanka struggle to convert these opportunities into realities while facing the pandemic.

The facts mentioned above prove that this study can be used in all developing countries and non-developed countries as a guideline to develop their educational system. Future researchers can use this conceptual framework as a base or to measure the factors affecting

to online education in their countries and implement policies with the aid of research results.

There are three main players (teachers, students and parents) in any kind of educational system. When considering the online educational system, the teacher should be fully aware of the technology as the teacher is not only the mentor but also the coach. The main challenge in the rural online education is the lack of technological awareness of the teachers. A few teachers were observed to be competent with the use of technology. "Train the trainer" concept can be a very important concept in such situation. The few teachers who are competent with technical knowledge associated with online learning can be used to educate the others in the school or educational zones. It is highly practical to address this issue in the context of the school as it is the smallest unit when compared to educational zones.

The three key important players, the public sector, private sector, and civil society can act on their own as well as collectively on the above mentioned key issues, as this is the best time for collaboration, synergies and mutual benefits. Clear objectives and workable action plans can avoid unconquerable barriers associated with online education. Therefore, efforts must be made to address the issues hampering rural area student adoption. This calls for the government for a comprehensive policy in favour of e-learning implementation that offers a multitude of features to overcome the adverse impacts noted in this regard. Accordingly, such policies will be accepted by all the institutions and major stakeholders.

## Conclusion and policy implications

The main objective of this study was to identify the factors affecting the adoption of online education in rural areas in Sri Lanka. Researchers intended to undertake studies in this ontological area are highly neglected in rural Sri Lanka. As such, researchers' efforts will provide a new epistemological stance in this area. By doing so, online adoption in rural areas is likely to receive more concern and attention from the related parties. The findings of this study will be helpful for responsible educational institutions and authorities to address and contribute to the key issues such as low perceived use, poor attitude, low awareness, and poor technology adoption. Accordingly, the government and the MOE can develop well-defined policies for which, this research can be a guideline. Finally, rural area students will be highly benefitted from this research. One reason is that the rural areas student population is relatively more underprivileged than those in urban areas. Hence, they are more vulnerable to adapting to sudden changes in education delivery. The other reason is that the factors mentioned in this study such as attitude etc., are comparatively significant among rural students, teachers and parents, thus, distancing them more from online adoption. These two reasons discussed can occur separately or simultaneously, whereas with the latter, the severity of the issue further intensifies.

From the Sri Lankan context, the one size fits all concept is not applicable to meet the current situations with challenges. Hence, before the execution of online education, above mentioned variables should be considered where the potential issues can be addressed in advance. Moreover, the low adoption for online education in rural areas needs to be addressed based on the observations and issues faced by the rural area affected by this issue. Here, one rural area may have its circumstances and face issues that are unique, which may differ from those in another area. Therefore, it can be recommended to handle issues in rural areas on a case by case basis, but not with a common solution as noted previously. Most developed countries may initiate immediate online and remote teaching during a disaster as the most feasible



option that is not impeded by social distancing rules imposed to curb the virus spread. Though the situation of developed countries is satisfactory, the same aspects or benefits may not apply to developing countries like Sri Lanka due to the lack of digital awareness, which can be highlighted as a major threat to the successful adoption of online education.

Meanwhile, government and educational institutes should follow digital transformation technologies by implementing policies, the use of low-cost technologies, awareness sessions, and capacity building techniques. Hence, this study can be referred to as a guide to obtain awareness about the students' perceptions of online education. Along with these strategies and interventions, a roadmap could be prepared at the policy level, and a quality online education platform could be developed to help students to benefit from any crisis at present as well as in the future. This is even more valid in the case of rural students, who are proven to be vulnerable in disaster situations, where a large gap remains to be closed to successfully reach online education adoption. All in all, the final outcome would be an effective and enjoyable learning experience. Moreover, there is potential for knowledge sharing features, clarification on subject matters on FAQs, user-friendly learning approaches etc., which are not feasible in regular classroom-based learning. It is noteworthy that those who resist online education adoption are not aware of these exclusive features of online mode, mainly due to their poor attitude and resistance.

The significant explanatory variables can be considered as challenges to the adoption of online education. All these challenges can be converted into opportunities for actors in the education sector, i.e. educational institutes, regulatory authorities such as the MOE to strengthen the overall education system in Sri Lanka through enhancing technical knowledge and infrastructure. All these efforts will be beneficial to overcome similar pandemic situations and disasters in the future. Furthermore, this study can support the government and the management of educational institutions with evidence-based insights for decision making on online learning adoption.

## Limitations

The research will primarily focus on the factors affecting the adoption of online education in Sri Lanka, with a special emphasis on rural areas. One limitation of the study is that the study did not consider the validation of multiple unidimensional instruments. Moreover, the research does not focus on the prolonged and continuous usage of the facilities and the factors affecting the same. Moreover, a lack of access was encountered due to the pandemic situation. Therefore, the research was carried out as an online survey and out of 25 districts only 16 were considered.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s11423-023-10201-8>.

