



# Polytechnic Teachers' Usage of ICT in Relation to their Digital Efficacy

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## **Abstract:**

The following study has been conducted before March 2020 (lockdown period). Hence, all the findings and discussions mentioned in this paper are pertaining to face to face teaching (offline teaching). Usage of ICT for this study means how well the polytechnic teachers do software usage, usage of instructional tools and materials, what factors encourage technology usage and how do they overcome barriers to technology usage. Digital efficacy means the personal faith/judgment of polytechnic teachers on the capacity to use technology with reference to usage of digital devices, online use and teaching learning process.

The researcher has tried to find out the relationship between usage of ICT by polytechnic teachers and their digital efficacy. It has been found that there is a significant, positive, moderate and curvilinear relationship ( $\eta^2=0.53$ ) between usage of ICT by polytechnic teachers and their digital efficacy. The researcher has also conducted an in-depth study of both the variables and has compared them with respect to gender. No significant difference was found in the usage of ICT and digital efficacy on the basis of gender for polytechnic teachers.

## **INTRODUCTION:**

All of us are aware that the entire world is suffering due to COVID 19 virus and during pandemic lock down time we have seen the teaching fraternity all over the world being engaged in conducting online classes and various platforms are used to conduct such classes. The present study was conducted before the pandemic and hence all the findings discussed here are pertaining to the situation of teachers before the pandemic.

Information and Communication Technology (ICT) in education is the mode of education that uses information and communication technology to support, enhance, and optimise the delivery of information. Information and Communication technology (ICT) has become increasingly responsible for economic growth and development of the country. ICT is an extended term for Information technology which is a technological source to make information available at the right time, right place in the right form to the right user. The use of ICT in teaching and learning process enhances the effectiveness of learning. It adds a new dimension to the teaching learning process which was not previously available. Students found learning in a technology-enhanced environment more stimulating and engaging as compare to a traditional classroom environment.

India is focussing on advancements of skills and these skills have to be relevant to the emerging economic environment. ICTs expand the needs for on-going professional development of technical teachers. Effective ICT use in education increases the needs of teachers' training and professional development. ICT has become the integral part of teaching learning activities. The old tool chalkboards are replaced with interactive digital smart boards. The digitally literate teachers are trained to use ICT which leads to increase higher order thinking skills, provide option for students to express their understandings, and preparing them to face the challenges in fast growing technology.

There are various ICT teaching aids available for teachers; smart board, Overhead Projector, Opaque Projector and or Document Camera, Internet/Web Environment etc. The factors which encourage the technology usage in teaching, like reward system, increase in investment of the institution on infrastructure of

instructional technologies, content development etc. ICT comprises with many software languages like Word Processors, Spread sheets, Presentation Software Power Point etc. Databases (Accesses), Computer Aided Instruction Software, Web Page Development Tools, Web Browsers, Search Engines (Google, yahoo etc.) etc. Technology is successful only when there are no barriers while using it. Barriers do exist, and can sometimes seem undefeatable. ICT integration in higher education brings a change in student and teacher learning behaviour and develops higher order skills such as collaborating across time and place and solving complex real-world problems (Alam September 25, 2016). Computers and the internet have become indispensable worldwide, and have frequently aided the creation of jobs and in consequence to economic growth (Bon 2009).

Digital literacy is defined as the ability to find, evaluate, share and create content using the internet. The application of digital devices set up in the classroom is capable of facilitating teacher-student interactions and in-class participation, which in turn enhanced engagement and active learning (Fitch, 2004; Partee, 1996; Stephens, 2005 2012).

The present research aimed to find out Usage of ICT by Polytechnic Teachers and to ascertain the relationship between usage of ICT and Digital Efficacy

## **STATEMENT OF THE PROBLEM**

A Study of Usage of ICT by Polytechnic Teachers in Relation to their Digital Efficacy

## **VARIABLES OF THE STUDY**

Since the research study intends to find the relationship between Usage of ICT, Digital Efficacy of Polytechnic Teachers

- a. Usage of ICT by Polytechnic Teachers
- b. Digital efficacy of Polytechnic Teachers

## DEFINITION OF KEY TERMS

Operational Definition: Usage of ICT

For the present research usage of ICT in Polytechnic Institutions by the teachers is with respect to

### **a. Software usage**

Software, in its most general sense, is a set of instructions or programs instructing a computer to do specific tasks. Software is a generic term used to describe computer programs. Scripts, applications, programs and a set of instructions are all terms often used to describe software.

