



## The Pre-Post COVID-19 Higher Educational Sector Perspective: Mediating Role of Intention to Adopt Technological Applications to Determine the Students' Satisfaction

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### Abstract

The core objective of this research effort entails the satisfaction assessment of the students of public sector universities of Punjab, Pakistan during and after the forced lockdown of COVID-19 for approximate two years and faced a number of issues, challenges, and problems during the restoration of the physical mode of education. The world had to face the lockdown as governments restricted travel and public gathering, and the behavior of students and participants of the education sector received a negative impact due to issues in adopting the tech applications that facilitate education activities. The study highlighted the core factors of e-education awareness, facilitating conditions, and behavioral intention to adopt the tech applications that have the tendency to influence the satisfaction level. The study uniquely contributed by assessing the mediation role of intention to adopt tech applications between e-education awareness, facilitating conditions and students' satisfaction. The current study utilized a simple random sampling technique for data collection through a questionnaire, the Smart-PLS was used for data analysis that provided the results that support the notion of the study that e-education awareness influences the behavioral intention to adopt tech applications and students' satisfaction, further the facilitating condition influences the intention of students to adopt the tech application, however, the facilitating condition found to be insignificant to the student's satisfaction. The intention to adopt the tech applications significantly mediated the relationship between e-education awareness, facilitating conditions and students' satisfaction. In future researchers may focus to alter the measurement scale of students' satisfaction, the methodological perspective can also be focused in future research by intensive modification in measurement scale of satisfaction. The future research avenue should entail the assessment of workplace environment related variables for determining the specific phenomenon.

**Keywords:** E-education awareness, Intention to adopt tech applications, students' satisfaction, COVID-19

### 1. Introduction

The COVID-19 pandemic era left a long-lasting negative impact on business practices, the economy, the health sector, the tourism industry, the airline industry, and the education sector as well as on all aspects of human life. The pandemic era prevented the social gathering in any case including the closure of educational institutes and all public places to control the rapid spread of the disease. The educational institutes were locked down all over the world due to the rapid spread of the virus, but education can never be ignored or discontinued around the world, so, therefore, the education sector adopted the online mode to conduct their activities and altered the conventional teaching method. The forced shift or sudden shift to the online mode created a number of complexities and impacted on the behaviors of individual stakeholders of the education sector and the whole system was disrupted. However, work from home, online classes, virtual meetings and many other aspects have been initiated around the world as an alternative to conduct activities for organizational survival that also meet the requirement of social distance. The governments of all countries around the world issued the public policies for social distance, isolation and self-quarantine (Sufian et al., 2020; Raza et al., 2021).

The information technology assisted education sector to adopt the dramatic and sudden changes and alteration of educational activities during pandemic. The acceptability of such technological applications for Pakistani education system was emerging and newly evolved during disruptive environment of the world. The prior studies have investigated the satisfaction of users influenced by the information quality, system quality and service quality of the e-learning system. The universities and educational institutes faced the higher level of stress due to the worldwide sudden closure of education sector due to pandemic, however teaching methods were adopted to pursue the educational activities, the lockdown restrictions and new variants of the corona virus spread around United Kingdom, Africa and EU that caused strict lockdown even the air travel was banned during pandemic era. The universities, colleges and other educational institutes adopted various technologies and applications such as Zoom, Google Meet, and Webex etc. to deliver the educational services to the students (Johnson et al., 2020). The COVID-19 situation occurred for the very first time in the world and similarly the situation faced by educational sector was exceptional, as the great responsibility was placed on educationists for designing the appropriate application for providing the better education and benefits to the learners. That was major challenge for academicians to engage the students in teaching-learning process for adoption of online teaching method and intention of students to adopt, as well as behavior of student towards adoption of online education method. The adoption of online teaching and learning method was unfamiliar to the students as well to the teachers (Tandon, 2021).

This research effort intends to determine the student satisfaction during COVID-19 as their educational degree consists of multiple years, and they have experienced both modes, physical mode and online mode. The quality of both modes can be judged, the impeding factors, and supportive factors and hurdles of both modes can be assessed

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for further long-term online education mode for willing students. As per observation the online mode or 'work from home' phenomenon has increasing gradually to cut the cost and operational expenses. The quality of online learning has been questioned as general public, members of educational community and important stakeholders have expressed their displeasure and dissatisfaction. This will be very interesting to assess the behavior of students about satisfaction with educational activities during online educational activities and in physical mode, because it has been reported as described earlier that lot of trouble has been faced when higher education sector intended to switch from online mode to physical mode in terms of strikes, unrest among students, and clashes between students and university management. There is dire need to assess the factors that play major role in student satisfaction and their intention towards adoption of technology-based software for educational purposes. This study intends to determine the role of e-education awareness and facilitating conditions to determine the behavioral intention for tech-application usage and finally to examine the satisfaction level of the students.

