INTENTION OF STUDENTS TOWARDS TECH-ORIENTED TEACHING-LEARNING METHOD: A STUDY OF UNDERGRADUATE AND POSTGRADUATE LEVEL

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ABSTRACT

This study aims to investigate the intention of students of higher education towards the adaptation of tech-oriented teaching-learning method. It also measures the intentional difference between post-graduate and under-graduate students regarding adaptation to the tech-oriented education system.

The investigation is based on 1826 responses collected through online survey. The extended form of Technology Acceptance Model is considered to investigate using Partial Least Square Structural Equation Modelling. The intentional difference is assessed by employing the multi-group analysis using the measurement invariance for composite approach.

The results reveal that perceived usefulness and perceived ease of use positively influence attitude that affects intention of students to the ICT-based education system. Moreover, ease of use and perceived usefulness also holds positive relationship with intention to use online education. Furthermore, results reveal that though social status and self-efficacy positively impact perceived usefulness and ease of use, economic status has an opposite influence. The study finds no significant difference between the post-graduate and under-graduate students towards adaptation of tech-oriented education system.

There is no previous evidence that makes a comparison between the undergraduate and postgraduate regarding their intention towards online education. The findings can help in designing appropriate policies for higher education.

Keywords: Technology Acceptance Model, Intention, Higher Education, Socio-cultural Status, Economic Status, Self-efficacy

INTRODUCTION

The impact of technological advancement is keenly felt in education as evident from expansion of e-learning programmes. Hence, the wide use of computer-based technologies for delivering instructions to the students is in practice for some years now (Ong & Lai, 2006) which is considered to be an effective tool for imparting knowledge, information and encouraging participation (Azlan et al., 2020). This form of learning, known as e-learning (also called online education) depends on technology and internet and is primarily web-based (Moore et al., 2011) and ICT-based (Jenkins & Hanson, 2003) which aims to promote access and enhance the quality of education through collaborative learning.

Though the e-learning market has been surging ahead the growth varies widely across economies. There are economies that are yet to develop sufficient ICT infrastructure which can help education reach all at a low cost. Thus, the readiness for online education is different in countries. However, the occurrence of the pandemic made technology-based education inevitable. Consequently, all levels of education got affected starting from the primary to the tertiary level. When social distancing was necessity, online education was the only solution to

avoid disruption in education about which people opined negatively (Huang et al., 2020). Since, education is vital in the life of students, the main focus was to maintain its continuity. In such circumstance, the only way was to resort to online education to combat the rate of disease spread. The governments across the globe directed the closure of academic institutions and suspension of academic activities which affected more than 1.9 billion learner across 188 countries (UNESCO's support: Educational response to COVID-19). The implementation of remote learning was even more vital for a populous country like India with insufficient health infrastructure. Almost all academic institutions, therefore, transitioned to remote learning which was entirely based on ICT support (Aguilera-Hermida, 2020). In India, due to the lack of highly developed ICT infrastructure and widely heterogeneous population mix, there were key issues that cropped up which included accessibility, cost, suitable environment etc. The issue of digital divide came to the forefront (Eltahir, 2019) which is in addition to the problems of network connectivity and poor technical knowledge (Aung & Khaing, 2015; Mulhanga & Lima, 2017), poor self-efficacy (Kanwal & Rehman, 2017; Tarus et al. 2015), political and cultural factors (Kenan et al., 2013) and technological issues (Al-Araibi et al., 2019). No matter what, the system came as a blessing in disguise as the wheels of education continued to move.

In almost every country, teachers and administrators were motivated to use applications that supported communication with students and parents and helped to conduct live lessons or send recorded materials. Several online meeting apps gained popularity to meet the demand for online education. Thus, countries scaled up their existing distance education modalities (Chan, 2020). The policy-makers did not give heed to whether it would really help as the issues of access, technical knowledge, infrastructure support, cultural and socio-economic background took centre-stage. Though, it is true that a substantial percentage is benefitting from the system, there is also a huge percentage who find this to be a burden. Inequity in access to devices that support ICT is a major concern, as students from economically weak backgrounds often have limited access to such tools. Also, lack of basic infrastructure like electricity and low internet connectivity are additional hindrances. Hence, with mixed experience for the past few years, studies have been done to identify the better mode of education, traditional or online (Yen et al., 2018; Lockman & Schirmer, 2020). The accomplishment of results through an e-learning system is dependent on the level of its acceptance by the students; reluctance to use it fails to generate benefits (Almaiah & Al-Khasawneh, 2020).

