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Examining the Pandemic Induced Adoption of E-Learning Through a UTAUT Model Approach

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Abstract: The Covid-19 pandemic's worldwide disruption has significantly impacted many facets of society, including education and learning. This seismic effect results from the urgent need to stop the virus from spreading, which calls for strong limitations on leaving one's home. This has resulted in the mass shutdown of industries, offices, schools, universities, theatres, parks, gymnasiums, and retail stores. Consequently, students across countries were forced to adopt e-learning at a mass scale to continue their education. This study uses a unified theory of acceptance and use of technology (UTAUT) model method to list the elements that led to the adoption of e-learning by Indian college students during the Covid-19 epidemic. The empirical study is based on an extensive literature review and an online survey of 162 undergraduate students at Delhi University, India. Regression analysis results show that the most significant predictors of students' preference for e-learning during the pandemic are their evaluations of performance expectancy, effort expectancy, facilitating conditions, and the social isolation brought on by the Covid-19 crisis. Furthermore, the Covid-19 epidemic is seen by students as the primary driver behind their adoption of e-learning. A sophisticated understanding of the complexities associated with adopting e-learning is likely to greatly assist in developing creative educational projects and policies in the future.

Introduction

E-learning is a network-enabled transfer of knowledge via electronic media that makes it a versatile, easy, and flexible way for users to learn anytime and anywhere. The prime components of e-learning are computers, laptops, desktops, tablets, e-books, smartphones, and the Internet. It has revolutionized the traditional teaching-learning style based on chalk, duster, board, and classroom by facilitating easier, simpler, relevant, updated, repetitive usage, prolific, quicker, flexible, round-the-clock, cheaper, personalized, self-paced, productive, and sustainable access (Verma and Bharati, 2023) of learning to the students on a mass scale. The digital revolution has changed the way in which content is accessed, consumed, discussed, learned, and shared (Mittal, 2020).

E-learning emerged as a lifeline for the entire teaching-learning fraternity after the closure of all educational institutions due to the Covid-19 pandemic (Tiwari, 2022; Yadav and Yadav, 2023) induced successive lockdowns across countries, including India. The central and state governments have taken numerous steps in India to compensate the learning loss of students during this time by providing free-of-cost access to different e-learning platforms, such as e-PG Pathshala, e-Adhyayan, MOOCS, e-Pathya, Swayam Prabha, TV Channels, Radio, DTH channels, e-textbooks, Open Access Resources, National Digital Library, E-ShodhSindhu, Virtual Labs, PRAGYATA, MANODARPAN (India Education Diary, 2020). Apart from this, printable study material, along with online video lessons and online add-on courses were made available in regional and national languages (Choudhury, 2020).

Academics have used different frameworks to interpret how end users assimilate and use developing technology (Marion et al., 2021; Gupta and Tiwari, 2023). A few of the well-known models include the Motivational Model (Wang et al., 2018), the Theory of Planned Behavior (Kumar and Smith, 2018), the Unified
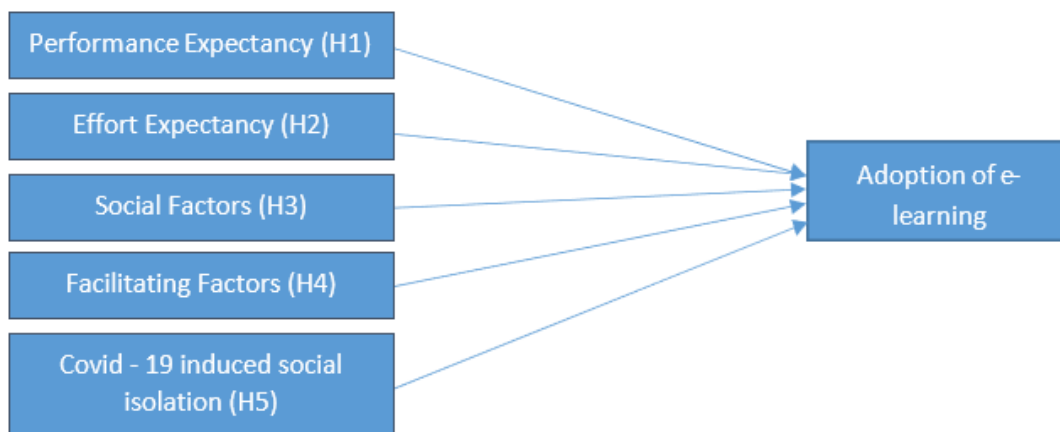
Figure 1. Proposed Model

Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), and the Technology Acceptance Model (Davis et al., 1989). Although, the researchers have validated the use of these models in different settings but found the UTAUT model as the most comprehensive, valid, and widely used model to explain the issues concerning the adoption of a technology (Sana, 2016; Malik et al., 2020; Maryam, 2021). This research study aims to contribute to the literature by carefully identifying the factors that impact college students in India the use of e-learning against the challenging background of the Covid-19 epidemic. This paper uses the Unified Theory of Acceptance and Use of Technology (UTAUT) model to conduct a thorough investigation using a demanding analytical framework. The goal is to offer nuanced insights into the complex dynamics governing the adoption of educational technologies in these unprecedented times.

Researchers have extensively applied the UTAUT model to (i) investigate the reasons behind the adoption of information technology by people at a mass level (Malik et al., 2020; Cheng, 2021; Shukla, 2021; Bansal and Goel, 2022); (ii) enumerate the motivational factors along with the facilitating conditions resulting in such adoption of technology (Maryam, 2021); (iii) understand the adoption of e-learning by students for educational purposes (Cheng, 2021; Marion et al., 2021; Shukla, 2021); (iv) its impact on students' school grades and creativity (Malik et al., 2020); (v) academician's adoption of e-learning (Gunasinghe et al., 2019); (vi) factors determining students' acceptance of online courses, MOOCS (Maryam, 2021); and (vii) m-learning (Chao, 2019; Mittal, 2020). Most of these researchers have identified certain common variables that significantly affect the users' adoption of information technology, such as (i) performance expectancy (expectations about the improvement in job performance by using a technology); (ii) effort expectancy (extent of efforts to use technology); (iii) social factors/norms (expectations of others to adopt a technology); and (iv) facilitating factors (availability of necessary infrastructure) (Malik et al., 2020; Hager et al., 2021).

Out of these variables, the researchers have identified "performance expectancy" as the most significant variable leading to the adoption of a technology followed by other variables (Venkatesh et al., 2003; Pinho et al., 2021). At the initial adoption stage, the variable "effort expectancy" is very significant (Malik et al., 2020; Pinho et al., 2021) whereby the higher user-friendly interface of a technology results in greater, wider, and quicker adoption of a technology (Chao, 2019; Marion et al., 2021). With the emergence of various social media platforms, the variable "social norms" in technology adoption has also attained significance (Davis et al., 1989; Venkatesh et al., 2003; Pinho et al., 2021). Researchers have also found a significant association between the variable "facilitating conditions" and the adoption of information technologies particularly in developing countries (Hager et al., 2021; Maryam et al., 2021; Achariya and Das, 2022).

Research Model Conceptualization and Hypotheses

The UTAUT model was developed by Venkatesh and others in 2003 by consolidating eight different technology adoption models (Venkatesh et al., 2003). Based on the literature review, the following UTAUT model was proposed for this study (Figure 1).

Performance Expectancy to Adopt E-Learning:

Venkatesh et al. (2003) defined it as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance". It is users' perception of the usability of the technology in terms of its outcome. For this study, this construct is defined as the extent to which students will find e-learning to be useful in improving their educational performance (Davis et al., 2003; Lwoga and Komba,

2015; Gunasinghe et al., 2019; Malik et al., 2020). Researchers have observed a positive relationship between performance expectancy and adoption of technology even in diverse settings (Akif, 2020; Shukla 2021) and countries (Pinhu et al., 2021). Thus, it seemed appropriate to propose that:

H1: Performance expectancy will affect the adoption of e-learning in education.

Effort Expectancy to adopt E-Learning:

Venkatesh et al. (2003) defined it as, "the degree of ease associated with the use of the system". This construct defines the user-friendly interface of any technology (Nain, 2021). Researchers have identified this as the prerequisite for any technology to be widely accepted (Venkatesh et al., 2003; Shukla, 2021). This study defines this construct as the amount of time and energy a student believes they will have to devote to use, understand, and implement e-learning in their academics (Venkatesh et al., 2012; Kocaleva et al., 2015). Past researchers identified this construct as an integral part of the UTAUT model to predict the adoption of any technology by students for learning purposes (Tian et al., 2020; Maryam, 2021). This construct is particularly important at the early stages of technology adoption (Venkatesh et al., 2003; Bellaaj et al., 2015). Hence, it seemed appropriate to hypothesize that:

H2: Effort expectancy will affect the adoption of e-learning.