### 1.1. Problem Statement

It has been observed and reported in the studies that during COVID-19 lockdown the students have lost their interest in the studies, demotivated with the online lecture timings or due to lack of understanding through online mode, lack of interaction their dedication towards education has reduced rapidly. The studies claim that there are number of negative behavioral outcomes have been observed among students around the world (Basuony et al., 2020). It has been reported in the study that in Indonesia students faced number of issues and problems in during online teaching methods such as lack of readiness towards education, network quality issues and material provided with quality concern (Pramono et al., 2020). The prior studies have examined the perceived efficiency and performance expectancy that influenced the online working environment and address the limitations or constraints faced by the stakeholders specifically end users. It has been also reported that students and teachers found to be dissatisfied due to utilization of technological applications for educational activities (Surahman, 2020). There is dire need to conduct the study on student satisfaction level influenced by the e-education awareness and facilitating conditions, before measuring the behavior intention to use technological applications, so therefore this study introduced the mediating variable of intention to use technological applications between the exogenous constructs e-education awareness and facilitating conditions and endogenous construct student satisfaction.

The technology has taken the importance due to forced shift towards online education, however it brings number of benefits to the organization such as cost control, empowerment, ease of working hours and occurrence of online business and educational activities. So therefore, there are number of organizations have taken online shift as a permanent solution for better organizational fit to grasp the benefits by providing the better facilitating conditions to the stakeholders. The usage of technology has altered the role of instructor and changed the context from traditional boundaries to online mode that should be aligned with learning preferences. There is need to assess the efficiency of the modern technologies in academic satisfaction to meet the academic expectations and satisfaction as conventional educational framework has been altered (Maini et al., 2021; Hussein et al., 2020). It has been reported that students have desire to minimize ambivalence in formal education and eager to get the success for achievement of goals, the active learning environment opposed to passive learning environment as they live in incredibly interactive society and they expected from lectures. Today the learning has become much creative and online learning may provide the better environment through variety of instructional models that may be accessible anytime, form and policy (Zaidi et al., 2021). This study intends to determine the students' satisfaction for online education shift influenced by the e-education awareness and facilitating conditions with mediating role of intention to use technological applications. There is dire need to conduct the study on students' satisfaction because it has been reported that during COVID-19 lockdown there was complete unrest, problems and issues between students and university management. However, number of new businesses and opportunities emerged during this crisis and hidden benefits were unleashed such as cost control, efficiency, physical operational cost control and other individual benefits, so if online education may be adopted in future for grasping the benefits, so do our stakeholders such as students will be satisfied with online education activities.

## 2. Literature Review

The negative impact of COVID-19 has left long-lasting footprints on the all aspects of the life including retail sector, production sector, tourism industry, airline services, health and pharmaceutical industry and education sector, the number of business organization suffered a lot, however number of new business emerged as online trend of business transactions have increased. The emergence of online business initiatives have gained the attention and emerged rapidly due to forced locked down and strict governments' restrictions to prevent public gathering and travel around the world. There was no other way to facilitate the general public, so therefore organizations adopted the utilization of alternatives for survival of their businesses such as online applications to conduct business activities. The education sector was placed under tight control, rigorous lockdown discontinued the educational activities around the world and education sector was set to operate online including lectures as well as exams. The online applications and utilization of information technology has been integrated in many aspects of life, this study focused on the higher education sector of Pakistan and discussed the hurdles faced during this transition, specifically behavioral aspect of the stakeholders more specifically the students that had to adopt the online educational activities instead of physical activities. The notion of current study is that forced shift to online educational activities has turned into an attractive option of higher education to pursue online education instead of being physically bound, as there are number of

benefits have been observed by the education sector. The education industry expected to perform better and organize their resources efficiently due to technological adoption and number of instructors and students participated in online educational programs that unleashed the benefits.

This section of the study presents the literature review and relationships between e-education awareness and intention to use technology, e-education awareness and students' satisfaction, facilitating conditions and intention to use technology, facilitating conditions and students' satisfaction. Further the mediation role of intention to adopt technological applications between exogenous and endogenous constructs.

### **2.1. E-education Awareness and Intention to Adopt Technology**

The government of all countries have taken various strict actions towards social gathering and imposed lockdown to prevent any public gathering, so whole of the countries were lockdown including education sector specifically to avoid any kind of spread of corona virus. The lockdown was imposed in all countries worldwide and controlled the public gathering that caused negative economic consequences as millions of people were staying in quarantine and were able to conduct their business activities. The education sector faced one of the toughest challenges ever to pursue their educational activities in lockdown, the dramatic change in environment due to rapid spread of corona virus and large-scale damage encouraged various businesses to take novel initiative against the situation to conduct the activities while remain in lockdown. The emergence of online applications and involvement of information technology in all aspects of life and specifically education sector gave the ray of hope to conduct the educational activities through online applications. The involvement of technological applications enabled the education sector to coordinate their large number of students and teachers to pursue online classes and educational activities (Raza et al., 2021).

The involvement of technology assists the firms to keep the task simple, specifically in education sector the web based technological applications has altered the traditional learning processes. The emergence of technological applications influenced the e-learning processes during lockdown and research scholars have coined the term learning management system (LMS) as web-based technology that play vital role in improvement of learning process, planning process, applications and evaluation in educational institutes. The LMS plays important role in improving the learning process by facilitating the e-learning without any constraint of time, place or any physical contact (Zwain, 2019). These applications enabled students and teachers to interact to share information and conduct educational activities. This is clear indication that utilization of technology-based applications has gained much more attention during COVID-19 outbreak and played crucial role in pursuing the learning activities. The previous studies have highlighted the various educational online applications including Moodle, WebCT, Blackboard, Desire2learn, GoogleMeet, Zoom and Webex. It has been revealed in literature that emergence of technology in higher education sector has changed the pattern of educational services. Involvement of technology has successfully altered the traditional method of teaching; however various issues and challenges have been faced by participants including teachers and students (Waheed et al., 2016).

