

## **Impact of Utilization of ICT on the Performance of Research Students in the Public Sector Universities of Rawalpindi and Islamabad**

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### **Abstract**



*The study was a survey type with a quantitative method in which usage of ICT by research students and its impact on their performance was investigated. The population of the study was students of public sector universities. The purposive sampling technique was used to select the sample of the study. The sample of the study was 600 research students of postgraduate who were almost near to complete their research. Data was assembled from the students with the help of a questionnaire. From the findings of the study, it was concluded that usage of ICT has a significant impact on the performance of research students. Based on findings it was recommended that research students should be trained to best utilize the ICT for academic purposes so they can enhance their performance at high to a very high level.*

**Keywords:** Utilization, ICT, Performance, Academic Performance, Academic Achievement

### **Introduction**

The term ICT is known as Information and Communication Technology, and it contains communication devices for example computer, laptop, smartphone, internet with hardware and software which could be used to receive, process, store, create, recover, make, operate, distribute just as communicate digital information (Cirera, Lage & Sabetti 2016). So, most of the developed and developing countries in the world attempt to provide their educational institutes the latest ICT devices, and most important are laptops, computers, the internet, smartphone, and multimedia. In this perspective in this study Information and Communication Technology (ICT) was taken as utilization of devices such as laptop, computer, internet, smartphone, and multimedia by university research students for academic purposes.

Likewise, these devices have changed the ways of working in all fields of life including the field of education (Adeoye, Oluwole & Blessing, 2013). That is the reason governments worldwide including the government of Pakistan have supported the integration and utilization of ICT in the sector of higher education. Because with the ICT the learning of students extended by enhancing their level of interest, communication, motivation, collaboration, creativity, and engagement (Pavel, Fruth & Neascu, 2015; Alharbi, 2014; Kinaanath, 2013; Siddiquah & Salim, 2017).

In higher education use of ICT has gotten fundamental in the learning process of university students inside and outside of the classroom and has impacted the quality and quantity of learning. Along these lines, students of higher education use ICT devices for their general academic purposes like for; searching, getting and disseminating information, assignments composition, searching information by digital libraries (digital books, journals, articles, and reference material) preparing projects, joining discussion forums, digital lectures, accessing course work and contents, as well as communication via email (Toro & Joshi, 2012; Shonola, Joy, Oyelere & Suhonen, 2016). Furthermore, students utilized effectively ICT devices for their general academic purposes to enhance their skills and competency in learning (Emeka & Nyche, 2016).

Students of higher education utilized the ICT for academic purposes to enhance their performance. Nisar, Munir, and Shad (2011) also pointed out that ICT utilization in academic activities upgraded their skills and performance. Hadi and Muhammad (2019) assessed the

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performance of research students of postgraduate by subjective measures (such as; level of understanding the research proposal defense or viva, review of the related literature, research projects standard and monitoring in comparison to colleagues, analysis of data, results in interpretation, as well as the writing of report). But some researchers considered the performance of students as their quantitative grades which they secure in their academic periods such as CGPA, GPA, and test scores. According to the views of researchers, if students secure higher CGPA at that point it implied they have high and if lower than they have low performance (Talukder, Alam & Apu, 2015; Upadyaya & Salmela-Aro, 2013). So, in this study, the researcher considered both subjective and quantitative measures for assessing the performance. While, in context of this study performance of research students of postgraduate was taken as academic performance; measured by subjective measures such as creativity, engagement, motivation, skills, communication skills, collaboration skills, self-directed and independent learning, and academic achievement; in the form of CGPA (quantitative).