### **b. Instructional tools and materials**

Instructional materials are the tools used in educational lessons, which includes active learning and assessment.

### **c. Factors that encourages technology usage.**

The internal and external factors which directly or indirectly encourage technology usage in teaching and learning process.

### **d. Barriers to ICT usage.**

Barriers are the factors that affect the successful implementation of ICT in teaching learning process.

## Operational Definition: Digital Efficacy

For this study, Digital efficacy is the personal judgment of the capacity to use technology during teaching learning process. Digital efficacy is the personal faith/judgment of polytechnic teachers on the capacity to use technology with reference to usage of digital devices, online use and teaching learning process.

## **AIMS OF THE STUDY**

1. To study of Usage of ICT by Polytechnic Teachers
2. To study the Digital Efficacy of Polytechnic Teachers
3. To ascertain the relationship between usage of ICT and Digital Efficacy

## **HYPOTHESES OF THE STUDY**

1. There is no significant difference in the Usage of ICT by Polytechnic Teachers with respect to the following dimensions
  - a. Software Usage.
  - b. Usage of Instructional Tools and Materials.
  - c. Factors Encourage Technology Usage.
  - d. Barriers to Technology Usage.

For the following Groups

- i. Engineering and Science Group
- ii. Computer Group
- iii. Electronics Group

2. There is no significant difference in the Usage of ICT by Polytechnic Teachers with respect to gender.

3. There is no significant difference in the Digital Efficacy by the Polytechnic teachers on the basis of following dimensions
  - a. Digital Efficacy w.r. to digital devices
  - b. Digital Efficacy w. r. to online use
  - c. Digital Efficacy w.r. to teaching learning process

For the following Groups

- i. Engineering and Science Group

- ii. Computer Group
- iii. Electronics Group

4. There is no significant difference in the Digital Efficacy by the Polytechnic teachers with respect to gender.

5. There is no significant relationship between usage of ICT and Digital Efficacy.

## RESEARCH DESIGN

- Methodology of the present study: For this study, the researcher has used a Descriptive Method of Correlational and Casual Comparative types under Quantitative Research Methods.

- Sample:

The sample for the present study consisted of the teachers of about 8 polytechnics from Mumbai and outside Mumbai region. There were about 167 teachers in 8 polytechnics colleges at the time of study. The sample was selected from this population using a combination of Stratified and Purposeful Sampling selection. The teachers were classified based on their Engineering Branches.

For study purpose the polytechnic teachers were divided into three major groups.

- o Engineering and Science Group(70)- Polytechnic teachers of Civil Engineering, Mechanical Engineering & Science (English /Physics/ Chemistry/ Maths)
- o Computer Group (53)- Polytechnic teachers of Information technology & Computer Engineering.
- o Electronics Group (44)- Polytechnic teachers of Electronics Engineering, Electronics and Telecommunication Engineering & Electrical Engineering.

- Tools for the Present Study:

In the present study, the researcher employed the following tools for data collection which were previously constructed and standardized by various researchers.

I. Usage of ICT Questionnaire (2008) prepared by Yasemin Gulbahar & Ismail Guven. (Guven 2008) Modified (2016) and calculated its Reliability coefficient which is 0.84

II. Digital Efficacy Questionnaire (2016) prepared by Ms. Pratibha Lotlikar. The reliability coefficient Cronbach's  $\alpha$  = 0.93 and split half reliability=0.93

## MAJOR FINDINGS AND DISCUSSION OF THE STUDY

The major findings of the study are as follows:

### 1. USAGE OF ICT WITH REFERENCE TO ITS DIMENSIONS

The following table 1 gives relevant statistics of Polytechnic Teachers' Towards Usage of ICT and dimensions like a. Software Usage, b. Usage of Instructional Tools and Materials, c. Factors Encourage Technology Usage and d. Barriers to Technology Usage