The one of the most important issues that is faced by educational institutes was acceptance of technological applications and an individual teacher or students willing to adopt the changed teaching methods. The involvement of technology-based applications altered the traditional method of teaching; hence it is not an easy task to adopt the applications to interact for educational purpose. The research scholars are concerned with the acceptance level of participants of higher education towards the adoption of technology based applications or e-learning modules to interact for education purpose (Raza et al., 2021). It has been highlighted that higher education sector investigated the acceptance level of e-learning among participants of education sector as it requires the huge resources and infrastructure. The universities has to consider the cost of technology based applications and new learning system as in case of failure of adoption of any participants may result in decline the performance or causes financial loss (Zwain, 2019). The previous literature identified the different levels of acceptance of learning management system or technology-based applications among students. The acceptance level of e-learning systems found to be lower in Saudi education sector, however the western countries found to be higher acceptance level towards utilization of technology-based applications to interact for education purpose. This study argues that e-education awareness among students and teachers influence the intention to adopt the technologies. On the base of this argument the following hypothesis is formed:

*H1: E-education awareness influences the Intention to adopt the technology in education sector*

### **2.2. E-education Awareness and Students' Satisfaction**

The e-education awareness influences the students' satisfaction because the forced shift of educational activities to online mode has created number of hurdles, challenges, issues and problems as stated in prior section of introduction. The research studies measured the relationship underpinned by UTAUT as technology acceptance behavior. The UTAUT theory assist in investigating the acceptance behavior of individuals towards utilization of technology-based applications. Previously, the theory was used to assess the acceptance level of mobile banking in Islamic banks of Pakistan (Raza et al., 2021). Moreover, the behavioral intention of students towards mobile learning has been empirically examined influenced by perceived enjoyment, satisfaction, trust, risk and self-efficacy (Chao, 2019). It has been suggested by various research scholars that UTAUT is one of the most appropriate theories to determine the technology acceptance for e-learning system (Dečman, 2015; Taiwo & Downe, 2013). The studies provide the base to assess the student satisfaction level with technological applications being used by higher education sector towards the e-learning during COVID-19 pandemic. The current study argues that e-education awareness influences the students' satisfaction and intention towards technology applications. The study claims the novelty in determining the empirical

investigation between exogenous and endogenous constructs. The research intends to determine the mediating role of behavioral intention between independent and dependent variables. This study has developed the notion that forced shift has turned into willingness of adoption of technological applications in education sector as number of benefits may be grasped if the students' satisfaction level met with adoption of technology. This argument formed the following hypothesis:

*H2: E-education awareness influences the students' satisfaction in education sector*

### 2.3. Facilitating Conditions and Intention to Use Technology

Facilitating condition is described as "the degree to which an individual considers that an organization and technical infrastructure exists to support the use of the system" (Venkatesh et al., 2003). The intention of end users or stakeholder in the case of current study teachers and students play important role in utilizing the technological applications for educational purposes, the factors such as circumstances and user habits entails the facilitating conditions. The technological development has continued to progress at slow pace that influence the educational and corporate environment, the Indonesia has utilized online learning methods to facilitate the learning processes (Zaidi et al., 2021). It has been well known and established phenomenon that online learning information found to be accessible from remote location and independence from any time restrictions that further offers number of advantages. The facilities given for the long distance and remote education and learning practices have importance in providing training and information sharing that saves the time and money when it comes to training of personnel (Niemi & Jia, 2017).

The firms strive to gain the strategic objectives by focusing and following strategic directions while emphasizing the sustaining value. The adoption of technology largely based on the facilitation conditions given by the organizations, the organizations strive to provide the facilities to the end-users or stakeholders through implementation of technological applications that brings the benefits on both sides (Muafi, 2020). The online learning brings number of advantages and it can reach to large number of participants, the management focuses on the effective utilization of time through utilization of technological applications. The facilitating condition entails the ease to learn, the degree to which an individual feel that technological infrastructure support the business operations by providing ease, efficiency and effectiveness (Xiang et al., 2015; Nguyen, 2015). The prior studies have expressed those conducive circumstances found to be no effect on behavioral intention but has an impact on behavior. The capacity of an individual to utilize the technology facilitate the availability of the resources that enable effectiveness and efficiency. The web-based technologies adoption faced impeded due to the lack of guidance, lack of timely support, inadequate knowledge or lack of resources (Kamaghe et al., 2020). This study argues that facilitating conditions of technological applications influence the Intention to use technological applications among students of higher education sector of Pakistan, so therefore, following hypothesis is formulated:

*H3: Facilitating conditions influences the Intention to adopt technological applications in the higher education sector*

