

# Limitations Involved in the Utilization of Computer Based Technologies at Universities' Teaching and Learning in Pakistan

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## ABSTRACT

With the advent of 21st century the usage of technology in every field of life made it inevitable to be used in the field of education as well. It is a familiar fact that the current scenario where technology has made advances by leaps, its usage in the field of education is of utmost importance. Like the rest of the world, the educational institutes in Punjab, public and private, are making efforts to adopt and integrate technological advancement in their teaching and learning processes. The universities in Punjab are no exception. However the hurdles and limitations involved in this process are hard to be ignored. Therefore this study will try to highlight those issues that are causing hurdles in use of technology in teaching and learning at universities in Punjab. For this purpose this study has made use of Ely's conditions model (1999) of technology implementation theory, which is reflected more appropriate for measuring the barriers in technological applications in academics. This research made an extensive and thorough investigation, based on the opinion of 3397 participants. The methodology used was survey research involving teachers, administrators and students from eight public and private universities' faculty of Education and Business. The responses were assessed by applying descriptive and inferential statistics. This study revealed a number of factors responsible for causing hurdles in technology adoption, but the major factor as per the respondents was the unavailability of Resources. There were some other factors mentioned as well such as Commitment, Rewards, Leadership, Participation and Skills. The overall level of involvement of these sub scales barriers is above average; therefore, unfortunately universities are still using the conventional method of education and cannot make as much use of technology as they could have.

## Keywords:

Computer Based Technologies (CBTs), Technology Adoption and Integration, Teaching, Learning, Barriers

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## Introduction

In order to bring the world on the same page, the need of the hour is to make sure that opportunities and resources are available for teachers and students to adapt themselves with computer based technologies (CBTs) like computers, internet, World Wide Web and laptops. This will not only enhance digitalized teaching and learning but also eliminate digital divide. In this regard, researchers believe that a big contribution in pupils' effective online education is the use of ICTs (information and communication technologies) (Gulek & Demirtas, 2005). A number of countries around the world like USA, Canada, Turkey, India and New Zealand have taken an initiative by introducing various computer based technologies. It is evident from research studies that use of CBTs have made the overall environment of teaching learning more

effective and conducive (Ahmed & Rafiq, 2016; Iftakhar, 2016; Payal and Kanvaria, 2018; Silviyanti & Yusuf, 2015). The demands that society has placed on universities in general and faculty in particular is utilization of digital resources in education (Greenhow, Robella & Hughes, 2009; Nicolle, 2005). The world of technology continues to progress with newer and newer digital resources like Internet, facebook, smart classrooms, teacher student web portals, blogs continue to spread in whole world (Muslem, Yusuf & Juliana, 2018).

For the purpose of effective integration of computer based technologies in education the government, HEC, universities' authorities and others have encouraged the easy access to this technology (Pettersson, 2017; Ahmed & Rafiq, 2016). But in reality there is a lot of room for

improvement. The teachers in universities are expected to play a main role in adapting themselves with the latest technology and instill it in their students. However, the findings in this regard are not very promising. (Hariadi, Dewiyani, & Sudarmaningtyas, 2016; Olofsson, Lindberg & Fransson, 2018).

Pakistan is a developing country with its fair share of problems faced by its education system, quite naturally it is difficult to integrate computer based learning in its educational system. With the ever growing digital gap and widening technological differences, the developed countries have left their developing counterparts far behind. According to Taimur-ul-Hassan & Sajid (2012) Pakistan is fragile to the use of CBTs in university education in terms of not only the limited access to these technologies but also its improper usage. Anwar, Hukamdad, and Nawaz (2011), also unveiled different causes of technology's failure in the educational system of Pakistan. These factors are limitations in internet access and speed, poor or no maintenance of digital resources and labs, lack of efforts to motivate teachers and students in use of technologies to its full potential and no inclusion of CBTs in curriculum and instruction. Iftakhar (2016) also analyzed the situations in Pakistan and claims financial constraints, in competencies in utilization of CBTs, no trainings in updated teaching technologies, untrained man power for maintenance of digital resources and lack of interest by management in use of CBTs, as major reasons for this failure. The educational system of Pakistan not only lacks in the skills and knowledge of digital teaching and learning, but also ignoring the educational value of e-learning (Iqbal & Ahmed, 2010). There are many other factors that need to be unleashed and brought into light as these are responsible for the daunting conditions of technology adoption and integration in teaching and learning in Pakistani universities.