Several studies have attempted to explain the role and the added value of ICT and its impact on students' performance. In terms of students' performance, the relationship between the utilization of ICT and student performance wasn't clear in previous researches such as the utilization of ICT for academic purposes has a significant impact on the performance of university students (Basri, Alandejani & Almadani, 2018; Ishaq, Zin, Rosdi, Abid Ijaz, 2020), While in some studies it was revealed that ICT has a negative impact on the performance of students (Ullah, et al., 2019; Karamti, 2016; Ng, Hassan, Nor & Malek, 2017), on the other hand, some studies revealed insignificant correlation (Sumathi, Lakshmi & Kundhavai, 2018). These studies provided evidence that the purpose for which ICT was provided, unclear to students. They don't know why, when, and how extended they have to utilize ICT. They don't know how they can effectively utilize ICT.

In the context of Pakistan ICT is being used almost in every organization like in other developing and developed countries. But there are some issues in the utilization of ICT in the institutes of higher education. As per Shaikh and Khoja (2011) universities confronted various issues associated with ICT among them most addressable was that students of Pakistan utilized ICT inappropriate for their educational purposes. Moreover, some international studies also investigated the relationship between the use of ICT and academic purposes and found no significant relationship (Ayub, Hamid & Nawawi, 2014). Outcomes of another previous study revealed that students even have sufficient infrastructure of ICT but they did not use it inappropriate manner for their academic activities (Hota & Naik, 2015). So, this put the researcher to investigate in this study to that how extent research students of postgraduate used ICT for their academic purpose and how this utilization impact on their performance.

### **OBJECTIVES**

The objectives of the study were: to determine the extent of ICT usage for academic purposes, to find out the performance of research students, and to analyze the impact of utilization of ICT on the performance of research students.

### **RESEARCH HYPOTHESES**

H<sub>01</sub>: There is no significant relationship between utilization of ICT and academic performance of research students.

H<sub>02</sub>: There is no significant relationship between utilization of ICT and academic achievement of research students.

### **LITERATURE REVIEW**

#### **WHAT IS ICT?**

ICT is the technological innovation without which nowadays we cannot do any work (Suliman, Khaidzir & Khaidzir, 2014). In numerous previous studies, ICT was referred to as Information and Communication Technology. ICT was stated as the usage of e-equipment and desktop computers to assemble, share, distribute, store, recover, and disseminate digital information (Cirera, et al., 2016; Kushwaha, 2011; Juma, Raihan & Clement, 2016; Desai, 2010).

Moreover, pointed out that in educational institutes the accompanying ICT equipment used such as; LCD, laptop, desktop computer, photocopy machine, audio and video devices, multimedia, smartphone, internet, projectors, and scanners (Talukder et al. 2015; Peter, Laud, Anthony, Lord & Micheal, 2014; Ghavifekr, Kunjappan, Ramasamy & Anthony, 2016 ). Furthermore, the consequences of the previous study revealed that students used numerous ICT apps (such as; cameras, audio calls,

video calls, emails) to copy, download, upload, and disseminate academic materials (Mtega, Bernard, Msungu & Sanare, 2012).

#### **UTILIZATION OF ICT FOR ACADEMIC PURPOSES**

According to previous studies, numerous students of universities used ICT devices such as; emails, websites, search engines for academic purposes (Gosper, Malfory, Mckenzie & Rankine, 2011; Toro & Joshi, 2013; Adekunmisi, Ajala & Iyoro, 2013). Moreover, Drain, Grier, and Sun (2012) in their study supported the above argument that those university students did better learning who used ICT devices in meaningful ways for their academic purposes.

In Previous studies, researchers demonstrated that students used ICT in various academic and learning activities like; note-taking, retrieving resources for searching information (White & Robertson, 2014; Sunnathi, Selva Lakshmi & Kundhavai, 2018), downloading lectures, reading digital books (Kumar, 2011), sharing academic files and materials, online quizzes, as well as for online discussions (Shonola et al., 2016), doing their assignments (Zainudin, Din & Othman, 2013).

