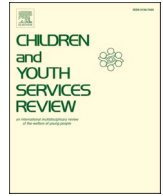




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## Adaption of distance learning to continue the academic year amid COVID-19 lockdown

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### ABSTRACT

This work investigates the use of distance learning in saving students' academic year amid COVID-19 lockdown. It assesses the adoption of distance learning using various online application tools that have gained widespread attention during the coronavirus infectious disease 2019 (COVID-19) pandemic. Distance learning thrives as a legitimate alternative to classroom instructions, as major cities around the globe are locked down amid the COVID-19 pandemic. To save the academic year, educational institutions have reacted to the situation impulsively and adopted distance learning platforms using online resources. This study surveyed random undergraduate students to identify the impact of trust in formal and informal information sources, awareness and the readiness to adopt distance learning. In this study, we have hypothesized that adopting distance learning is an outcome of situational awareness and readiness, which is achieved by the trust in the information sources related to distance learning. The findings indicate that trust in information sources such as institute and media information or interpersonal communication related to distance learning programs is correlated with awareness ( $\beta = 0.423$ ,  $t = 12.296$ ,  $p = 0.000$ ) and contribute to readiness ( $\beta = 0.593$ ,  $t = 28.762$ ,  $p = 0.001$ ). The structural model path coefficient indicates that readiness strongly influences the adoption of distance learning ( $\beta = 0.660$ ,  $t = 12.798$ ,  $p = 0.000$ ) amid the COVID-19 pandemic. Our proposed model recorded a predictive relevance ( $Q^2$ ) of 0.377 for awareness, 0.559 for readiness, and 0.309 for the adoption of distance learning, which explains how well the model and its parameter estimates reconstruct the values. This study concludes with implications for further research in this area.

### 1. Introduction

Distance learning has revolutionized education; the terminology describes many types of teaching situations (Jowsey, 2020; Qazi, 2021). The use of distance learning dates back to the use of correspondence based studies in Europe (Valentine, 2002; Diacopoulos and Crompton,

2020). However, the emergence of the internet and online learning applications such as Zoom, Microsoft teams, Google classroom, and others has revolutionized distance learning protocols in online teaching using the internet. The global COVID-19 pandemic has led to a shutdown of cities worldwide. Closure of educational institutes was the first step to restrict mass gatherings and enforce social distancing practices

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(UNESCO, COVID-19 Impact on education., 2020; Sahu, 2020; Wikipedia, Impact of the, 2020). As the world continues to battle the infectious disease, vaccines are now available, but only for the frontline workers and old aged people (Dooling, 2020). In this scenario, when students do not have readily available access to the COVID-19 vaccine, experts fear that some nations might have to adopt social distancing until as far as 2022. The concept of distance learning using online teaching has emerged as a guiding light in this tumultuous situation (Wilder-Smith and Freedman, 2020; Bank, 2020; Pearson, 2020). The education sector reacts to an impulsive shift to distance learning using online resources (Siddiqui, 2020; Learning, C.W.o., Keeping the doors of learning open COVID-19., 2020; Toh and Kirschner, 2020). Since the beginning of the COVID-19 pandemic, the world has seen a sudden surge in online management software, helping educators manage and deliver lectures amid lockdown (Noveet, 2020; Beauford, 2020).

In unprecedented times such as the one created by the COVID-19 pandemic, students are vulnerable to suffering in academics, socializing, and career lapses. However, the adoption of distance learning technologies to continue the academic calendar emerged as the best make-shift solution amid the COVID-19 pandemic (Wilder-Smith and Freedman, 2020; Bank, 2020; Pearson, 2020). It helps to implement important preventive measures, i.e., social distancing and quarantine and saves students' precious time. Besides, online education provides access to educational resources for developed nations and those who have nothing to do, with no access to entertainment, recreational areas and friends (Siddiqui, 2020; Learning, C.W.o., Keeping the doors of learning open COVID-19., 2020; Qazi, 2020). The adoption of distance learning technology by educational institutes worldwide has highlighted the significance of adopting routinely measures that ensure that a consolidated online system is available at every educational institute to meet students' needs during times of unprecedented turmoil. We tested the proposed model against data collected in the pandemic's high peak to examine how trust in information sources (formal/informal) such as institutes and media information or interpersonal communication is associated with adopting particular behaviour, e.g., distance learning. Furthermore, we have performed sentiment analysis against students' responses. Sentiment analysis helps gain an overview of the wider public opinion expressed in various languages behind certain topics (Abo et al., 2019; Yang et al., 2020; Qazi, 2016).

Our findings can aid the government and other public educational managers with the acceptance, behaviour and trust of their populace concerning distance learning, and in turn, suggesting the best strategies to help the education sector during a public health emergency.