Social Factors to Adopt E-Learning:

Venkatesh et al. (2003) defined this as "the degree to which an individual perceives that important others believe he or she should use the new system". This construct indicates the extent of importance given by the adopters of technology to the opinion of others, i.e., how other people important to the adopter will perceive him after adopting new technology. In this study, it is the extent to which students think they have adopted e-learning as per the opinion of people important to them (Gunasinghe et al., 2019; Malik et al., 2020; Tian et al., 2020). Researchers have referred to this concept by various names, including subjective norms, social variables, and social norms. Most of the previous researchers have observed a positive impact of "social factors" on the adoption of technology from different perspectives (Salloum and Shaalan, 2018). Hence, it was assumed that:

H3: Social factors will affect the adoption of e-learning in education.

Facilitating Factors to Adopt e-learning:

Venkatesh et al. (2003) defined it as "the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system". In this study, It is conceptualized as the perception of a student about the availability of required resources needed for the adoption of e-learning in education, such as digital devices (smartphone/laptop/desktop/e-book/notepad), Internet connectivity, and technical support (Chao, 2019; Chang, 2021; Pinho et al., 2021). Facilitating conditions are important in the adoption of any technology in a developing country (Tian et al., 2020). Achariya and Das (2022), for instance, found that despite the exponential growth in e-learning platforms, their adoption is far below expectations due to the restricted availability of required facilities in many developing and under-developing countries. Accordingly, it is proposed that:

H4: Facilitating factors will affect the adoption of e-learning in education.

Covid-19 induced social isolation to adopt e-learning:

The novel coronavirus (COVID-19) disease created an unprecedented global crisis in every sphere of life. Strict lockdowns were imposed worldwide, halting all activities, including education. All the educational institutions were closed continuously for a very long duration and students had no physical contact with their friends, teachers, relatives, and others during this time, leading to social isolation (Achariya and Das, 2022). This variable is defined theoretically as the total or almost total absence of meaningful social interactions that a student experiences over a prolonged period that can be attributed to the Covid-19 pandemic-induced lockdowns, adherence to social distancing protocols, physical mobility limitations, remote work arrangements, closure of markets, amusement parks, public gatherings, and reliance on online education, all of which contribute to a marked state of social isolation (Raza et al., 2020). The worldwide outbreak of this pandemic led to significant travel restrictions for everyone, including students worldwide. It made e-learning the only available form of instruction during this time. Thus, it is assumed that:

H5: Covid-19-induced social isolation will affect the adoption of e-learning in education.

Research Methodology

This is an exploratory study. The target population comprised undergraduate college students of Delhi University, India. A purposive sampling technique was applied to select 300 college students across different

streams. An online survey was designed for data collection. The final sample consisted of 162 students who provided complete information. The data collection period was January 2023. Table 1 provides a brief sample profile of the respondents of this study. Delhi University students were chosen for this study as respondents as the Covid-19 pandemic forced the university to be closed for students in March 2019. Consequently, students and teachers had no other option but to adopt the online learning mode instead of offline teaching as the only available option to continue the teaching-learning process.

Results and Discussion

The regression analysis was applied for the purpose of data analysis. The analysis process spanned across three stages. Each variable's internal reliability, validity, and dimensionality were assessed at stage one. For this purpose, various rounds of exploratory factor analysis were performed, leading to the final selection of 19 statements (Table 2) that had factor loading above a recommended threshold of 0.70 (Raza et al., 2020). Further, the Cronbach's alpha coefficients (α) and Composite Reliability coefficients (CR) were calculated to ensure the internal reliability and consistency of the

Table 1. Sample Composition

Characteristics	Number (N = 162)	%
Students' Gender		
Male	70	43%
Female	92	57%
Students' Age (years)		
Below 19	30	19%
19-20	69	43%
Above 20	63	39%
Course-Stream		
Arts/Humanities	85	52%
Science	26	16%
Commerce/Management	51	32%

The surveyed sample of 162 students consisted of 43% male (N = 70) and 57% female (N= 92). The sample had 19% students below 19 years, 43% in the age group of 19-20 years, and the remaining 39% above 20 years. About half (52%) of the respondents were from arts/humanities, 32% from commerce, and 16% from science. The research instrument used for data collection was a standardized questionnaire. The literature review provided the necessary inputs for questionnaire development. The questionnaire was divided into 3 parts. Study objectives and scope, along with the rights of the respondents, constituted Part 1. Part 2 covered the demographics of respondents, and Part 3 included statements about the adoption of e-learning by students in their education.   The literature review led to the identification of 40 statements under six scales. A pilot study with 18 students was conducted to assess these statements in terms of flow, language adequacy, and question continuity. This process led to a few corrections and the dropping of 6 statements. The final questionnaire had 42 statements.

scales used in this study (Table 2). Accordingly, the adopted scales were found to be internally reliable and consistent as each coefficient value (Table 2) is greater than the minimum recommended value of 0.70 (Gerbing and Anderson, 1988). Finally, scales' convergent validity was confirmed (Table 2) by the AVE values higher than the minimum cut off 0.50, as suggested by Gerbing and Anderson (1988).