## Background

A number of different technological innovation/change models have been used in almost every time period. Educational and managerial scientists have taken keen interest in various models as these models are interdependent. Interestingly, these models are linked with each other, and somehow supports one another. The processes of these models of change, work similarly in both business and educational setups (Bucherer & Uckelmann, 2011; Zott, Amit & Massa, 2011). These similarities between academic theories about change and industry practices, have brought these fields on a common ground.

As per Ely (1999), the dynamics of change is introducing the technological innovations to the society. In order to understand this process we must understand its implementation as it is the most important part of the whole process. (Ely, 1990b; 1999). According to Ely, the conditions paving way for a innovation will also enable the implementation of innovation/change. This enforcement of change can have both positive and negative aspects. The positive aspect of this change philosophy highlights the facilitating factors of change whereas the negative aspect highlights the limitations in the implementation of change. Earlier is opposite of later. This study refers to the limitations faced in the implementation of change are argued.

## Ely's Conditions

Donald P. Ely initiated exploring the environments for the technological innovation, back in 1975. An article on application of technologies in libraries was written by him. Due attention to his work was received, which stimulated him to work intensively in this field. Ely explained in reference of his work that the conditions such as skills and knowledge, commitment, leadership, participation, incentive and rewards and management support lead to the process of change. During 1989, Ely extended his

work in other cultures and concluded that these conditions of change were equally supportive in other cultures (Ely, 1999). Ely's work gained a lot of popularity despite the fact that other researchers had an opposite view. Other researchers opined that the adoption of technology in developed nations cannot be generalized on underdeveloped nation. This difference among developed and underdeveloped nations is due to demands for modern education and training, environment and culture (Porter, 2012). Ely emphasized on the situation, but he was also firm that for actual

implementation, the features of innovation cannot be overlooked. An effort is made in this study to unleash the limitations in technology integration in universities with reference to Ely's conditions model for successful application of technology. According to Ely if the conditions for technology implementation are conducive, then the education sector will be able to inculcate advance technology in their education system. Therefore, the limitations in technology proliferation must be controlled and efforts should be made to overcome these.

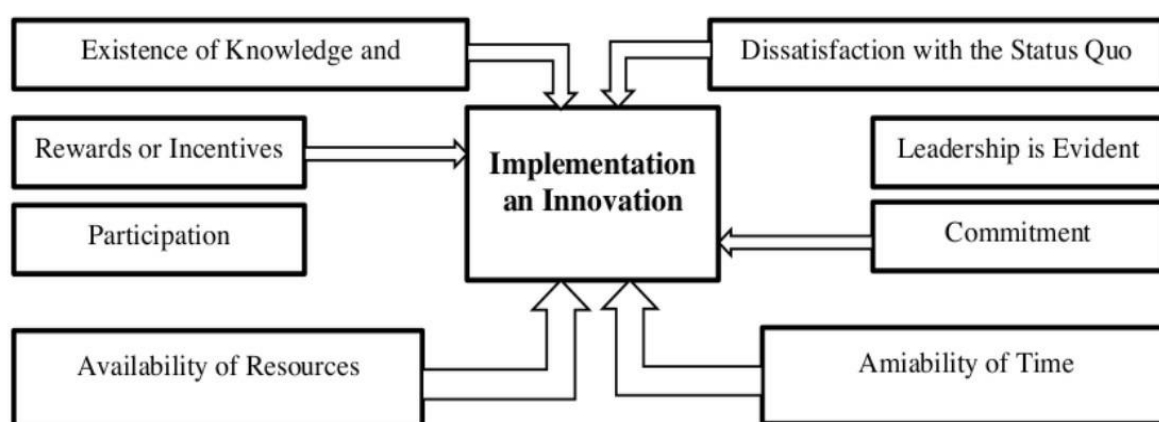


Fig.1 Ely's Conditions for Implementation of an Innovation

### Research Objectives

Following objectives were planned to be achieved:

- Explore the limitations/barriers involved in integration of computer related advanced technologies in higher education institutions (universities) leading to Ely's Conditions for execution of Innovation Model.
- Assessing the need to improve the application of CBTs in higher education institutions (universities) of Punjab with respect to determinants of Ely's Conditions model.
- Recognize the significant differences in the views of students, teaching faculty and academic heads regarding limitations involved in CBTs' incorporation in university's academic activities in the province Punjab.