Variable and its dimensions	Groups(n)	Mean	SD	F Ratio	df	P	Level of Significance
Usage of ICT	Engg & Sc Group(70)	116.29	8.22	407.75	166	0.00	S at 0.01 level
	Computer Group(53)	85.96	10.80				
	Electronics Group(44)	101.50	10.73				
a. Software Usage	Engg & Sc Group(70)	32.02	4.94	9.46	166	0.00	Sig 0.01 level
	Computer Group(53)	35.28	2.97				
	Electronics Group(44)	32.59	4.37				
b. Usage of Instructional Tools and Materials	Engg & Sc Group(70)	22.21	2.81	0.38	166	0.83	NS
	Computer Group(53)	22.36	2.86				
	Electronics Group(44)	22.00	3.08				
c. Factors Encourage Technology Usage	Engg & Sc Group(70)	21.07	2.28	1.71	166	0.38	NS
	Computer Group(53)	22.62	1.74				
	Electronics Group(44)	22.5	2.00				
d. Barriers to Technology Usage	Engg & Sc Group(70)	38.3	3.92	8.31	166	0.00	S at 0.01 level
	Computer Group(53)	40.03	3.35				
	Electronics Group(44)	37.22	2.95				

Table 1

Relevant Statistics of Polytechnic Teachers' Towards Usage of ICT and dimensions

From the table 1 it can be seen that

- A significant difference was found in the mean scores of Usage of ICT at 0.01 level. Engineering and Science group was higher than the Electronics Group followed by Computer Group. As far as dimensions are concerned a significant difference was also found for the software usage and barriers to technology usage by Polytechnic Teachers with respect to different groups. In software usage as well as in barriers to the technology, the Computer Group is higher than the Engineering and Science Group & Electronics Group. No significant difference was found for the dimensions like usage of instructional tools & materials and factors encourage technology usage.

It was found that the Computer group is showing more Usage of ICT followed by the Engineering and Science Group and the Electronics Group. This may be due to compatibility of computer teachers toward software and hardware as these two are the parts of their curriculum in their engineering study. Computer group usually makes use of ICT in teaching whereas other two groups showing less interest to use ICT in teaching. Usage of ICT in polytechnic can be influenced by using instructional tools and materials like Computer-Projector System, Internet/Web Environment, Television / Video etc. Thus, above study shows significant difference in all these three groups. Computer group teachers learn computer languages like C++, JAVA, Programming in 'C' etc. during their engineering study and these software are a part of the polytechnic curriculum. Word Processors, Spreadsheets, Presentation Software Power Point, Databases etc. are learnt in software usage. Computer Aided Instruction Software ICTs play a dynamic role in technical education during delivery of learning materials as learners can access knowledge and improve their skills from anywhere and anytime. (Shamim, M. R. H., Raihan, M. A., 2016)

In the dimensions like software usage and barriers to the technology, the Computer Group is higher than the Engineering and Science Group & the Electronics Group. This may be because Polytechnic teachers of Engineering and Science Engineering, Mechanical Engineering might be more dependent on the readily available software & while teachers from Science (English /

Physics/ Chemistry/Maths) might be facing issues like time to prepare materials or lacking knowledge to prepare materials, accessibility, lack of interest of teachers and facing difficulties of improper teaching methods for technology usage. The institutions may have no computer laboratory or shortage of computers. All these issues might be reasons for computer group in software usage and barriers to the technology

- No significant difference was found in the usage of ICT by Polytechnic Teachers on the basis of usage of instructional tools and materials, factors that encourage technology in the usage and materials for different groups such as Engineering and Science Group, Computer Group & Electronics Group. This might be as the institutions might be having rewarding mechanisms for the technology usage efforts of teachers in instructional activities or support for the projects towards the expansion of instructional materials or reducing work load to provide opportunities to teachers for developing instructional materials

Since Polytechnic teachers being technical persons are aware of Instructional Tools and Materials used in ICT so no significant difference is observed among three groups. Instructional tools and materials like Overhead Projector, Opaque Projector and /or Document Camera Multimedia Computer, Computer-Projector System, Internet/Web Environment, Television /Video etc are generally used in ICT. As the technology progresses the new Instructional Tools and Materials are designed.

Also, there are several factors, which influence teachers' decisions to use ICT in the classroom such as access to resources, quality of software and hardware, ease of use, support in their Institutes, Institute and national polices, include lack of regular power supply, lack of training in ICT and internet use etc. These factors are common to all polytechnic teachers.