### 2.4. Facilitating Conditions and Students' Satisfaction

The internet usage has been increased recently and social networking has taken the importance as the number of subscribers have been increased for their own interest around the world through mobile phones that has extended the boundaries of the connection and enriched the communication (Y.-S. Lee & Moon, 2017). The studies have been reported that difficulty in learning newly developed applications and reaction to new applications reduces the intention of stakeholders (Halili & Sulaiman, 2019). The young users adopt the technological changes more rapidly instead of older workforce, so therefore it is point of concern that older workforce in the university teachers may be reluctant to adopt the technological applications due to complexity and lack of skills (Pimmer et al., 2019). It has been stated that when it comes to considering new technologies, males are less reliant on enabling circumstances. Women, on the other hand, have a tendency to place a greater focus on external supporting forces. Extensive experience may result in increased familiarity with technology as well as superior understanding to aid learning, hence decreasing reliance on external help (Kamaghe et al., 2020; Masadeh et al., 2016).

It has been well known and established that Industrial Revolution environment and higher level of technology utilization optimize the manufacturing, contribute in economic growth, and assists in corporate networking (Choi, 2019). The facilitating conditions include availability of resources, knowledge to use technologies, compatibility of technologies, availability and willingness of employees to support the technologies. The habits of users shape the perception, reflect the outcomes, knowledge, age and gender of an individual influence the adoption of technology (Tadesse et al., 2018). The literature argues that adoption of newly emerging technologies statistically significant to behavior. The online learning habit considered as impactful factor to the behavior (Chou et al., 2022). The prior research also stated that frequency of individuals to utilize technology diminishes the influence of behavior and technology usage, it has been proposed that there are three indicators to behavioral intention including intention to use technology in future, habits to use technology, and interest to use technology that brings ease to the operational activities (Tran et al., 2020). The current study assumes that facilitating conditions has the tendency to influence the students' satisfaction in the higher education sector of Pakistan, researcher has focused on the facilitating conditions because the participants of online learning in Pakistan has faced number of issues, challenges and problems due to lack, and ease of use of technological applications for education purposes. The following hypothesis was developed on the base of literature and above discussion.

*H4: Facilitating conditions influences the students' satisfaction in the higher education sector*

### 2.5. Intention to Adopt Technological Applications and Students' Satisfaction

This section expresses the relationship between intention to adopt technological applications and students' satisfaction, that claims that intention of an individual towards adoption of technological applications influences the behavior of participants or stakeholders. The online learning has increased in recent years due to ease to perform and get engaged in business activity with flexibility of working hours and physical location. It provides the flexibility, the required infrastructure and ease of doing job (Ain et al., 2016). It has been stated that human resources contribute for higher level of performance, however inequality at workplace led by scarcity of HR activities and personal. The pace of change in time and business environment has highlighted the skills gap in information and communication technology (Ambarwati et al., 2020). One of the crucial challenges is the adoption of technology at large, that how it would be possible that such large population embrace the technology, the technological advancements and improvements had significant impact on organizational outcomes, it influences and contributes in the effective and efficient management, operational processing, storage of data, security of the data and dissemination of such information among business. The newly developed technologies have been adopted for gathering, finding and analysis of data that assist in decision making, these technological instruments reduce the operational cost however complexity of digital information has to be faced, that may cause hurdle in adoption (C. Lee, 2020). The managerial support in adoption of online learning initiatives is very important the Indonesian online education sector faced the challenge of lack of interest of management. The lack of managerial support considered as impediment factor for adoption of online learning system for students as well as for teachers in effective educational activities (Ambarwati et al., 2020). The infrastructure must be supportive but it is still inadequate for the support of online learning practices (Muniasamy & Alasiry, 2020). The current study argues that intention to adopt technology influences the behavior as impact the students' satisfaction. Based on the theory of planned behavior that intention of something influences the behavior of employees/participants (Ajzen, 2011), the following hypothesis is formed:

*H5: Intention to adopt technology influences the students' satisfaction in the higher education sector*

### 2.6. Mediating Role of Intention to Adopt Technology

This section entails the review of the literature that expresses the mediation importance of intention between exogenous and endogenous constructs. It has been well understood and explained phenomenon that information technology helps to reduce the barriers of information flow and enhance the effectiveness and efficiency while increase the speed of knowledge sharing. The literature has embarked on the need of IT adoption and focuses to utilize the information technological equipment in organizations to grasp the number of benefits. The culture of organizations plays important role in IT adoption, the external environment influences the firms to adopt latest technology for survival and competitive advantage (Mohammadi, 2015). The studies have been expressed the relationship between IT adoption intention and knowledge sharing intention, similarly the leadership styles influence the employees way to think and act (Asbari et al., 2021; Purwanto et al., 2021; Widodo et al., 2022). The study depicted that IT adoption influenced the knowledge sharing, and leadership mediated the relationship between IT adoption and knowledge sharing (Widodo et al., 2022). The prior literature has investigated the phenomenon of intention to use internet banking, the study revealed that employees found to be willing to adopt the internet facilities and equipment for routine activities, the study claimed that information technology adoption increase the service quality of the banking sector, further the performance expectancy and effort expectancy mediated the relationship between website design, customer services and intention to adopt the IT based banking (Rahi et al., 2019).