This research, therefore, aims to find the key influencers in the technology adoption process and to identify the difference, if any, between the under-graduate and post-graduate students in respect of adoption of online education. The researchers, therefore, capture the motivators that that drive attitude and behavioral intention among these students.

1.   REVIEW OF LITERATURE, THEORETICAL FRAMEWORK AND HYPOTHESES FORMULATION

The growing popularity of e-learning does not necessarily mean that all's well with the system. Hence, its acceptance by the stakeholders is very important which will determine its success (Almaiah, 2018). Thus, the present investigation delves into the issues that affect attitude and intention to use online education. There are numerous foreign studies that have looked into the issue. Salloum et al. (2019) in a UAE-based study establish the relevance of innovation, qualitative issue, trust and sharing of knowledge. Al-Gahtani (2016) in the research using TAM find the role of perceived usefulness, self-efficacy, subjective norms and the possibility of external control. Subjective norms and experience are also identified as significant factors (Abdullah & Ward, 2016). The importance of technical knowledge of both teachers and students and ICT infrastructure is highlighted by Alhabeeb and Rowley (2017). Prior exposure to ICT-based education is also recognized to be an important factor (Sukendro et al., 2020).

The researchers in this empirical work consider the extended form of the Technology Acceptance Model which was pioneered by Davis (1989). The model is very popularly used by researchers while investigating the factors that affect technology adoption (Unal & Uzun, 2021; Zhong, et al., 2021). It has two constructs namely perceived usefulness and perceived ease of use (Hsu & Lin 2022). The former pertains to the notion about superior results arising from the application of technology which needs to be strengthened (Yee et al., 2009). On the contrary, the latter is the ease with which technology can be learnt and applied. Therefore, if it can be learnt easily, its acceptance will be more (Alrafi, 2009). The extant of literatures show the significant impact of

perceived usefulness (PU) and perceived ease of use (EoU) on attitude which in turn impacts behavioral intention (BI). BI is the extent to which an individual designs plans about using the new system one faces (Clement & Bush, 2011). As per the original TAM, the actual use of online education is decided by perceived usefulness, perceived ease of use, attitude and behavioral intention (Kartal, et al., 2022). However, with time, researchers have incorporated modifications in the original TAM by including new constructs.

The present research is carried out in two steps. The first step identifies the important factors relating to behavioural intention to use tech-oriented education system. The second step tests the intentional differences between post graduate and under graduate students, if any, towards tech-oriented education system. As per the proposed framework, the two constructs used by Davis (1989) are considered. Three more constructs are introduced in the model which includes socio-cultural state, economic status and self-efficacy. The relationships are detailed hereunder.

1.1 Influence on perceived usefulness

The term PU refers to the perception about the extent of benefits that will arise with the application of new technology. It is expected that socio-cultural status has an effect on technology acceptance. The behavior of society, peers, family members and societal norms has an influence on the notion about benefits from the new system. There are numerous evidences that support the significant role of referent groups (Park, 2009). In similar terms, the importance of culture in learning is also highlighted in social constructivism in education (Kinasevych, 2010). Similarly, the relevance of culture on learning and adoption of technology is observed by Joy and Kolb (2009) relating to success of information systems.

The economic status in similar terms influences perceived usefulness. It can be strongly argued that with a good financial standing, it is possible to have the necessary infrastructure that is required for engaging in online education which will in turn helps to understand the potential benefits of that system which has been supported in the discussion by Nawi et al. (2022). Non-availability of infrastructure at home with lack of support from the members in the surrounding also demotivates students (Farooq et al. 2020). Similarly, there is an idea that self-efficacy affects perceived usefulness.

1.2 Influence on perceived ease of use

The term 'perceived ease of use' is related to the conception of the effort required to learn and use new technology. It is expected that the nature of environment including people and cultural mix will influence easiness of use. It can be argued that an environment with supporting and knowledgeable members helps in easy understanding of new technology. Similarly, with a strong financial back-up, it is expectedly easier to learn about tech-related developments. Moreover, self-efficacy is believed to have positive impact on perceived ease of use not only because of better technical knowledge but also self-motivation to learn new things for gathering knowledge and self-improvement.

1.3 Effect on attitude and behavioral intention

This aspect takes cue from the original model in which it was conceptualized that both perceived usefulness and perceived ease of use affected attitude which in turn was expected to significantly influence behavioral intention. There are research contributions that have tested the validity of the relationship between perceived usefulness and perceived ease of use and attitude or behavioral intention (Kim et al., 2009).