## 2. Background and hypothesis development

In this work context, trust can be defined as a firm belief in the reliability and truth of the information related to distance learning sources to manage and deliver distance learning effectively. This research intends to highlight the significance of trust in information on the emerging event, e.g., distance learning sources and their association with awareness and readiness amid the COVID-19 pandemic. Previous studies support the fact that perceived information trust influences the utility of given information sources (Calman, 2002). Situational awareness in the epidemic is derived from previous public information that has risen from formal and informal information sources. Formal sources include institute, government and media information; informal sources include social sources observation, family, peers and neighbours (Voeten, 2009; Ali, 2020; Thomas, 2020). Besides, stakeholders' perceived knowledge and efficacy beliefs contribute to awareness and access, while experience and familiarity contribute to readiness. These have been considered the driving factors for technology adoption in education and other domains (Hirai, 2011; Sabah, 2016; Okai-Ugbaje et al., 2020; Huff and Gosha, 2018; Bandura et al., 1999; Meisels, 1998). This provides the grounds to establish the relationship between information sources, awareness and readiness, which ultimately

influences adoption behaviour, e.g., distance learning. Therefore, we hypothesized that trust in information sources related to distance learning is directly correlated to awareness and the readiness to adopt a health-protective behaviour, e.g., adoption of distance learning (ADL) amid the COVID-19 pandemic. We used the first level of situational awareness theory (SAT) in conjunction with readiness and adoption from the technology acceptance model (TAM) (Ensley, 1995; Davis, 1993; Lin et al., 2007). The TAM is frequently used to predict technology's adoption in educational environments (Almasri, 2014; Iqbal and Ahmed Bhatti, 2015).

According to the Endsley model, this theory (SAT) is widely used by researchers to increase awareness of managing healthcare emergencies (Stubbings et al., 2012; Cooper, 2010; Qazi, 2020; Mittelmeier, 2019). It is further integrated with technology readiness (TR) and adopting the e-service system (Huff and Gosha, 2018; Acheampong, 2017). It was reported that information influences one's situational awareness. We report a theoretical model that incorporates awareness (perceived understanding), readiness (experience, access, familiarity) and adoption of distance learning (Fig. 1). However, no detailed study using a combination of these variables for online learning amid COVID-19 has been conducted to date. Therefore, we developed the study underlying theoretical and logical support for their potential importance in the context of COVID-19.

We tested this model against data collected in the peak phase of the COVID-19 pandemic to examine how the trust in risk prevention information in academic scenarios is associated with distance learning adoption. In this research, we have investigated and analyzed the adoption of distance learning among college students during the COVID-19 pandemic for several salient purposes. The first is to evaluate college students' trust in information sources related to distance learning during the COVID-19 pandemic and provide a theoretical basis to adopt interferences with college students and deliver a basis for the declaration of national policies.

## 3. Method

### 3.1. Study design

The survey questionnaire was developed for response estimation on a 5-point Likert scales ranging from 1 for strongly disagree to 5 for strongly agree. Respondents were asked to rate the perceived level of effectiveness of 17 items on distance learning practices amid COVID-19. Furthermore, the development of study items is based on research on trust in information related to distance learning amid COVID-19, situational awareness and readiness that advises learners to develop individual beliefs that influence acceptance of behaviour related to the specific situation underlying the existing literature (Iqbal and Ahmed Bhatti, 2015; Qazi, 2020; xxx; Liao, 2010; Grandison and Sloman, 2000; Chapnick, 2000; Antonietti et al., 2008; Alaeddin and Altounjy, 2018; Ngai et al., 2007; Mohammadi, 2015).

The final section of the survey included open-ended responses. Respondents were asked to express their opinions on distance learning to continue education when being put into self-isolation or mandatory quarantine (at home). The questionnaire was distributed among various provinces in Pakistan and reviewed by three PhD students and two virologists for constructing items and contextual relevance. An online link was then generated to collect responses.

### 3.2. Data collection

The population was randomly sampled from college students to record their opinions that are important to find the facts on a certain situation (Qazi, 2014; Qazi, 2017; Qazi, 2021). A structured questionnaire was exploited to record the responses during the COVID-19 lockdown. A total of 220 responses were recorded anonymously, from which a total of 150 valid responses amounted to a 68.2% response rate for the open-