At stage two of the analysis, three different statistics (Table 3) were calculated to validate the use of regression analysis: (i) Variance inflation factor (VIF) coefficients to ascertain the multicollinearity in the variables; (ii) Durbin-Watson (DW) value to measure the autocorrelation in the residuals from a regression analysis; and (iii) coefficient of determination (R^2) also known as "goodness of fit". All these values gave a clear go-ahead to apply regression analysis to assert the conclusiveness of study hypotheses (Table 3). The coefficient of determination, R^2 (5, 155) = 0.626 is significant ($F = 51.822$) at $p < 0.001$ (Table 3), implying about 63 percent variability of the dependent variable "adoption of e-learning".

Table 2. Reliability Analysis of Constructs

Construct name	Items*	Factor Loadings	α	CR	AVE
Performance Expectancy to adopt e-learning	Usage of e-learning increases the quality of my educational performance.	0.729	0.866	0.859	0.606
	E-learning permits me to do my work in a timely manner.	0.841			
	E-learning is helpful to me in my academic work.	0.752			
	Embracing e-learning improves my understanding of the study material.	0.790			
Effort Expectancy to adopt e-learning	E-learning is a flexible tool for academic work.	0.817	0.781	0.806	0.598
	I found e-learning to be simple to apply to my educational activities.	0.807			
Social Factors to adopt e-learning	My life's most important people suggested me to use e-learning to accomplish my educational work.	0.743	0.750	0.772	0.532
	My classmates advised me to use online learning for my coursework.	0.659			
	Persons that influenced me think that I ought to use e-learning for my academics.	0.780			
Facilitating Factors to adopt e-learning	Generally, I have all the necessary support for using e-learning.	0.738	0.840	0.811	0.532
	I have all the needed equipment, tools, and facilities to use e-learning for my education.	0.746			
	I am fully equipped to use e-learning for my academic purposes.	0.762			
Covid-19 induced Social Isolation to adopt e-learning	Due to the lockdown, my school was closed and e-learning was the only option available to continue my studies.	0.799	0.903	0.889	0.679
	With e-learning, I think I have someone to make me understand the subjects given in our syllabus.	0.858			
	E-learning connects me with my studies, teachers, friends, and others, whenever I wish to.	0.789			
Adoption of e-learning	E-learning is my most preferred mode of learning for my educational purposes.	0.525	0.831	0.819	0.622
	In the future, I will also keep on using e-learning for my education.	0.624			
	I will recommend using e-learning for educational purposes to others as well.	0.684			
	I wish to use e-learning in the next year also after the opening of my college.	0.726			

Table 3. Preliminary Regression Analysis

Independent Variables	VIF coefficients	Durbin-Watson value	R^2
Performance expectancy	2.627		
Effort expectancy	3.001		
Social factors	1.759	1.956	R^2 (5, 155) = 0.626, *F* =51.822, p =.000*
Facilitating factors	2.404		
Covid-19 induced social isolation	1.719		
Cut-off point	< 5 (Savic and Pesterac, 2019)	between 1.50 – 2.50 (De Souza and Junqueira, 2005)	

Table 4. Regression Analysis Results

Independent Variables	Dependent Variable (AEL)		R^2
	β	t-value	
Performance expectancy	0.507	5.753*	0.000*
Effort expectancy	0.139	1.663***	0.098***
Social factors	0.029	0.473	0.637
Facilitating factors	0.091	1.235	0.219
Covid-19 induced social isolation	0.125	1.893**	0.040**
*p < 0.001; ** p < 0.05; *** p < 0.10*			

*Significant at p < .001

The final analysis stage entailed the application of regression analysis and the interpretation of results thereof (Table 4). The *t*-values are significant for the independent variables: (i) performance expectancy to adopt e-learning (t = 5.753, p = 0.000); (ii) effort expectancy to adopt e-learning (t = 1.663, p = 0.098); and (iii) Covid-19 induced social isolation to adopt e-learning (t = 1.893, p = 0.040) leading to the acceptance of hypotheses H1, H2, and H5. However, for rest of the two independent variables, t-values are insignificant: (i) social factors to adopt e-learning (t = 0.473, p = 0.637); and (ii) facilitating factors to adopt e-learning (t = 1.235, p = 0.219) resulting in the rejection of hypotheses H3, and H4.