- Collect recommendations to improve the utilization of CBTs for academic activities in public and private sector universities situated in the province Punjab.

### Research Questions

- What are the limitations that restrain the utilization of computer related technologies by the teaching faculty and students engaged in academic activities in universities leading to Ely's Conditions for execution of Innovation model?
- What is the need to improve the application of CBTs in universities with respect to determinants of Ely's Conditions for execution of Innovation model?
- Is there a significant difference of views amongst the community of students, teaching faculty and academic heads

regarding barriers faced by CBTs' integration in universities?

- What are the suggestions of academic heads, teaching faculty and students for improving the conditions of CBTs' execution at universities?

### Research Methodology

This research measured the limitations/barriers faced by universities' teaching and learning at Punjab according to Ely' conditions model (1999). Survey method is used to achieve the objectives of this research.

### Sample of the Study

In order to select the sample, method of multistage sampling was adopted. The province Punjab was divided into 4 regions i.e. Central Punjab (18 districts), Southern Punjab (07 districts), Western Punjab (07 districts) and

Northern Punjab (04 districts). Due to greater percentage of population and the larger numbers of universities, the Central Punjab was chosen. In second stage, the purposive sampling was adopted for sampling purpose. A total of eight universities under the category of general type were chosen based on the following conditions:

- Presence of both sector universities in similar geographic boundaries.
- Serving as main campuses
- Faculties of Social and Management Sciences are existing.

In third stage, the census and proportionate sampling were exercised. Census was used for nomination of the faculty members and administrators. Students were nominated on proportionate sampling and among the sampled faculties, from the total students, a 30% were nominated as sample.

Table 1 *Nominations of the Respondents in Sampled Universities*

Sr. No	University	Sector	Participants (Estimated)			
			30% of total students	Teachers	Admin	Total
•	Punjab University, Lahore, Pakistan	PUBLIC	1141	84	16	1241
•	Government College University, Faisalabad		695	81	14	790
•	UOE, Lahore (University of Education)		116	51	5	172
•	Lahore College for Women University		187	23	5	215
•	UMT, Lahore		210	66	7	283
•	University of Faisalabad, Faisalabad	PRIVATE	210	66	7	283
•	Beacon House National University, LHR		180	11	2	193
•	University of Lahore, Lahore		210	12	2	224
	Grand Total		2949	394	58	339

### Instrument

The instrument was developed for the education and business oriented faculties of public

and private sector universities of the province Punjab. The research tools adapted for this study comprised of self-report queries on five point

Likert type scale. The questionnaires further parted into: Demographic information, the limitations in the execution of CBTs in academic activities and the last part of the questionnaire was designed to find out the solutions to the limitations/barriers of technology execution at universities. On basis of Ely's conditions, the limitations were further distributed into six parts, consisting of 23 items. The instrument's reported reliability after the pilot study was 0.814, which was later floated for data collection.

### Collection and analysis of data

The survey was managed by the researcher personally, visiting the sampled universities for the data collection. Data were gathered from the teachers, students and academic heads of public and private sector universities in central Punjab. To achieve the objectives of this study the factor analysis, one sample t-tests, independent samples t-test, one-way ANOVA, Multi Analysis of

Variance (MANOVA) and descriptive statistics were used.

### Results

The Cronbach's  $\alpha$  coefficient of the instrument was 0.848. In this study, the sample comprised of students (with majority, 87.4%), academic heads and teaching faculty. Majority of respondents were from PU, Lahore (36.9%). The age brackets used were as 21-30 years (85.9%), 31-40 years (8.6%), 41-50 years (3.8%), 51-60 years (2.2%) and above 61 years (0.6%). Discipline wise management sciences (60.1%) and social sciences (39.9%). Respondents from public sector were (64.8%) from private sector were (35.2%). Female respondents were in majority (59.1%) than male (40.7%). Factor analysis was run to extract the 6 factors model of limitations involved in technology utilization in university education in the Punjab