**Data availability** The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

## Declarations

**Conflict of interest** All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

## References

- Acharya, B., & Lee, J. (2018). Users' perspective on the adoption of e-learning in developing countries: The case of Nepal with a conjoint-based discrete choice approach. *Telematics and Informatics*, 35(6), 1733–1743. <https://doi.org/10.1016/j.tele.2018.05.002>
- Aderibigbe, S. A. (2021). Can online discussions facilitate deep learning for students in General Education? *Heliyon*, 7(3), 1–6. <https://doi.org/10.1016/j.heliyon.2021.e06414>
- Aitchison, J., & Silvey, S. D. (1957). The generalization of probit analysis to the case of multiple responses. *Biometrika*, 44(1–2), 131–140. <https://doi.org/10.1093/biomet/44.1-2.131>
- Al-Huneini, H., Walker, S. A., & Badger, R. (2020). Introducing tablet computers to a rural primary school: An activity theory case study. *Computers & Education*, 143, 1–10. <https://doi.org/10.1016/j.compedu.2019.103648>
- Alshurafat, H., Al Shbail, M. O., Masadeh, W. M., Dahmash, F., & Al-Msiedeen, J. M. (2021). Factors affecting online accounting education during the COVID-19 pandemic: an integrated perspective of social capital theory, the theory of reasoned action and the technology acceptance model. *Education and Information Technologies*, 26(6), 6995–7013. <https://doi.org/10.1007/s10639-021-10550-y>
- Antee, A. (2021). Student perceptions and mobile technology adoption: implications for lower-income students shifting to digital. *Educational Technology Research and Development*, 69(1), 191–194. <https://doi.org/10.1007/s11423-020-09855-5>
- Boateng, R., Mbokoh, A. S., Boateng, L., Senyo, P. K., & Ansong, E. (2016). Determinants of e-learning adoption among students of developing countries. *The International Journal of Information and Learning Technology*, 33(4), 248–262. <https://doi.org/10.1108/IJILT-02-2016-0008>
- Bordoloi, R., Das, P., & Das, K. (2021). Perception towards online/blended learning at the time of Covid-19 pandemic: an academic analytics in the Indian context. *Asian Association of Open Universities Journal*, 16(1), 41–60. <https://doi.org/10.1108/AAOUJ-09-2020-0079>
- Chesney, T. (2006). An acceptance model for useful and fun information systems. *Human Technology: an Interdisciplinary Journal on Humans in ICT Environments*, 2(2), 225–235. <https://doi.org/10.17011/ht/urn.2006520>
- Churi, P., Mistry, K., Asad, M. M., Dhiman, G., Soni, M., & Kose, U. (2022). Online learning in COVID-19 pandemic: an empirical study of Indian and Turkish higher education institutions. *World Journal of Engineering*, 19(1), 58–71. <https://doi.org/10.1108/WJE-12-2020-0631>
- CISCO (2019). Digital readiness index 2019. Retrieved Oct 27, 2021, From [https://www.cisco.com/c/m/en\\_us/about/corporate-social-responsibility/research-resources/digital-readiness-index.html#Technology%20Adoption](https://www.cisco.com/c/m/en_us/about/corporate-social-responsibility/research-resources/digital-readiness-index.html#Technology%20Adoption)
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297–334. <https://doi.org/10.1007/BF02310555>
- DATAREPORTAL (2021). Digital 2021: Sri Lanka Retrieved Oct 27, 2021 From <https://datareportal.com/reports/digital-2021-sri-lanka>
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>
- Dube, B. (2020). Rural online learning in the context of COVID-19 in South Africa: Evoking an inclusive education approach. *Multidisciplinary Journal of Educational Research*, 10(2), 135–157.
- Dündar, H., & Akçayır, M. (2014). Implementing tablet PCs in schools: Students' attitudes and opinions. *Computers in Human Behavior*, 32, 40–46. <https://doi.org/10.1016/j.chb.2013.11.020>
- Escobar Fandiño, F. G., & Silva Velandia, A. J. (2020). How an online tutor motivates E-learning English. *Heliyon*, 6(8), 1–7. <https://doi.org/10.1016/j.heliyon.2020.e04630>
- Gunawardana, K. D. (2017). *An empirical study of potential challenges and benefits of implementing e-learning in sri lanka*.
- Hewagamage, K. P., Maddawin, A., Garcia, M., & Hayashi, R. (2020). Online learning in Sri Lanka's higher education institutions during the COVID-19 pandemic. *Asian Development Bank*, 2021(151), 1–12. <https://doi.org/10.22617/brf200260-2>
- Ismaili, Y. (2021). Evaluation of students' attitude toward distance learning during the pandemic (Covid-19): a case study of ELTE university. *On the Horizon*, 29(1), 17–30. <https://doi.org/10.1108/OTH-09-2020-0032>
- Jesuiya, D., & Priyadarshani, H. D. C. (2020). *Impact on online teaching learning process during covid-19: With reference to Faculty of Education, The Open University of Sri Lanka*.
- Kisanga, D. H. (2016). Determinants of Teachers' Attitudes Towards E-Learning in Tanzanian Higher Learning Institutions. *The International Review of Research in Open and Distributed Learning*. <https://doi.org/10.19173/irrodl.v17i5.2720>