Further, the *β* values predicted the strength of the relationship between the dependent variable and the five independent variables used in this study. All the *β* values are positive, indicating a positive relationship between the dependent and independent variables. The analysis results show that the variable "performance expectancy to adopt e-learning" is the most decisive factor (*β* = 0.507), followed by the variables: effort expectancy to adopt e-learning (*β* = 0.139); covid-19 induced social isolation to adopt e-learning (*β* = .125); facilitating factors to adopt e-learning (*β* = .091); and social factors to adopt e-learning (*β* = 0.029). Most of these results are similar to the existing literature (Venkatesh et al., 2003; Price et al., 2018; Barrot, 2020; Raza et al., 2020; Azawei, 2021; Ramanujam, 2021).

The study results have several implications for different stakeholders during the ongoing pandemic-induced adverse impact on the existing teaching-learning process worldwide (Shukla, 2021). Though at a slower rate, the digitization of education began long before the Covid-19 epidemic hit but at a restricted pace. The pandemic has exponentially accelerated the adoption of e-learning almost across the world due to the complete disruption of the traditional learning process. During this time, e-learning emerged as the sole option to minimize the learning loss and keep the learning process going. These results are also significant for policymakers in the Indian context, which is the second most populous country in the world in terms of providing cost-effective education to all. E-learning has several strengths at this end.

The results indicate that information technology can only be adopted at a mass scale by people only if: (i) it has the potential to enhance the job performance of the users; (ii) easy to use, learn, understand, and apply; (iii) cost-effective; (iv) socially supported; (v) availability of necessary infrastructure, and technical assistance; and (vi) favorable conditions. Indian governments at various levels are also working to embrace the benefits of e-

learning in their future educational approach in the form of blended learning.

The study results are based on the data collected from undergraduate college students and every possible care was taken to make it a representative sample, but it is advisable to generalize the results with precautions. Future researchers may extend this study by obtaining data from other universities, schools, professional institutions, states, and areas. Similarly, the UTAUT model can be examined by including more variables with more inclusive sample.

Conclusion

Following the worldwide disruption brought about by the Covid-19 epidemic, this research examined the dramatic repercussions on some industries, with an emphasis on the paradigm shifts that affected education and learning in particular. Due to the shutdown of many institutions and facilities due to strict measures taken to stop the virus's spread, students worldwide were forced to adopt e-learning on a never-before-seen scale. This article used the Unified Theory of Acceptance and Use of Technology (UTAUT) paradigm to thoroughly investigate the variables impacting the adoption of e-learning among Indian college students during the epidemic. Based on a thorough examination of the literature and an online survey of 162 Delhi University undergraduate students, the empirical study produced important new information about the dynamics of e-learning uptake. Three steps of regression analysis were carried out, and the results provide a solid basis for the interpretation of the study's assumptions. Evaluations of the accepted scales' internal consistency, reliability, validity, and dimensionality guaranteed their legitimacy. The measures' convergent validity provided additional support for their applicability to the research. The next steps comprised statistical analyses, such as the coefficient of determination ($R2$), Durbin-Watson (DW) value, and Variance Inflation Factor (VIF) coefficients. These measurements supported the acceptability of regression analysis by showing a large variability (about 63 percent) in the dependent variable, "adoption of e-learning". The results of the individual variable analysis showed that the adoption of e-learning was significantly influenced by performance expectancy, effort expectancy, and social isolation brought on by Covid-19. Interestingly, the pandemic itself turned out to be a major influence on e-learning uptake. The study's findings have important ramifications for creating curricula and policies that are responsive to kids' changing needs in the face of disruptive occurrences like pandemics. The ramifications

of these discoveries encompass a multitude of stakeholders, such as legislators, instructors, and establishments managing the obstacles presented by the continuous epidemic. The study emphasizes how critical it is that e-learning programs improve work performance, are easy to use, are economically and socially beneficial, and have the required technological support and infrastructure.

Conflict of Interest

There is no conflict of interest.

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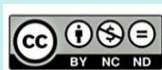
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