Table 2 *Communality and Eigen values of the Limitations in CBTs*

Items	Communality	Factor	Eigen value	% of Variance	Cumulative % Variance
Knowledge to use it	0.54	1	6.30	29.98	30.44
Ability to use it	0.71	2	1.76	8.36	38.34
Training in CBTs	0.84	3	1.38	6.72	45.14
The financial resources	0.65	4	1.52	6.19	51.14
The infrastructure of this university	0.64	5	1.17	5.01	56.13
The informational resources	0.60	6	1.12	4.68	61.19
The culture (technology oriented)	0.51				
My awareness about the CBTs policy being practiced in university	0.42				
CBTs policies are latest	0.56				
CBTs policies are documented	0.59				
CBTs policies are familiar to teachers	0.59				
quantity of rewards	0.66				
My immediate boss enables my use of these technologies	0.55				
quality of rewards	0.68				
CBTs policies familiar to learners	0.53				
Technical maintenance by university's management	0.50				

My immediate boss is supportive of my beliefs	0.97
Overall support by university upper management	0.45
communication to incentives	0.55
My immediate boss promotes my ideas about it	0.97
Administrative support by university upper management	0.50

Factor analysis was applied to extract the six Model of technology limitations recognized as the budding factors (Resources, Rewards, Skills, Participation, Commitment and Leadership) in CBTs' utilization for teaching and learning activities at universities. As per the Kaiser criterion, eigenvalues greater than 1 were taken. . Principal Component Analysis was the method of extraction. Direct Oblimin was the rotation

method. Nelson (2005, p. 24) suggested that "items with loading value more than 0.3 should be retained in a factor". That is why, the items with 0.30 and more and the items with minimum 0.30 on its own factor and less than 0.30 on any other factor were also reserved. The "Percentage Variance" row informed that 61.91% of the total variance resulted by these six factors.

*Table 3(a) Factor Loadings for Barriers in CBTs in Teaching and Learning Sub-Scales*

Items	F1(factor) (Skills)	F 2 (Resources)	F 3 (Participation)	F 4 (Rewards)	F 5 (Comitment)	F 6 (Leadership)
Knowledge to use	0.76					
Training in CBTs	0.85					
Ability to use	0.85					
The financial resources		0.83				
University's infrastructure		0.74				
The informational resources		0.75				
CBTs policies are latest			0.71			
CBTs policies are documented			0.77			
CBTs policies are familiar to students			0.69			
CBTs policies are familiar to faculty			0.73			
quality of rewards				0.71		
communication to incentives				0.83		
quantity of reward				0.79		



The overall development of culture by upper management	0.40
Administrative support by upper management	-0.48
Technical support by management	0.49
My immediate boss is supportive of my beliefs	0.95
My immediate boss promotes my ideas about it	0.96
My immediate boss enables my use of it	0.66

Table 3 Mean and One-Sample t-values of the Limitations in CBTs' application at Universities

Barriers	Statements	Mean	SD	df	t-value
	I find the following limitations in use of CBTs in university's teaching and learning				
	Knowledge to use it	3.84	1.96	2871	104.70*
	Training in these technologies	3.30	1.09	2871	160.78*
	Ability to use it	2.62	1.30	2871	107.29*
	The financial resources	3.52	1.12	2871	168.63*
	The infrastructure of this university	3.32	1.05	2871	168.40*
	The informational resources	3.25	1.04	2871	166.24*
	CBTs policies are familiar to teachers	3.19	1.07	2871	159.32*
Skills	CBTs policies are familiar to the students	3.18	1.08	2871	156.94*
Resources	CBTs policies are documented	3.22	1.02	2871	168.41*
Participation	CBTs policies are up-to-date	3.21	1.05	2871	162.91*
Rewards	Communication to rewards and incentives	3.31	1.06	2871	166.51*
Commitment	The quality of rewards	3.31	1.04	2871	170.44*
Leadership	The quantity of rewards	3.30	1.02	2871	173.23*
	Technical support by university upper management	3.33	1.04	2871	171.31*
	Administrative support by upper management	3.34	1.14	2871	156.46*
	The development of CBTs oriented culture by university upper management	3.35	1.06	2871	169.40*
	My immediate boss enables my use of it	3.25	1.04	2871	166.88*
	My immediate boss promotes my ideas to it	3.29	1.09	2871	160.72*
	My immediate boss is supportive of my ideas	3.29	1.09	2871	160.72*

The findings of Table 7 show that the respondents have shown agreement about the limitations in use of CBTs in university education as in most cases the mean score is above the cut point 3.0. The most prominent barrier in CBTs' integration in

university instruction is the knowledge to use these technologies with highest mean score ( $M=3.83$ ) whereas the respondents disagree with one of the limitation as the ability to use these technologies.