Apart from the above mentioned hypotheses, the investigators decipher whether there is any difference between the students of the post-graduate and under-graduate courses by testing the following hypotheses:

H_1: BI towards tech-oriented education is significantly different.
H_2: Attitude towards tech-oriented education is significantly.
H_3: Perceived usefulness towards tech-oriented education is significantly different.
H_4: Perceived ease of use towards tech-oriented education is significantly different.
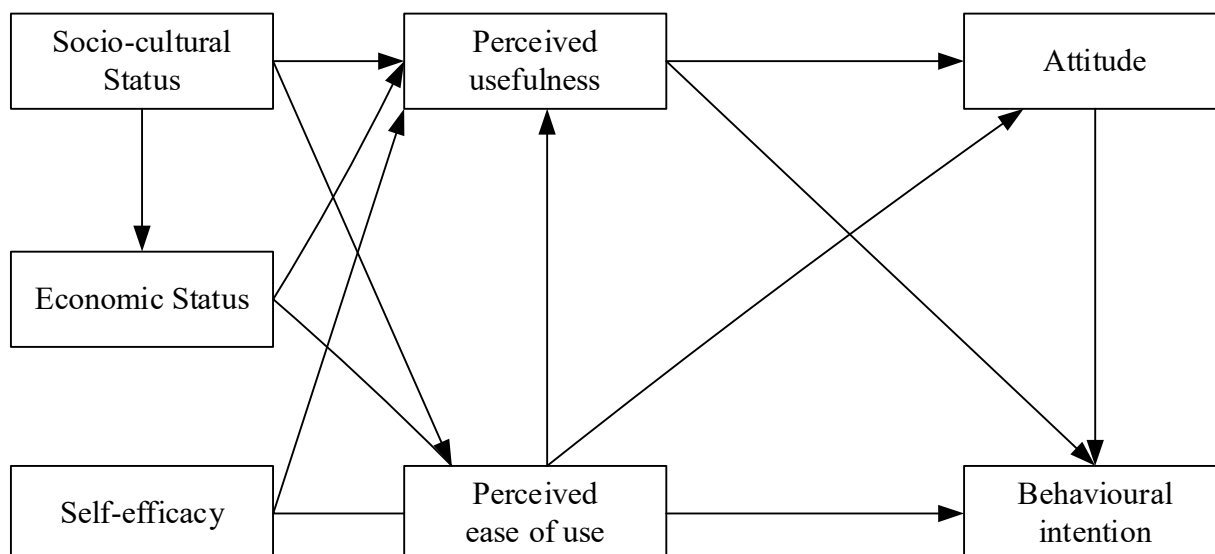
The proposed model is given below.

Figure-1 Theoretical Framework

2. METHODOLOGY

The basis of the investigation is a sample of 1826 students of higher education from the state of West Bengal (India). Due to Covid-19 restrictions, online survey method is employed in which questionnaire is distributed using google form link among the undergraduate and postgraduate students with the assistance from their teachers. The data is collected from 22nd April, 2021 to 10th June, 2021. The research instrument for this exploratory study is well-structured questionnaire for investigating students' attitude towards technology and intention towards online education. The extreme values (outliers) have been identified with the help of Z-score values for univariate cases and by employing the Mahalanobis distance method for multivariate cases as recommended by Pallant (2011). By applying the procedure, five outliers are identified and therefore the final sample size stands at 1821. The demographic characteristics of the sample considered for the study is presented in table 1.

Table-1 Sample structure

Gender			Family Monthly Income		
Male	1079	0.59	Less than 15000	1278	0.70
Female	742	0.41	15001-30000	210	0.12
			30001-45000	141	0.08
Streams			45001-60000	125	0.07
Arts	779	0.43	Above 60000	69	0.04
Commerce	597	0.33			
Science	447	0.25	Location		
Level of Education			Urban	318	0.17
PU	472	0.26	Semi-Urban	284	0.16
UG	1351	0.74	Rural	1221	0.67

Source: Primary survey

3. MEASUREMENT SCALES

The measurement scales are adapted from extant literature. However, some items are modified by reformulating sentences in order to fit the present research. The latent variables, perceived usefulness and perceived ease of are taken from the priori studies of Davis (1989) and from the recent contribution by Bag et al. (2020) with slight modification. The scales of self-efficacy have been adopted from the prior studies of Lassar et al. (2005) and

Wang et al. (2003). The scale of attitudes toward technology is taken from the research contribution of Ghorai et al. (2021); Zhang et al. (2008). Finally, the scale of 'intention to use' is taken from the recent contribution of Al-Maroof and Al-Emran (2018). For putting the response against each item in the questionnaire, five-point Likert scale is applied.