- Li, Y., & Ranieri, M. (2013). Educational and social correlates of the digital divide for rural and urban children: A study on primary school students in a provincial city of China. *Computers & Education*, 60(1), 197–209. <https://doi.org/10.1016/j.compedu.2012.08.001>
- Lucas, G. N. (2020). COVID-19 pandemic and school education. *Sri Lanka Journal of Child Health*, 49(3), 207–209. <https://doi.org/10.4038/sljch.v49i3.9135>
- Luu, T. M. V. (2022). Readiness for Online Learning: Learners' Comfort and Self-Directed Learning Ability. *International Journal of TESOL & Education*, 2(1), 213–224. <https://doi.org/10.54855/ijte.222113>
- Ministry of Education (2020). Annual school census of sri lanka. Retrieved Jul 06, 2021, From <http://www.statistics.gov.lk/Education/StaticInformation/SchoolCensus/2020>
- Mutambara, D., & Bayaga, A. (2021). Determinants of mobile learning acceptance for STEM education in rural areas. *Computers & Education*, 160, 1–33. <https://doi.org/10.1016/j.compedu.2020.104010>
- Naveed, Q. N., Qureshi, M. R. N., Tairan, N., Mohammad, A., Shaikh, A., Alsayed, A. O., Shah, A., & Alo-taibi, F. M. (2020). Evaluating critical success factors in implementing E-learning system using multi-criteria decision-making. *PLoS ONE*, 15(5), e0231465. <https://doi.org/10.1371/journal.pone.0231465>
- Ndzinisa, N., & Dlamini, R. (2022). Responsiveness vs. accessibility: pandemic-driven shift to remote teaching and online learning. *Higher Education Research & Development*. <https://doi.org/10.1080/07294360.2021.2019199>
- Oyedotun, T. D. (2020). Sudden change of pedagogy in education driven by COVID-19: Perspectives and evaluation from a developing country. *Research in Globalization*, 2, 1–5. <https://doi.org/10.1016/j.res-glo.2020.100029>
- Taber, K. (2011). *Constructivism as educational theory: Contingency in learning, and optimally guided instruction Educational Theory* (pp. 39–61). Nova.
- Tang, Y. M., Chen, P. C., Law, K. M. Y., Wu, C. H., Lau, Y. Y., Guan, J., He, D., & Ho, G. T. S. (2021). Comparative analysis of student's live online learning readiness during the coronavirus (COVID-19) pandemic in the higher education sector. *Computers & Education*, 168, 1–17. <https://doi.org/10.1016/j.compedu.2021.104211>
- Tarhini, A., Hone, K., & Liu, X. (2013a). Factors affecting students' acceptance of e-learning environments in developing countries: A structural equation modeling approach. *International Journal of Information and Education Technology*, 3, 54–59. <https://doi.org/10.7763/IJIE.T.2013a.V3.233>
- Tarhini, A., Hone, K., & Liu, X. (2013b). User acceptance towards web-based learning systems: Investigating the role of social, organizational and individual factors in european higher education. *Procedia Computer Science*, 17, 189–197. <https://doi.org/10.1016/j.procs.2013b.05.026>
- The World Bank (2020a). Lessons for education during the COVID-19 crisis. Retrieved Oct 24, 2021, From <https://www.worldbank.org/en/topic/edutech/brief/lessons-for-education-during-covid-19-crisis>
- The World Bank (2020b). Remote learning and COVID-19. Retrieved Apr 15 2021, From <http://documents1.worldbank.org/curated/en/266811584657843186/pdf/Rapid-Response-Briefing-Note-Remote-Learning-and-COVID-19-Outbreak.pdf>
- UNESCO (2018). Education and literacy, Sri Lanka. Retrieved Oct 27 2021, From <http://uis.unesco.org/en/country/lk?theme=education-and-literacy>
- Yan, L., Whitelock-Wainwright, A., Guan, Q., Wen, G., Gašević, D., & Chen, G. (2021). Students' experience of online learning during the COVID-19 pandemic: A province-wide survey study. *British Journal of Educational Technology*, 2021(00), 1–20. <https://doi.org/10.1111/bjet.13102>
- Zhang, L., Carter, R. A., Jr., Qian, X., Yang, S., Rujimora, J., & Wen, S. (2022). Academia's responses to crisis: A bibliometric analysis of literature on online learning in higher education during COVID-19. *British Journal of Educational Technology*, 53(3), 620–646. <https://doi.org/10.1111/bjet.13191>

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