Table 4 Mean Scores and One-Sample *t*-values Against Respondents groups for Sub-Scales

Factors (CBTs in teaching activities)	Alpha	Mean
Skills	0.86	3.25*
Resources	0.71	3.35*
Participation	0.76	3.25*
Rewards	0.75	3.29*
Commitment	0.66	3.36*
Leadership	0.69	3.29*
Overall Barriers	0.88	3.2*

The factor analysis explored 6 factors of limitations namely: leadership, resources, participation, rewards, commitment and skills. Using the mean scores and standard deviation, the limitations are ranked. In limitations, the resources is the most bulging limitation with

highest scores ( $M= 3.35^*$ ,  $SD=0.72$ ) referring that the respondents agree the most with the resources as major limitation in CBTs in universities. It is followed by commitment, rewards, leadership, skills and participation.

Table 5 One-Way MANOVA and Post Hoc Tests Tukey HSD for Multiple Comparisons of Limitations in CBT' Integration in Teaching and Learning for Sub-Scales with respect to Respondents groups

CBTs in Teaching Activities	Administrators 01 (N=44)		Teachers 02 (N=320)		Students 03 (N=2811)		Mean Diff. 01 v/s 02	Mean Diff. 01 v/s 03	Mean Diff. 02 v/s 03	F- values	Effect size ( $\mu$ )
	Mean	SD	Mean	SD	Mean	SD					
Resources	3.19	0.96	3.28	0.83	3.36	0.70	-0.09	-	-0.08	2.99*	.01
Skills	3.14	1.34	3.25	1.05	3.22	1.05	-0.11	-0.08	0.03	0.26	.00
Leadership	3.23	1.09	3.22	0.94	3.27	0.82	0.01	-0.05	-0.05	0.64	.00
Participation	3.19	0.87	3.19	0.68	3.24	0.69	0.00	-0.05	-0.05	0.73	.00
Commitment	3.33	0.92	3.32	0.74	3.33	0.83	0.02	0.05	-0.01	0.02	.00
Rewards	3.02	0.71	3.32	0.85	3.29	0.84	-0.29	-0.28	0.02	2.45	.00
Overall limitations	3.18	0.78	3.25	0.62	3.28	0.57	-0.07	-0.05	-0.03	0.87	.01

\* $p<0.05$

MANOVA along with post-hoc was run to compare the limitations involved in use of CBTs in universities across the respondent's groups.

Administrators as 01, teachers as 02 and students as 03, were the three respondents' classifications. No significant differences of opinion were found



among the respondents' groups regarding limitations in CBTs utilization in the overall limitations .05 levels in mean and standard deviation values, with F value of 0.87. It is was also found that there was no significant differences of opinion between the pairs of participants as well (01 Vs 02, 01 Vs 03 and 02 Vs 03).

Within the limitations, the students significantly show higher degree of agreement than the administrators regarding resources as a limitation/barrier. Eta square was used for computing the effect size which was .01. This refers that the real difference in the mean scores was small.

Table 6 *Suggestions/Opinions of Participants about their Practices as operators of CBTs' in Universities*

Opinions	Administrators		Teachers		Students		Total	
	N	%	n	%	n	%	n	%
CBTs should be installed in every classroom.	---	---	---	---	7	1.0	7	1.0
CBTs are more beneficial for university students 'use rather than college students.	---	---	---	---	30	4.3	30	4.1
Global competition within nations can only be enhanced by use of digitalization of education.	---	---	---	---	8	1.1	8	1.1
CBTs should be used to facilitate the academic environment.	---	---	2	6.9	---	---	2	0.3
CBTs are very productive if used for academic purpose.	---	---	1	3.4	---	---	1	0.1
CBTs may be promoted in social sciences rather than only in pure sciences	---	---	1	3.4	---	---	1	0.1
CBTs always better than books.	---	---	---	---	5	0.7	5	0.7
CBTs should be given due importance as every field of life is engaged with it.	---	---	---	---	73	10.4	73	9.9
Electronic resources have reduced our book habits.	---	---	---	---	43	6.2	43	5.9
Government may provide internet and laptop every university student.	---	---	---	---	183	26.2	183	24.9
Modern digital devices and labs are needed.	---	---	2	6.9	---	---	2	0.3
More investment should be made in use of ICTs.	---	---	---	---	33	4.7	33	4.5
Pakistan needs CBTs integration in education to	---	---	2	6.9	---	---	2	0.3