4. RESULTS AND DISCUSSION

Initially, for determining the internal consistency of the outer model, reliability and validity are required to be tested as cited by Chin (2010). The results for reliability (measured using α) and composite reliability (denoted by CR) of the various latent variables are presented in Table-2. The value for alpha is found to be more than the threshold value of 0.70 which thereby meets the criterion for reliability (Islam & Bag, 2020). In order to check for convergent validity, the minimum value of 0.50 for average variance (AVE) as given by Fornell and Larcker's (1981) is given consideration. As evident from table-2, the AVE for the latent variables in all the cases viz. composite, PG and UG level exceeds 0.50. Moreover, values of Composite Reliability (CR), rho_A and Cronbach alpha exceed threshold levels. Thus, on the basis of the results for different criterion, the questionnaire is found to be reliable and valid.

Table 2: Reliability and convergent validity of measurement model

Constructs	Alpha α			rho_A			CR			AVE		
	Composite	PG	UG	Composite	PG	UG	Composite	PG	UG	Composite	PG	UG
ATT	0.861	0.856	0.863	0.870	0.865	0.872	0.900	0.897	0.901	0.644	0.635	0.647
BI	0.882	0.885	0.881	0.888	0.892	0.887	0.911	0.913	0.910	0.632	0.637	0.630
ES	0.704	0.708	0.713	0.707	0.701	0.715	0.835	0.824	0.840	0.629	0.610	0.636
EoU	0.792	0.779	0.797	0.794	0.784	0.799	0.865	0.858	0.868	0.616	0.602	0.622
PU	0.887	0.890	0.886	0.888	0.892	0.887	0.914	0.916	0.913	0.640	0.647	0.638
SE	0.813	0.823	0.810	0.833	0.857	0.826	0.877	0.881	0.875	0.641	0.651	0.637
SS	0.702	0.700	0.707	0.712	0.702	0.732	0.835	0.834	0.838	0.629	0.627	0.637

Source: Computed by researchers

For establishing discriminant validity, Heterotrait-Monotrait (HTMT) ratio is computed which should be less than 0.9 for each latent variable (Henseler et al., 2015; Bag et al., 2021). Table 3 which presents the results of HTMT ratio indicates that discriminant validity is acceptable not only for both post-graduate and under-graduate level students but also for the composite model.

Table-3 Results of Discriminant Validity

	Post-graduate level								Under-graduate level						
	ATT	BI	ES	EoU	PU	SE	SS		ATT	BI	ES	EoU	PU	SE	SS
ATT															
BI	0.812								0.876						
ES	0.106	0.062							0.068	0.086					
EoU	0.812	0.755	0.129						0.851	0.767	0.087				
PU	0.851	0.774	0.058	0.876					0.857	0.783	0.080	0.881			
SE	0.723	0.679	0.138	0.752	0.795				0.750	0.722	0.110	0.844	0.885		
SS	0.450	0.381	0.675	0.449	0.410	0.399			0.250	0.175	0.789	0.215	0.211	0.196	

Source: Calculation by researchers

Before conducting the multi group analysis to identify the difference in intention between post-graduate and under-graduate students, path analysis is done to determine the structural effects of constructs of the study. Figure-2 represents the result of path analysis where 'β' represents strength of the relationship. It is observed that socio-cultural status has a positive impact on both perceived usefulness ($\beta=0.59$, $p<0.05$) and ease of use ($\beta=0.59$, $p<0.156$). They in turn bring create positive attitude (mind-set) towards the intention to adapt tech-oriented education. Moreover, socio-cultural status also positively influences economic status of the students ($\beta=0.540$, $p<0.05$). It implies that students with sound socio-cultural status are economically better placed which is essential for maintaining qualitative learning in higher studies. On the other hand, the economic status of the students studying in higher educational institutions has a negative influence on ease of use ($\beta=-0.128$, $p<0.05$) and perceived usefulness ($\beta=-0.034$). Thus, when the economic condition is better, there is an encouraging effect on the level of usefulness and the use of this non-traditional form also appears to be simple. On the contrary, ease of use positively impacts perceived usefulness ($\beta=0.425$, $p<0.05$), attitude ($\beta=0.324$, $p<0.05$) and intention ($\beta=0.103$, $p<0.05$) towards the use of tech-oriented education system.