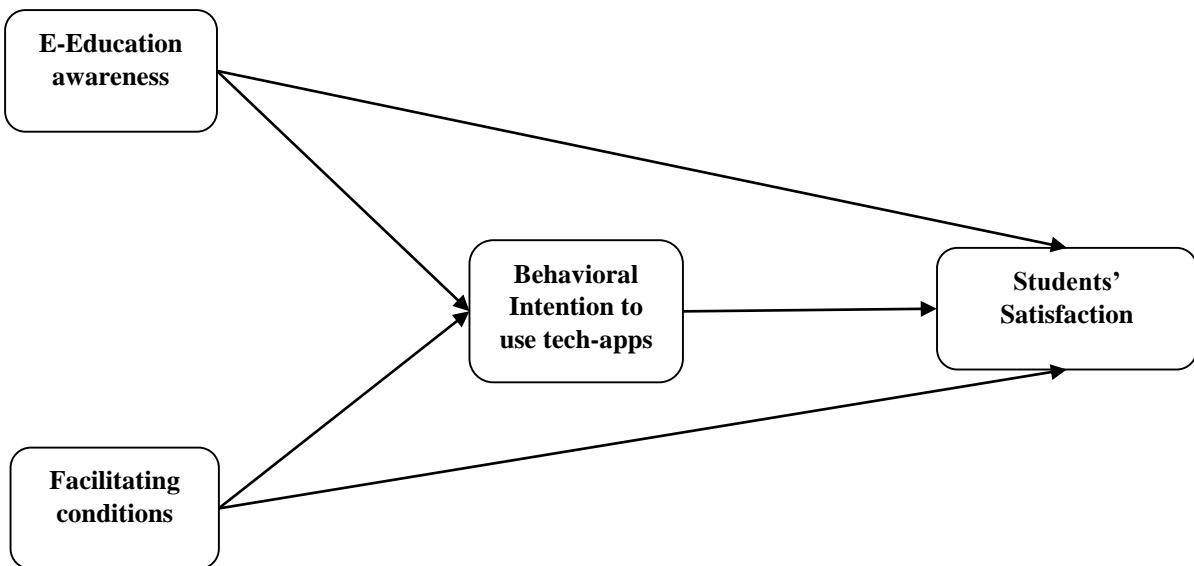
The previous literature examined them mediating role of intention between attitude and behavior among Chinese consumers, the study depicted significantly positive results that intention significantly mediated the relationship between attitude and behavior (Cai & Shannon, 2012). The literature has examined the intention to adopt e-learning in Jordanian universities, as e-learning considered as an effective tool based on the theory of planned behavior to identify the factors that influence the intention to adopt e-learning. The technology usage, attitude of instructor, subjective norms, and perceived behavioral control and usefulness, ease of use and normative beliefs, self-efficacy and perceived accessibility plays important role as previous studies argued. The study depicted significant mediating role of attitude, subjective norms, and perceived behavior to intention to adopt the technology (Altawallbeh et al., 2015). Based on the above literature, the current study assumes that intention to adopt technology has the tendency to mediate the relationship between independent variables and dependent variables. Thus, the following mediating hypotheses are formed:

*H6: Intention to adopt technology mediates the relationship between e-education awareness and students' satisfaction*

*H7: Intention to adopt technology mediates the relationship between facilitating conditions and students' satisfaction*

### 3. Research Framework

This section demonstrates the research framework in Fig-1. The students' satisfaction is considered as dependent variable, the e-education awareness and facilitating conditions and mediating role of behavioral intention to use tech-app.



**Figure 1: Research Framework**

#### 4. Research Methodology

The purpose of the current research effort is to determine the relationship between variables as occurred in the framework, so therefore the quantitative approach is appropriate, as this approach is suitable for theory testing and hypothesis testing through statistical tools (Creswell & Creswell, 2017). This study is quantitative in nature as data was collected from the students of the universities in South Punjab. For the purpose of the analysis the data was collected from the students of the universities who had gone through the educational lockdown, engaged in online education activities and then shifted to the normal mode that faced number of issues, problems and challenges as discussed earlier in the first section of the current study. The questionnaire was adopted from the prior literature for reliable and valid measurement. The students of the universities are unit of analysis, the population is students of all universities and sample has been drawn on through simple random sampling based on (Krejcie & Morgan, 1970). The appropriate sample size for generalization of results is 350 and data was collected through questionnaire, total 308 complete and useable responses were collected that is considered as appropriate sample responses obtained for analysis.

##### 4.1. Measurement Scales

The measurement scales for behavioral intention to use online applications was adopted from (Raza et al., 2021). Measurement items of behavioral intention the four items' measurement scale:

- I intend to continue using online applications
- For my studies, I would use online applications
- I will continue to use online applications on a regular basis
- Because of the possibilities that online applications offer, I plan to approach my next course more effectively

The measurement scales for student satisfaction by using online applications was adopted from (Basuony et al., 2020).

The student satisfaction towards online application utilization for education the five items' measurement scale:

- The academic quality of online classes is on par with face-to-face classes I have taken
- I have learned as much from online classes as I might have from a face-to-face version of the courses, I have taken
- I would recommend online course instructors to other students
- I would recommend online classes to other students
- I am satisfied with the overall online course experience

The measurement scale for E-education awareness was adopted from (Faaeq, 2014).