compete with the world								
Students need more training of CBTs especially in public sector.	---	---	---	---	15	2.1	15	2.0
Technology enhance our analytical thinking	---	---	---	---	23	3.3	23	3.1
CBTs for effective teaching and learning is a must and not an option.	---	---	2	6.9	---	---	2	0.3
Computer based technologies should be used maximum in research work.	---	---	---	---	80	11.4	80	10.9
The utilization of computer technologies should be at all educational levels.	2	33.3	17	58.7	---	---	19	2.6
The major challenge in use of CBTs is the leakage of personal information which needs to be controlled.	---	---	---	---	8	1.1	8	1.1
Training and assistance of CBTs' use may be provided to university teachers.	3	51	---	---	---	---	3	0.4
Total	6	100.0	29	100.0	699	100.0	734	100.0

It is evident from findings that most of the administrators (51%) have marked 'training and assistance of CBTs' use may be provided to university teachers', majority of the teachers (58.7%) found 'the utilization of computer technologies should be at all educational levels', whereas most of the students (26.3%) have mentioned 'govt. may provide internet and laptop to every university student irrespective of CGPAs, as the most desirable feedbacks for CBTs utilization in universities of Pakistan.

## Discussion

This research was organized to achieve three basic objectives. The first research question was, "What are the limitations that restrain the utilization of computer based technologies by the teachers and students in university's teaching and learning according to Ely's Conditions for Change model?" As per our findings, the respondents are in a mutual agreement about the eighteen

identified barriers with respect to Ely's conditions model in the use of CBTs in university teaching and learning. There are other research studies which show that the resources are the major factor that limit the use of CBTs in university education (Ahmed & Rafiq 2016; Iftakhar, 2016; Payal & Kanvaria, 2018). The most prominent factor in CBTs' integration in university instruction is the knowledge to use these technologies with highest mean score. Ghavifek and Rosdy, (2015) also confirm in their study that the knowledge to use the computer based technologies is always mistreated by the universities as these universities have never made an effort to make CBTs as part of university curriculum. The respondents disagree with one of the limitation as the ability to use these technologies. The skills, as a limitation in this research included: knowledge to use it, training in CBTs and ability to use it. Through this study, it has been revealed that the major factor that limits our use of technology is the lack of

knowledge to use it. The reason might be that respondents feel deprived of possessing the up dated and professional awareness to apply these digital resources in universities.

The next goal to be achieved through this study was, “What is the need to improve the application of CBTs in university’s teaching and learning with respect to determinants of Ely’s Conditions for Change model?” referring to the findings of this research the majority of respondents have recognized that the limitations preventing the use of CBTs in universities by respondents include; leadership, participation, rewards, skills commitment and resources. According to this study’s findings, resources are the most prominent barrier in the use of technology at universities’ teaching and learning, followed by Commitment, Rewards, Leadership, Participation and Leadership. In other research studies also, lack of required resources is held accountable for the inadequate use of technology for teaching and learning. Technology application is an expensive process which not only requires computers but many other equipment, software programs, and gadgets etc. The ever evolving and progressing technology needs to be monitored quite closely and frequently. The in availability of updated resources is not only because of scarcity of hardware and software but also the result of other factors such as poor accessibility to digital devices by the teachers, deficiency and poor management of resources and outdated soft wares. The limitations associated to the availability of latest digital resources for faculty members are prevalent. Other limitations to these digital resources are inadequate access to internet, limited and outdated soft wares, slow speed of internet and inadequate units for use (Asnawi, Yusuf & Rena, 2017; Payal & Kanvaria, 2018). Through this study, we have also found out that undoubtedly resources do play a major role in evolving a technology oriented culture in universities. The respondents of our study believed that all they have are the computers, but

that is not sufficient to cultivate a technology oriented culture in our institutions.