Figure-2: Result of path analysis of the proposed model
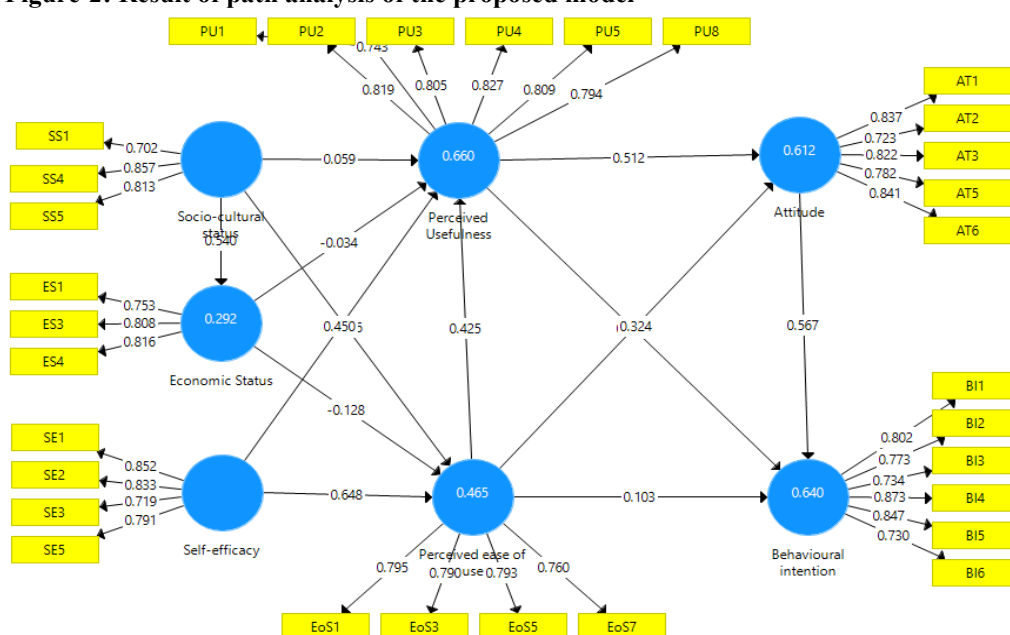
Source: Computation by researchers

The results match that of previous studies (Nasri et al., 2013; Amin, 2007). Similarly, perceived usefulness also positively influences attitude (β=0.512, p<0.05) and behavioural intention (β=0.189, p<0.05) of the students towards tech-oriented education system, which corroborates with the findings in Martinez-Lopez et al. (2020). Finally, the positive impact of attitude on the intention to adapt tech-oriented education (β=0.567, p<0.05) supports the result of Svenningsson, et al., (2021).

As mentioned earlier, the researchers also aim to test the difference between the under-graduate and post-graduate students. For the purpose, the measurement invariance is to be examined for the two groups which is an important criterion to conduct multi group analysis (Rasoolimanesh et al., 2020; Sarstedt et al., 2011). The researchers dealing with primary data analysis opine that measurement invariance for composite (MICOM) approach is ideal for PLS-SEM (Noor et al., 2019). The MICOM procedure has three stages which include measurement of configural and compositional invariances along with the assessment of equal means and variances (Rasoolimanesh et al., 2017). Moreover, partial measurement invariance is calculated to carry out multi-group analysis about which inference is drawn by establishing compositional and configural invariance. Table 4 that gives the findings using MICOM indicates agreement with partial measurement invariance. Hence, on that basis, group analysis can be applied for making a comparison between the path coefficients in the two models (for the two groups separately) and test the hypotheses set before.

Table-4 Results of invariance measurement testing

Constructs	Configural Invariance	Compositional invariance (Correlation = 1)		Partial measurement invariance	Equal mean assessment			Equal variance assessment			Full measurement Invariance established
		C=1	Confidence Interval (CIs)		Differences (PG-UG)	Confidence Interval (CIs)	Equal	Differences (PG – UG)	Confidence Interval (CIs)	Equal	
ATT	Yes	1.000	[0.999, 1.000]	Yes	-0.009	[-0.339, 0.322]	Yes	0.023	[-0.473, 0.429]	Yes	Yes
BI	Yes	1.000	[0.996, 1.000]	Yes	-0.029	[-0.330, 0.343]	No	0.075	[-0.457, 0.401]	Yes	Yes
EoU	Yes	1.000	[0.998, 1.000]	Yes	0.003	[-0.348, 0.338]	Yes	0.024	[-0.559, 0.581]	Yes	Yes
PU	Yes	1.000	[0.995, 1.000]	Yes	0.063	[-0.329, 0.350]	Yes	0.057	[-0.610, 0.572]	Yes	Yes
SE	Yes	0.999	[0.999, 1.000]	Yes	0.006	[-0.229, 0.250]		0.073	[-0.289, 0.354]	Yes	Yes