The five items are as under:

- I receive enough information about e-education services.
- I receive enough information about the benefits of e-education services
- I receive enough information about how to use e-education services
- The government promotes awareness about e-education services provided through the Internet
- Nowadays, government services are available on the Internet

The measurement scales for facilitating conditions were adopted from previous study of (Raza et al., 2021). Items are given as under:

Items for facilitating conditions the four items' measurement scale:

- I have resources to use online applications
- I have the knowledge to use online applications for education
- A specific person (or group) is available to assist when difficulties arise with online education applications
- Using the system fits into my study styles

## 5. Analysis and Discussion

This phase presents the analysis, that consists of two sections, including measurement model assessment, and structural equation modeling, the Smart-PLS is used to conduct the analysis.

### 5.1. Measurement Model Assessment

This section demonstrates the measurement model assessment, this phase entails the reliability and validity of the constructs. The reliability and validity of measurement scales were tested on alpha ( $\alpha$ ), Composite reliability and Average Variance Extracted (AVE). The discriminant validity of the constructs is presented to assess the validity of constructs. The table 1 presents the values of  $\alpha$ , Composite reliability and AVE.

**Table 1: Reliability and Validity**

Constructs	A	CR	Average Variance Extracted (AVE)
SS	0.854	0.895	0.630
EeAw	0.941	0.955	0.808
FC	0.867	0.909	0.716
BehInt	0.939	0.956	0.846

Note: SS (students' satisfaction), EeAw (E-education Awareness), FC (Facilitating Conditions), BehInt (Behavioral Intention to adopt Tech app)

The above table demonstrated the Cronbach alpha, CR and AVE, the values presented in the table shows that values for Cronbach alpha found to be acceptable as threshold value for Alpha is 0.60, the threshold value for CR is 0.60 for acceptable composite reliability and AVE must remain higher than 0.50 for acceptability (Leguina, 2015). The above table shows the results of the Cronbach alpha, CR and AVE, the results for the Cronbach alpha is present that all values found to be greater than 0.70 which shows acceptable reliability, similarly the results of CR found to be higher than the threshold value and acceptable statistically for further analysis. Similarly, the results of AVE were found to be higher than the threshold and acceptable statistically as per the suggested criteria for construct reliability and validity.

### 5.2. Discriminant Validity

The table 2 below presents the discriminant validity, the square root of AVE must remain higher than the correlation values with other constructs for acceptable discriminant validity as per suggested criteria of (Fornell & Larcker, 1981).

**Table 2: Discriminant Validity, Fornell & Larcker Criterion**

Constructs	BehInt	EeAw	FC	SS
BehInt	0.920			
EeAw	0.669	0.899		
FC	0.609	0.638	0.846	
SS	0.649	0.629	0.526	0.794

Note: SS (students' satisfaction), EeAw (E-education Awareness), FC (Facilitating Conditions), BehInt (Behavioral Intention to adopt Tech app)

The above table shows the discriminant validity according to the Fornell & Larcker (1981) criteria, as per suggestion the square root of AVE must be greater than the correlational values of other constructs. The cross-sectional values present the correlational value; the requirement is that correlational value with itself of a construct must be higher in order to achieve the discriminant validity. The test results satisfy the condition of discriminant validity; therefore, it is acceptable for discriminant validity that met the criteria.

### 5.3. Structural Equation Model (SEM)

This section entails the relationship testing between the variables of the framework, the significance of the relationship is assessed on the base of  $\beta$  value, T-value and p-value, the  $\beta$  shows the direction of relationship, whereas the T-value determines the significance of the relationship the p-value is confidence interval 95% so the value must remain lower than 0.05 for acceptable significance of relationship as per criteria of (Leguina, 2015; Hair et al., 2012).

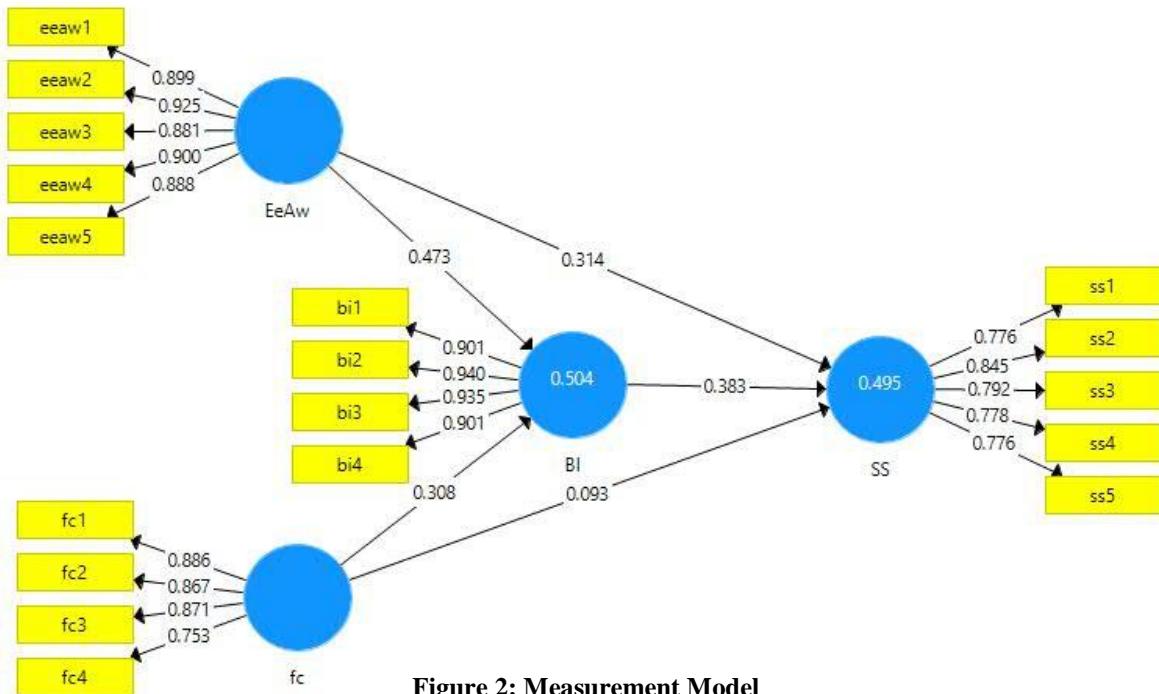
This section presents the direct relationship and specific indirect relationship that depicts the mediating role of behavioral intention to adopt technological applications.