## USAGE OF ICT BY POLYTECHNIC TEACHERS ON THE BASIS OF GENDER

- No significant difference was found in the usage of ICT based on gender of polytechnic teachers. Following Table 2 shows 't' Ratio for Usage of ICT by Polytechnic Teachers with respect to gender

**Table 2**

**'t' Ratio for Usage of ICT by Polytechnic Teachers with respect to gender**

Gender	N	Mean	SD	't' value	df	P	Level of Significance
Male	58	115.44	8.44	0.98	165	0.37	NS
Female	109	116.75	8.11				

From the table 2 it can be said that usage of ICT in teaching requires personal interest and ability to put efforts for that. Even though both male and female teachers have almost equal technical qualification, its their individual attitude which decides the Usage of ICT in polytechnics. The wide adoption of ICT calls for mindsets and skill set that are adaptive to change. ICT integration in higher education brings a change in student and teacher learning behaviour and develops higher order skills such as collaborating across time and place and solving complex real-world problems. This is irrespective of gender of teachers.

(Alam September 25, 2016)

	Group	Mean	Kruskal Wallis Test 'H'	df	P	Level of Significance
Digital Efficacy	Engg & Sc Group (70)	62.09	18.99	2	< 0.0001	5 at 0.01 level
	Computer Group (53)	70.72				
	Electronics Group (44)	65.45				
Digital Efficacy based on digital devices	Engg & Sc Group (70)	25.29	17.7	2	0.0001	5 at 0.01 level
	Computer Group (53)	29.09				
	Electronics Group (44)	26.82				
Digital Efficacy based on online use	Engg & Sc Group (70)	6.27	6.36	2	0.0416	5 at 0.05 level
	Computer Group (53)	7.04				
	Electronics Group (44)	6.80				
Digital Efficacy based on teaching learning process	Engg & Sc Group (70)	31.33	14.1	2	0.0009	5 at 0.01 level
	Computer Group (53)	34.58				
	Electronics Group (44)	31.48				

## 2. DIGITAL EFFICACY

The following table 3 shows the relevant statistics of Digital Efficacy and its dimensions for Polytechnic teachers

**Table 3**  
**Relevant Statistics of Digital Efficacy and its dimensions for Polytechnic teachers**

- A significant difference was found in the Digital Efficacy of the Polytechnic teachers with respect to different groups. The significant difference is also seen in the Digital Efficacy with respect to digital devices and online use, based on dimension teaching learning process. From the results it is concluded that Polytechnic Teachers belonging to three groups such as Computer, Engineering and Science and Electronics groups show differences in the Digital Efficacy and Engineering and Science group show higher efficacy than the computer and electronics groups. Polytechnic teachers of computer group are very much proficient with computers hardware as well as software. They are updated with new technological developments through polytechnic curriculum and other sources. So, the Digital Efficacy of Computer group teachers is more as compared to Engineering and Science and electronics group. Teachers prepare to integrate digital competences into their teaching and learning activities. Teachers' underlying beliefs and attitudes (particularly their self-efficacy beliefs) are the key elements that influence use and integration of digital technologies in the classroom (Jo Tilton and Hartnett 2016).

The results interpret that Polytechnic Teachers belonging to three groups such as Civil, Computer and Electronic groups show differences in the Digital Efficacy with respect to digital devices. Computer Teachers are more confident in using computer and computer assisted tools in teaching technical subjects in polytechnics. Computer teachers are more adaptive towards new trends in technology. So computer group is high on using digital devices as compare to other Engineering and Science and electronics groups. The use of technology in teaching process increases interest of students towards learning and it is also easy to reach the learning resources. Digital technology makes classes more interesting, allow for better use of students' time, allow them to use new study strategies, enhance their learning (Nina B Eduljee 2016).

- The Computer Group is showing more Digital Efficacy based on the dimension of online use. Teachers are using e-mail, forum and chat to make communication easier. As computer teachers are have more knowledge about software, they are keen to use computers in daily use. Execution of

program has to be learnt in computer labs only. So, computer teachers are more confident in online use as compare to Engineering and Science and Electronics group teachers.

- The results interpret that Computer teachers show more Digital Efficacy based on dimension teaching learning process compare to Electronics Group and Engineering and Science Group. Curriculum of computer engineering group comprises with both software and hard ware. As computer teachers having more Digital Efficacy implementation of curriculum is easier in teaching learning process. Teacher use computer in class activities more effectively and it is convenient for computer teachers. Technology supported learning increases the quality of learning. It is necessary to obtain an adequate self-efficacy in digital competences of the teacher (Samir Thakkar 2017).