Source: Computed by researchers

5. ANALYSIS OF STRUCTURAL MODELS AND RESULT OF MULTI-GROUP ANALYSIS

Before performing the multi-group analysis to make a group-wise comparison between the effects of five dimensions of students' intentions towards use of online education system and test the proposed hypotheses, the structural equation model for both the groups is framed. To evaluate the structural model, it is necessary to assess the values of R^2 and test the Stone–Geisser criteria (Q^2) for technology-based education. Moreover, the significance of path coefficients for the different paths in the two cases is also to be studied (Ali et al., 2018). The analysis shows R^2 value of 0.670 for intention in the case of post-graduates and 0.631 for under-graduate students which refer to high scores (Rasoolimanesh et al., 2017). The result of Q^2 for post-graduate and under-graduate students as per the predictive model is 0.621 and 0.534 respectively which is positive and hence fulfils the criterion to be fulfilled for acceptance of a structural model (Ali et al., 2018). Moreover, significance of the path coefficient is determined using the confidence intervals based on bias-corrected measures. Table 4 clearly depicts that all the three constructs that are considered for the study have a positive as well as significant effect

on the students' intention to use tech-oriented education system which is applicable for both under-graduate and post-graduate students.

Table 5 represents the results of multi-group analysis and testing of proposed hypothesis. Two nonparametric approaches viz. Henseler's multi group analysis (MGA) and permutation approach (Chin & Dibbern, 2010) are employed to compare the behavioural intention of the students. With the application of these two methods, it is seen that there is no significant difference between the two categories.

Table-5 Results showing comparison between the two student categories

Hypothesis	Path	Path Coefficient		Diff. in path coefficient	Henseler's MGA	p-value	Remarks
		PG	UG				
H1	ATT -> BI	0.627	0.554	-0.083	0.705	0.133	No/No
H2	PU -> ATT	0.550	0.499	-0.051	0.802	0.391	No/No
H3	EoU ->ATT	0.269	0.344	0.075	0.596	0.232	No/No
H4	EoU -> PU	0.460	0.408	-0.052	0.589	0.369	No/No

Source: Calculation by researchers

6. CONCLUSIONS
The pandemic has created panic across the globe. The technology-driven online form is the need of the hour. In India, due to the sudden transformation from the traditional to this tech-oriented system, several issues cropped up. With such a background, the aim of the study is to find out the intention among the students in higher studies to use technology-driven education. The examination of the primary data shows that perceived usefulness and ease of use are two pertinent factors that influence attitude of the students significantly. Moreover, these two constructs also significantly impact behavioural intention of students positively. Hence, policy-makers, administrators and instructors need to highlight the easiness of using tech-oriented education and also motivate them to use the ICT-based education. The investigation further points that attitude significantly impacts the intention to use tech-oriented education. Hence, it becomes essential to create positive attitude in the mind of the students towards the non-traditional form of education system.

The study further establishes that social state and self-efficacy of students have significant influence on perceived usefulness and ease of using tech-oriented education. Thus, the higher education institutions should create sufficient scope to build students' efficacy for handling technology-related issues in their learning process. Besides, their socio-cultural development will also play a vital role in exploring the tech-oriented education system. However, the economic position of the students' family has negative influence on the perception about the perceived usefulness and ease of use. In addition, the investigation also addresses the intentional differences between post-graduate and under-graduate students which is seen to have no significant difference in respect of using the system. So, tech-oriented education system can be an effective mode of education system in higher education. But, the loopholes need to be plugged for making this education mode more successful and acceptable in the long-term.

7. LIMITATION AND SCOPE FOR FURTHER RESEARCH
Despite the fact that the researchers followed the necessary steps in arriving at the results and conclusions, the study is not free from limitations. Though, the paper considered important constructs in framing the extended technology acceptance model, some other important aspects could not be considered as it would make the model too complicated. The other constraint is that the test for difference is applied on the students of under-graduate and post-graduate levels. Other important bases like gender, location can be considered in the future efforts.

8. ACKNOWLEDGEMENT

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