### 5.4. Assessment of Direct Relationships

The table 3 below demonstrates the direct relationships between the constructs of the framework, the direct relationship between E-education awareness and behavioral intention to adopt technological applications, the direct relationship between E-education awareness and students' satisfaction, another direct relationship is tested between the facilitating conditions and behavioral intention to adopt tech-applications, the direct relationship between facilitating conditions and students' satisfaction. The direction relationship between behavioral intention to use tech-applications and students' satisfaction is assessed through bootstrapping method of PLS that provides the results in terms of  $\beta$ -value, T-value and p-value.

The direct relationship between e-education awareness and behavioral intention to use technological application is assessed through bootstrapping method of PLS and resulted that ( $\beta = 0.473$ , T-value = 4.432, p-value = 0.000), this

satisfied the conditions for significance of the relationship, the t-value found to be higher than the threshold value 1.96 and observed as 4.432 that is higher and meanwhile the p-value found to be lower than cutoff point 0.05, with confidence interval 95%, so therefore the relationship is accepted statistically.



**Figure 2: Measurement Model**

Note: SS (students' satisfaction), EeAw (E-education Awareness), FC (Facilitating Conditions), BehInt (Behavioral Intention to use Tech app)

**Table 3: Direct Relationship Assessment**

Hypotheses	$\beta$	T-Value	P-value
EeAw $\rightarrow$ BehInt	0.473	4.432	0.000
EeAw $\rightarrow$ SS	0.314	2.505	0.013
FC $\rightarrow$ BehInt	0.308	3.024	0.003
FC $\rightarrow$ SS	0.093	0.864	0.338
BehInt $\rightarrow$ SS	0.383	3.075	0.002

Note: SS (students' satisfaction), EeAw (E-education Awareness), FC (Facilitating Conditions), BehInt (Behavioral Intention to use Tech app)

The e-education awareness is very important in online educational mechanism, without awareness of the technological tools, there will be trouble for both major stakeholders of education system, the university management must be able to provide the training to the teachers and awareness and may be necessary training to the students as well for successful utilization of e-educational tools and applications.

The direct relationship between e-education awareness and student's satisfaction has been assessed as well, and resulted as ( $\beta = 0.314$ , T-value = 2.505, p-value = 0.013), this satisfied the conditions for significance of the relationship, the t-value found to be higher than the threshold value 1.96 and observed as 2.505 that is higher and meanwhile the p-value found to be lower than cutoff point 0.05, with confidence interval 95%, so therefore the relationship is accepted statistically.

The above results show that e-education awareness also plays an important role students' satisfaction, the students found to be satisfied if the appropriate e-education awareness is given, in the presence of e-education awareness the students found to be more satisfy in usage of technological applications for education purposes.

The direct relationship between facilitating conditions and behavioral intention to use tech-applications is assessed to determine the relationship and resulted as ( $\beta = 0.308$ , T-value = 3.024, p-value = 0.002), this satisfied the conditions for significance of the relationship, the t-value found to be higher than the threshold value 1.96 and observed as 3.024 that is higher and meanwhile the p-value found to be lower than cutoff point 0.05, with confidence interval 95%, so therefore the relationship is accepted statistically.

Similarly, the facilitating conditions found to be significantly important towards the development of behavioral intention for the usage of tech-applications, the result of the current study claims that the facilitating conditions that are related to the tech-applications has the tendency to develop the intention among participants to adopt the tech-applications.

The direct relationship between facilitating conditions and students' satisfaction is assessed to determine the significance of the relationship and resulted as ( $\beta = 0.093$ , T-value = 0.864, p-value = 0.388), this does not satisfy the

conditions for significance of the relationship, the t-value found to be lower than the threshold value 1.96 and observed as 0.864 that is lower and meanwhile the p-value found to be higher than cutoff point 0.05, with confidence interval 95%, so therefore the relationship is rejected statistically.