The third research objective of the study was, “What are the suggestions of administrators, teachers and students for improving the conditions of CBTs utilization in teaching and learning at universities?” according to the results of this research, the recommendations made by the three groups of respondents are as follows: the most of the administrators (51%) have recommended to provide ‘training and assistance of CBTs’ use may be provided to university teachers, most of the teachers (58.7%) have recommended that ‘the utilization of digital resources should be at all levels of academics, while most of the students (26.3%) have marked ‘govt may provide internet and laptop to every university student irrespective of CGPAs. The most recommended solution by the administrators for the effective integration of technology that is training and assistance in these technologies is also recommended by the research findings of Hariadi, Dewiyani, and Sudarmaningtyas (2016) as these researchers suggested that incorporation of computer based technologies into classrooms may enhance the educational process. Bulfin, Johnson, Nemorin and Selwyn, (2016) also emphasize on working on developing the skills of teachers and students to prevail the maximum benefits out of these technologies in teaching and learning. The most mentioned recommendation by the students for the effective integration of computer based technologies was the provision of free laptops and internet facility for each and every student despite their CGPAs. This argument of free laptop initiative by the government has been supported by an extensive research (Ahmed & Rafiq 2016; Ballew, 2017; Binbin Zheng, Mark Warschauer, Chin-Hsi Lin, & Chi Chang, 2016) Research also supports this recommendation that the ease and accessibility of the free laptops initiative by the concern authorities have increased the use of CBTs in academics (Ahmed & Rafiq, 2016). Teachers in this study recommended the use of

these technologies not only at university level but also at schools levels. The reason being that acquiring the skills of using technology and putting it to practice from early levels of education will not only make the students comfortable with its use but also polish their skills. Bagdasarov, Yupeng and Wuet, (2017) also recommend in their study that CBTs may be used in classroom teaching at school levels to make lectures vivid and interesting.

### Conclusions

On the basis of this study, the crux of the matter is that the limitations involved in effective technology adoption and integration in teaching and learning at universities of Punjab includes resources, commitment, rewards, leadership, skills and participation. The findings showed that the deficient resources which include the financial, infrastructural and informational resources are responsible for lingering the adoption of technology process. The respondents gave their recommendations to improve the current scenario of technology in teaching and learning at Universities of Punjab. These recommendations included the trainings and skill building of the respondents in CBTs effective use in instruction, free internet and laptop initiatives by the concerned authorities, use of CBTs at initial levels of education, maintenance and up gradation of these technologies, breaking the status quo of conventional teaching and learning and many others.

### Recommendations

Based on results obtained, the following recommendations are suggested;

- In order to improve the limitations in use of CBTs in universities' teaching and learning, the limitations may be evaluated in terms of "state-of-the-actual" instead of "state-of-the-art" so that respondents' perceptions on the "state-of-the-actual" or

the limitations may increase the use of CBTs in teaching and learning

- One of the major limitation in proliferation of digitalized academics is unavailability of resources. Therefore it is suggested to the government, HEC and other concerned authorities to focus their energies on obtainability of resources and address it on priority. The authorities may provide high speed internet, latest and updated computer labs, updated soft wares, sufficient CBTs units, maintenance force and an easy access of teachers to digital resources.
- The teachers who lack the skills to use CBTs in the classroom are causing to be a major hurdle in the smooth running of the whole process. Therefore it is of utmost importance to enable them to use the technology based learning and be able to instill it among their students.
- Another limitation revealed is the documentation of CBTs' policies, it is suggested that such policies and strategic planning on CBTs' use in universities may be dispersed among the stakeholders in a documented form. A constant reminder will promote the use of these technologies among the teachers and students. Such policies may be exhibited inside schoolrooms, bill boards, lecture theaters, cafeterias and libraries.
- Another recommendation is that the concerned establishments may provide incentives with the application of CBTs in universities and communicate it with the faculty members and pupils over the flier's and notices, so that they may get motivated.
- There is a need to establish a CBTs' oriented culture in universities. It is recommended that HEC, concerned establishments, faculty and student groups and IT oriented companies like MS, IBM and Google may team up their efforts to

infuse the future generations with technology based education.

- The leadership or the immediate boss may analyze the required capacities of teachers and learners for these technologies and develop them accordingly.
- The authorities may retrieve the abandoned project of the Prime Minister free Laptops Scheme for pupils in state Universities. Similarly the universities and HEC may also assist their faculty and pupils further by initiating payback loans with easy repayments thus the underprivileged and deserving pupils may have a chance to show their true potential.