## DIGITAL EFFICACY OF THE POLYTECHNIC TEACHERS WITH RESPECT TO GENDER

Gender	N	Mean	SD	't' value	df	P	Level of Significance
Male	58	64.96	12.39	0.87	165	0.024	NS
Female	109	66.49	9.88				

The following table 4 shows relevant statistics of Digital Efficacy of the Polytechnic teachers with respect to gender.

**Table 4**

### 't' Ratio Comparing Digital Efficacy of the Polytechnic teachers with respect to gender

- There is no significant difference in Digital Efficacy of polytechnic teachers based on gender. From the above test results, we can conclude by saying that irrespective of a teacher's gender, digital efficacy of Polytechnic teachers remains the same. The basic educational qualification for both male and female teachers is same. All the teachers use computer inside

and outside the classroom confidently. Whether the curriculum is easy or difficult, teachers understand and deliver it to the students with the help of digital devices. Both male and female teachers in their technical education employ various instructional and learning resources to enhance the effectiveness of their teaching and to promote students' learning outcomes and hands-on skills. Information materials are key aspects of instructional and learning resources (Odunlade 2017). So, there is no significant difference in the Digital Efficacy of the Polytechnic teachers with respect to gender.

### 3. RELATIONSHIP BETWEEN USAGE OF ICT AND DIGITAL EFFICACY

- Variables: ICT and Digital Efficacy
- Test used: Eta Correlation
- N=167

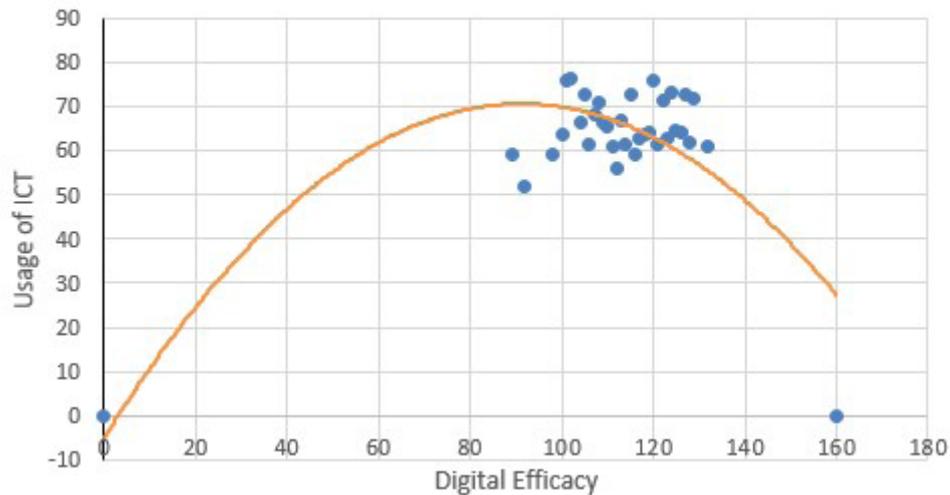
ICT	$\eta^2$	$y'$	$Y-My$	$(Y-My)^2$	$(Y-My)^2 \eta^2$
89	1	59	-6.74	45.36	45.362
92	1	52	-13.74	188.65	188.654
98	1	59	-6.74	45.36	45.362
100	4	63.75	-1.98	3.92	15.681
101	1	76	10.27	105.47	105.472
102	3	76.33	10.6	112.36	337.08
104	2	66.5	0.77	0.59	1185
105	1	73	7.27	52.85	52.852
106	5	61.6	-4.13	17.06	85.284
107	5	68.2	2.47	6.10	30.504
108	9	71.1	5.38	28.94	260.499
109	3	66.66	0.93	0.86	2.5947
110	2	65.5	-0.23	0.05	0.105
111	8	61.12	-4.61	21.25	170.016
112	2	56	-9.73	94.67	189.345
113	6	66.83	1.1	1.21	7.26
114	10	61.4	-4.33	18.75	187.489
115	13	73	7.27	52.85	687.087
116	8	59.25	-6.48	41.99	335.923
117	7	63	-2.73	7.45	52.170
118	7	63.85	-1.88	3.53	24.740
119	7	64.24	-1.49	2.22	15.540
120	6	76.16	10.43	108.78	652.709
121	4	61.5	-4.23	17.89	71.5716
122	5	71.6	5.87	34.46	172.2845
123	6	62.66	-3.07	9.42	56.5494
124	7	73.14	7.41	54.91	384.356
125	14	64.5	-1.23	1.51	21.180
126	6	64.16	-1.57	2.46	14.789
127	3	73	7.27	52.85	158.558
128	4	62	-3.73	13.91	55.651
129	1	72	6.27	39.31	39.312
132	5	61.2	-4.53	20.52	102.604