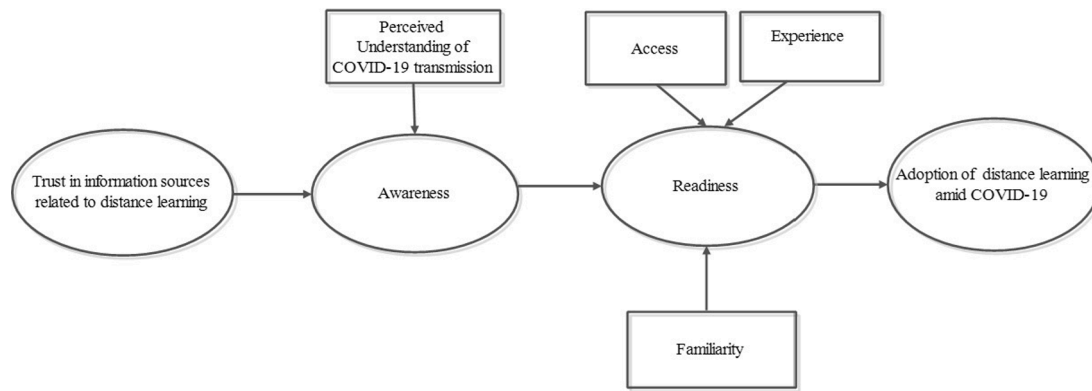


Fig. 1. Proposed distance learning adoption model.

ended questions.

3.3. Data analysis

The measurement model was conducted to determine the validity and reliability of the constructs. This approach is appropriate to test the hypotheses by conducting path analyses. The study’s suggested model was tested using PLS Smart Version 3, which tests causal models using philosophical and influential constructs (Baron and Kenny, 1986; Temme et al., 2006; Davenport and Prusak, 1998; Davis et al., 1989). It is a 2-step analysis comprising measurement and structural model assessments. Furthermore, to determine students’ sentiment amid COVID-19 with the use of textual analysis, sentiment analysis was performed on the 150 open-ended question responses. The manual card sorting approach was used to classify the sentiments into positive, negative and neutral classes (Hudson, 2005; Qazi, 2017; Qazi, 2014). Charts and word clouds were then used to visualize the classification and denote the opinion occurrences’ frequency.

3.4. Ethical consideration

All participants were informed about the study’s purpose before getting involved in the study, and we have received voluntarily informed consent from all the participants.

4. Results

The study model was analyzed using a PLS-Graph. The initial screening of data and factor analysis were carried out using SPSS. The Partial Least Squares (PLS) technique was employed to test the suggested model presented in Fig. 1. PLS is a well-established technique with path analytics modelling using latent variables (Baron and Kenny, 1986). It is used for assessing the theories at their stages for testing the causal models and supporting the assessment through both reflective and formative constructs (Qazi, 2020).

4.1. Measurement model

Construct validity, which is determined using both discriminants, and convergent validity, show that the constructs are well related. Three tests were used to show convergent validity. These were an item and composite reliability, along with average variance. Loading was estimated at or above 0.5. This indicates that the suitable reliability of an item explains 50% of the constructs. Results show that all reported items have loadings >0.5.

The reliability test results show robust internal consistency reliability, as indicated by composite reliability. The outcome ranges between 0.873 and 1.000, which exceeds the threshold of 0.70 (Nunnally, 1994). The outcome shows that CR’s value has satisfactory loadings for

internal consistency reliability (Table 1). Cronbach’s alpha provides composite reliability; values > 0.6 demonstrate adequacy. This study’s composite reliabilities lie around > 0.8 and Cronbach’s alpha > 0.7 (Table 1). Finally, the average variance extracted (AVE) is > 0.50, which justifies the item validity (Fornell and Larcker, 1981). It is thus concluded that the constructs have satisfactory convergent validity.

The discriminant validity outcome is reported based on Fornell and Lacker’s recommendation (Fornell and Larcker, 1981) Table 2 (a). AVE’s square roots are shown as matrix diagonals; these are all higher than off-diagonal elements, thus supporting our scales’ discriminant validity.

The heterotrait-monotrait (HTMT) ratio of correlation was introduced as a novel method of validating discriminant validity (Henseler et al., 2015). Table 2 (b) presents the results of testing our measure scales’ discriminant validity using the HTMT ratio. Specifically, an HTMT value of 0.85 is considered as a strict threshold to ensure discriminant validity. It is fair to conclude that the model has achieved internal consistency, convergent and discriminant validity, and, consequently, the structural model’s determination.

4.2. Structural model

The bootstrapping and percentile bootstrap confidence interval of 95% was used to assess a reliable path coefficient. Table 3 presents the structural model path coefficients. As shown from the table, all the path coefficients are highly significant and therefore accepted as supporting the predefined hypothesis. Specifically, the path coefficients between trust in formal & informal information > Awareness ( $\beta = 0.423, t = 12.296, p = 0.000$ ) were highly significant, hence, accepted.