## REFERENCES

- [1] Ahmed, M., & Rafiq, S. (2016). Accessibility and usability of internet among university students in Khyber Pakhtunkhwa, Pakistan. *Pakistan Journal of Information Management & Libraries (PJIM&L)*, 18(1), 37-51.
- [2] Anwar, M., Hukamdad., & Niwaz, A. (2011). Experience of e-learning in Pakistan: Perceptions and suggestions of graduate students. *International Journal of Academic Research*, 3(3), 373–376.
- [3] Asnawi, M., Yunisrina, Q., Yusuf, H., & Rena, J. (2017). Perceptions and Barriers to ICT Use among English Teachers in Indonesia. *Teaching English with Technology*, 15(2), 3-23.
- [4] Ballew Cameron, E., & Green, M. (2012). *Making sense of change management: A complete guide to the model, tools and techniques of organizational change* (3rd ed.). London: Kogan Page Limited.
- [5] Bagdasarov, Z., Yupeng, L., & Wuet, W. (2017). The influence of tablet-based technology on the development of communication and critical thinking skills: an interdisciplinary study. *Journal of Research on Technology in Education*, 49(1), 55-72. doi:10.1080/15391523.2017.1293576.
- [6] Binbin, Z., Mark, W., Chin, -H. L., & Chi, C. (2016). Learning in One-to-One Laptop Environments: A Meta-Analysis and Research Synthesis. *Review of Educational Research*, 86(4), 1052 – 1084.
- [7] Bucherer, E., & Uckelmann, D. (2011). Business models for the internet of things. *Architecting the Internet of Things*, 40(2), 253-277.
- [8] Bulfin, S., Johnson, N., Nemorin, S., & Selwyn, N. (2016). Nagging, noobs and new tricks students' perceptions of school as a context for digital technology use. *Educational Studies*, 42(3), 239-251. doi: 10.1080/03055698.2016.1160824.
- [9] Ely, D. P. (1999). Conditions that facilitate the implementation of educational technology innovations. *Educational Technology*, 39(6), 23-27.
- [10] Ghavifekr, S., & Rosdy, W. A.W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science (IJRES)*, 1(2), 175-191.
- [11] Greenhow, C., Robella, B., & Hughes, J. A. (2009). Learning teaching and scholarship in a digital age. *Educational Researcher*, 38(4), 246-259
- [12] Gulek, J. C., & Demirtas, H. (2005). Learning with technology: The impact of laptop use on student achievement. *The Journal of Technology, Learning and Assessment*, 3(2), 440-460.
- [13] Hariadi, B., Dewiyan, M., & Sudarmaningtyas, P. (2016). Development of web-based learning application for generation Z. *International Journal of Evaluation and Research in Education*, 5(1), 60-68.
- [14] Iftakhar, S. (2016). Google classroom: What works and how? *Journal of Education and Social Sciences*, 3(1), 12-18.

- [15] Iqbal, M. J., & Ahmed, M. (2010). Enhancing quality of education through e-learning: The case study of Allama Iqbal Open University. *The Turkish online journal of distance education*, 11(1), 89-108.
- [16] Muslem, A., Yusuf, Y. Q., & Juliana, R. (2018). Perceptions and perceptions to ICT use among English Teachers in Indonesia. *Teaching English with Technology*, 18(1), 3-23. <http://www.tewtjournal.org>
- [17] Payal, H., & Vinod, K. K. (2018). Learning with ICT: Use & barriers from teachers' perceptions. *International Journal of Recent Science Researches*, 9(1), 23545-23548. DOI: <http://dx.doi.org/10.24327/ijrsr.2018.0901.1489>.
- [18] Pettersson, F. (2017). On the issues of digital competence in educational contexts – a review of literature. *Education and Information Technologies*, 44(3), 330-350. Available at: <https://link.springer.com/journal/10639/onlineFirst/page/1>
- [19] Porter, B. (2012). Time and implementing change. *British Journal of Educational Technology*, 36(6), 1063-1065.
- [20] Silviyanti, T. M., & Yusuf, Y. Q. (2015). EFL teachers' perceptions on using ICT in their teaching: To use or to reject? *Teaching English with Technology*, 15(4), 29-43.
- [21] Taimur, H., & Abdur, R. S. (2012). ICTs in learning in Pakistan. *International Journal of Evaluation and Research in Education (IJERE)*, 1(2), 51-60.
- [22] Zott, C., Amit, R., & Massa, L. (2011). The business model: Recent developments and future research. *Journal of Management*, 37(4), 1019-1042.