**Table 5 shows Coefficient of Correlation between Teachers' ICT and Digital Efficacy.**

**Computation of the eta-coefficient:**

$$S_y = 10.8$$

**Curvilinear correlation between Teachers' Usage of ICT and Digital Efficacy**



$$S_{y'} = 5.74$$

$$r_{\eta y.x} = S_{y'}/S_y = 5.74/10.8 = 0.5315$$

**Interpretation of  $\eta'$ :**

The obtained value of ' $\eta'$ ' after conducting eta-coefficient Correlation between teachers' Usage of ICT and Digital Efficacy is 0.5315. The ' $\eta'$ ' is highly significant at 0.01 level, which is moderately high and positive correlation. Thus, the null hypothesis is rejected and the alternate hypothesis is accepted which states that there is a moderate positive significant relationship between teachers' Usage of ICT and Digital Efficacy. **It may be concluded that when the Digital efficacy is either low or high, usage of ICT is low but when Digital efficacy is moderate, usage of ICT is high.** Thus, usage of ICT and Digital Efficacy are related to each other. A person with fair Digital Efficacy makes use of ICT in teaching-learning process. Probably

due to Digital Efficacy the confidence for handling digital instructional materials increases. By using Web Browsers (Netscape, Explorer etc.), Search Engines (Google, yahoo etc.) and communication means like Electronic Mail (e-mail), Discussion Lists and Newsgroups, Chat and / or Forum etc. a relation between Usage of ICT and Digital Efficacy can be observed. ICT helps to improve classroom management as students are well-behaved and more focused. Students learn more effectively with the use of ICT as lesson designed are more engaging and interesting. This is possible only if teacher has moderate Digital Efficacy. (Simin Ghavi fekr 2015).

## **Recommendations:**

- In the era of digital India and after lock down due to COVID 19, few of these recommendations must be materialised to some extent.
- The study suggests the usage of various teaching tools in ICT for polytechnic teachers. The study also manages to make teachers understand their level of digital efficacy. The study will also help teachers to change their belief about the use of technology in teaching learning and make them more confident for ICT usage.
- There is a need to upgrade the standard of polytechnic institutions. It is possible by adopting various ICT related technology. Polytechnic Institutes can provide training to polytechnic teachers for more and more usage of ICT for the benefit for the polytechnic students.
- The research will help the curriculum developers of polytechnic to design the curriculum to provide more lifelong learning experiences to polytechnic students with the help of ICT usage. This research may help policy makers of state department education and Technical board of Maharashtra to design ICT based curriculum to motivate teachers to use technology in teaching. Also, to have the holistic development of the students and making them ready for the industry.

- The present research will help other researchers to use it as a guide and reference material for future research work. Findings of this research will serve as an important document for further research in use of ICT in teaching in Polytechnic curriculum. The findings of the study were wholly based on the scores obtained in the Usage of ICT Questionnaire, Digital Efficacy Questionnaire before the lockdown. For future studies, researchers can develop more reliable tools or Google forms which are more favourable for the Indian context and suitable as per the situation.

## **CONCLUSION**

The present study was an earnest attempt by the researcher to shift the focus from regular teaching and learning issues to various other issues which focussed on the usage of ICT by Polytechnic Teachers. The findings have indicated that ICT has great significance in supporting polytechnic teachers in their teaching process. The study was an attempt to investigate usage of ICT by Polytechnic teachers in relation to their Digital Efficacy. Polytechnic Teachers of computer group are showing more Digital Efficacy for usage of ICT as compared to other groups. A significant positive moderate curvilinear relation is observed between Usage of ICT and Digital Efficacy of polytechnic teachers. The rapid growth in ICT due to lock down all over the world has brought remarkable changes in the process of teaching and learning. Online teaching has been adopted and integrated by teachers in the teaching-learning process. The impact of using ICT in polytechnic education after lock down all over the world is highly considered. The findings of this study indicate that teachers have strong desire for the integration of ICT into education but they encountered many barriers to it.

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