Similarly, the path coefficients leading to readiness, namely; Awareness > Readiness ( $\beta = 0.593, t = 28.762, p = 0.001$ ), were highly significant and thus accepted. Finally, the path coefficient between the Readiness and ADL ( $\beta = 0.660, t = 12.798, p = 0.000$ ) was highly significant, hence, accepted.

Predictive relevance ( $Q^2$ ) was evaluated using the Stone-Geisser test. It is defined as the “degree of well-observed values that are reconstructed using the model and parameter estimates” (Urbach and Ahlemann, 2010).  $Q^2$  is recognized through blindfolding; its value > 0 signifies predictive relevance. In this study, predictive relevance values were 0.377 for awareness, 0.559 for readiness, and 0.309 for

Table 1  
Convergent Reliability.

Constructs	Cronbach’s Alpha	CR	AVE
Trust in formal & informal information	0.803	0.884	0.766
Awareness	0.910	0.873	0.754
Readiness	0.871	0.940	0.743
ADL	0.877	0.916	0.732



2020). During pandemics, trust leads to situational awareness, which leads to readiness, impacting the adoption of distance learning practices. Hence, the adoption of technology practices allows for a more flexible and convenient learning process (Denan, 2020) and maintains social distancing amid COVID-19.

The sentiment analysis outcome was mostly positive in adopting smart technology amid the COVID-19 pandemic for distance learning purposes. People feel that distance learning using online tools has helped them avoid at least one aspect contributing to fear and anxiety and saved an academic year using smart technology. The adoption of distance learning has emerged as a support for teachers and students alike. The findings are consistent with previous works (Toh and Kirschner, 2020; Gijsselaers, 2016). The majority of the respondents think positively of the adoption of distance learning, but some complained about connectivity issues in using online apps. The COVID-19 pandemic has highlighted the educational and internet divide like never before (xxxx). Finally, the study suggests that since reduced social mixing is demanded to control the spread of the COVID-19 pandemic, then the adoption of distance learning can play a vital role in making a good balance amid COVID-19. There is also a need to make the public aware and ready to adopt distance learning successfully.

### 6 Implications

The study demonstrated that the adoption of distance learning is an outcome of situational awareness and readiness, which is achieved by the trust in information sources. This finding underlines the need to heighten students' situational awareness, readiness, and distance learning adoption as a health-protective measure and learning without delay amid pandemic.

Awareness can be promoted using various learning activities to draw students' attention to activities that help them feel motivated (Qazi, 2020; Liao, 2010). Furthermore, education departments and instructors should become acquainted with strategy-based teaching to widen their tactic collections and upturn their self-confidence and capability in coaching pupils on how to use distance learning, especially amid public health emergencies. Research is required to examine instructors' current level of strategy and psychological awareness, their perception of the value of knowledge, technical and content readiness, and preparedness in teaching and learning, particularly with distance learning during public health emergencies COVID-19 pandemic.

Our findings suggest that institutes should acknowledge that trusting information sources can affect the adoption and future use of distance learning. The findings can increase the understanding of the formation of students' trust in online environments. Therefore, students should focus on learning technologies according to their requirements during the early stages of health emergencies. This study comes along with several limitations. Firstly, this study's findings cannot be generalized because of the small data size and coverage. Therefore, more research is needed to increase the generalizability of the findings of this research.

Moreover, research on the role of students' awareness of distance learning amid public health emergencies is extremely important. Therefore, research (such as focus group interviews) should be carried out to detect students' sources of the avoidance of distance learning while their level of readiness is satisfactory. Based on the findings, helpful action should be taken to help the education sector to enhance its learning strategies with technology amid public health emergencies such as the COVID-19 pandemic.

### 6. Conclusion

The only option available to the authorities is the closure of educational institutes during the pandemic. The adoption of distance learning allows us to maintain social distancing and stay protected while simultaneously learning amid COVID-19. However, to the best of our knowledge, no study has been conducted to evaluate the hypothesis that students' adoption of distance learning is an outcome of situational awareness and readiness achieved by the trust in information sources

related to distance learning. Therefore, tested the hypothesis, and the results reveal that trust in information sources is positively associated with awareness. The outcome of this survey also suggests that awareness is a contributing factor to readiness. The structural model path coefficient has indicated that readiness has a strong influence on adopting distance learning amid the COVID-19 pandemic. This study offers several implications for practitioners and policymakers and future work for researchers in this area. Given the importance of students' awareness and readiness during health emergencies, we predict our findings will be valuable to others who engage in this field's theory and practice. The study concludes that students and instructors should pay more attention to developing trust in information sources, situational awareness, and readiness to adopt distance learning amid pandemic when social distancing is imposed for future success.

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