This is important to note that facilitating condition has no significant relation to the students' satisfaction, that is may be due to the lack of facilitating conditions provided by the usage of tech-app as well as from the university management, the facilitating found to be insignificant to the students' satisfaction, that clearly shows that university management has to take such initiatives that address the concerns of the students and the participants of the online education system in order to gain the higher level of satisfaction. The results are insignificant due to lack of concern that provides the facilities during online education perspective.

The above table shows the results of the direct relationship, the relationship between behavioral intention to use technological applications and students' satisfaction is assessed and resulted as ( $\beta = 0.383$ ,  $T$ -value = 3.075,  $p$ -value = 0.002), this satisfied the conditions for significance of the relationship, the t-value found to be higher than the threshold value 1.96 and observed as 3.075 that is higher and meanwhile the p-value found to be lower than cutoff point 0.05, with confidence interval 95%, so therefore the relationship is accepted statistically.

The result of the current hypothesis shows that there is significant relationship between behavioral intention and students' satisfaction. The intention to adopt the tech-applications has the significant relation to the students' satisfaction, that means the lower the intention to adopt tech-app will be resulted in lower satisfaction, and the higher intention to adopt tech-app has the higher impact on the satisfaction, so therefore, the university management must be able to take such initiatives that shape the higher intention of participants to adopt the tech-application by providing the appropriate awareness, training and benefits of adopting technological applications.

### 5.5. Specific Indirect Effect (Mediating Role)

This section presents the mediation role of behavioral intention to adopt tech applications between exogenous and endogenous constructs of the framework. The table 4 below presents the mediation results.

**Table 4: Mediated Hypotheses Results**

Hypotheses	$\beta$	T-Value	P-value
EeAw $\rightarrow$ BehInt $\rightarrow$ SS	0.181	2.880	0.004
FC $\rightarrow$ BehInt $\rightarrow$ SS	0.118	2.091	0.037

Note: SS (students' satisfaction), EeAw (E-education Awareness), FC (Facilitating Conditions), BehInt (Behavioral Intention to use Tech app)

The specific indirect relationship between e-education awareness to intention to adopt tech applications that further influences the student's satisfaction has been assessed as well, and resulted as ( $\beta = 0.181$ ,  $T$ -value = 2.880,  $p$ -value = 0.004), this satisfied the conditions for significance of the relationship, the t-value found to be higher than the threshold value 1.96 and observed as 2.880 that is higher and meanwhile the p-value found to be lower than cutoff point 0.05, with confidence interval 95%, so therefore the relationship is accepted statistically and significantly mediate the relationship between e-education awareness and students' satisfaction.

The specific indirect relationship between facilitating conditions to intention to adopt tech applications that further influences the students' satisfaction is assessed to determine the significance of the relationship and resulted as ( $\beta = 0.118$ ,  $T$ -value = 2.091,  $p$ -value = 0.037), this also satisfy the conditions for significance of the relationship, the t-value found to be higher than the threshold value 1.96 and observed as 2.091 that is higher and meanwhile the p-value found to be lower than cutoff point 0.05, with confidence interval 95%, so therefore the relationship is accepted statistically and mediates the relationship.

### 5.6. Future Research Avenue

This study has number of limitations, including time and cost constraints as the researcher has limited time frame and this research was not funded so cost limitations restricted the scope of research. The future research study on assessing the under-discussed phenomenon should be funded and longitudinal research must be taken into consideration for generalization of the findings. This research was limited to few public sector universities of a province. In future the comparative study may be taken into consideration with universities with online mode of education or distance educations activities. This research was limited in order to assessing the variables, the future studies should focus on diverse variables, the emerging work environment variables to determine the pre-post COVID-19 era.

## 6. Conclusion

The prime concern of the current research effort is to determine the satisfaction level of the students of public sector universities of the Punjab, Pakistan that have been engaged in online educational activities during the forced lockdown and online shift of classes and exams during their degree. The education sector has received such negative impact of COVID-19 lockdown all over the world and had to switch their educational activities online from remote location as there was complete ban on travel and public gathering. The students' satisfaction was at stake during the online education system due to number of issues highlighted by this study, this research focused on the e-education awareness, and facilitating conditions to determine the satisfaction, the important contribution of the current study entails the mediation assessment of behavioral intention of adoption of tech-applications for education purposes. The students were unit of analysis specifically that have faced the both phases of online education era as well moved towards physical mode, the number of hurdles, problems, issues and challenges have been faced by university management as well as serious concerns at the end of students for quality education. The result of current study

revealed that e-education awareness significantly influences the behavioral intention to adopt tech-applications, and significantly influence the students' satisfaction. The results also depicted that facilitating conditions influences the behavioral intention, however insignificant to the students' satisfaction, that means there is serious concern of the students that university management has lack in providing the facilitating conditions in order to sustain the benefits of the online education and connect to educational institute from remote location. The behavioral intention to adopt tech-application significantly influences the students' satisfaction, that means intention of an individual towards adoption of tech-app leads towards the satisfaction. The university management must be able to take such initiatives for online education participants including students as well as teachers to by creating the e-education awareness, by proving facilitating conditions that enrich the intention of individual to adopt online tech-applications that further contribute in achievement of satisfaction level of students of public sector universities in order to avoid the negative impact and to grasp the maximum benefits of online mode for longer time span.

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