#### **IMPACT OF UTILIZATION OF ICT IN PERFORMANCE OF STUDENTS**

Performance of students stated differently by different researchers. According to some researchers, academic performance is the amalgamation of numerous educational results in students such as; motivation, the skill of learning, communication, study, and attitude. Besides this researcher suggested that the performance of students also can be considered as creativity, skills of working, creative writing, grades, their self-realization and self-reliance, characteristics of students, teachers' characteristics, and educational environment (Yasmin, 2013; Khattak & Jan, 2015).

Moreover, Argueta, Huff, Tingen, and Corn (2011) exposed that outcomes (performance) of students which impacted by the ICT device (laptop) are; engagement (behavioral, cognitive, emotional), motivation (extrinsic, and intrinsic), achievement (test score, GPA, CGPA), attendance, discipline, 21<sup>st</sup>-century skills, technology skills, learning and innovation skills (creativity), communication and collaboration skills, and self-directed learning.

Furthermore, in some studies performance was taken as an academic achievement which was assessed as CGPA, GPA, grades, and test scores (Mushtaq & Khan, 2012; Akinleke, 2012; Arshad, Zaidi & Mahmood, 2015; Rashid & Asghar, 2016; Wentworth & Middleton, 2014; Karamti, 2016; Upadyaya & Salmela-Aro, 2013). In terms of impact as per these studies students who used ICT, then positively and significantly impact their academic achievement (Aristovnik, 2012; Charaya, Bana & Malhotra, 2017; Castano-Munoz, Duart & Sancho-Vinuesa, 2013; Al-hariri & Al-hattami, 2017; Akinoso, 2018). Basri et al. (2018) identified the academic performance of students as an improvement in their information and capabilities which are shown in their GPA and accordingly in their character.

But according to the outcomes of the study usage of ICT by students has; insignificant association with their academic achievement (Sana, Weston & Cepeda, 2013; Jacobsen & Forste, 2011). Moreover, Lepp, Barkley, and Karpinski (2015) demonstrated that more usage of ICT by students decreases their GPA.

ICT played a significant and pivotal role in the performance of research students. In this regard, previous studies found that utilization of ICT assisted in better performance of students and supported students to build their abilities of knowledge and learning (Nisar et al., 2011). Furthermore, in several previous studies, researchers examined the impact of the utilization of ICT on the performance of students and exposed varied outcomes. For instance; some researchers found from the aftereffects of their conducted studies that students used ICT most of the time for their academic purposes, so productive utilization of ICT has a significant impact on their performance (Ishaq et al., 2020; Noor-ul-Amin, 2013; Khattak & Jan, 2015; Adegbite, 2017; Eguavoen, 2016; Drain et al., 2012; Sari, 2012; Ogedebe, 2012; Sari, 2014; Serradell-Lopez & Castillo-Merino, 2014; Enriquez, 2010; Chen & Tzeng, 2010).

In some studies, researchers found a positive correlation between usage of ICT devices and academic performance of students (Bawaneh, 2011; Eyyam & Yaratana, 2014; Jackson, Eye, Witt, Zhao & Fitzgerald, 2011). Moreover, the consequences of the study shown that ICT has an impact on the academic performance of university students (in terms of aid in; research, access to information resources, help in preparing assignments and projects, and in the communication) (Jibrin, Musa & Shittu, 2017; Chowdhury, Debnath & Bhowmik, 2020).

Numerous researchers found that utilization of ICT has; no significant impact (Rashid & Asghar, 2016; Sunnathi, et al., 2018; Talukder et al., 2015; Islam & Fouji, 2010; Mbaeze, Ukwandu & Anudu, 2010), inverse relationship (Harman, & Sato, 2011; Wentworth, & Middleton, 2014), on academic performance of students. It inferred that the academic performance of university students is not merely dependent on the use of ICT and they used the ICT for non-academic purposes.

In light of the above-stated review of related literature distinguished and identified the factors of dependent variables of this study i.e. performance of students to present the conceptual framework. The conceptual framework of the study is schematically displayed in figure 1.

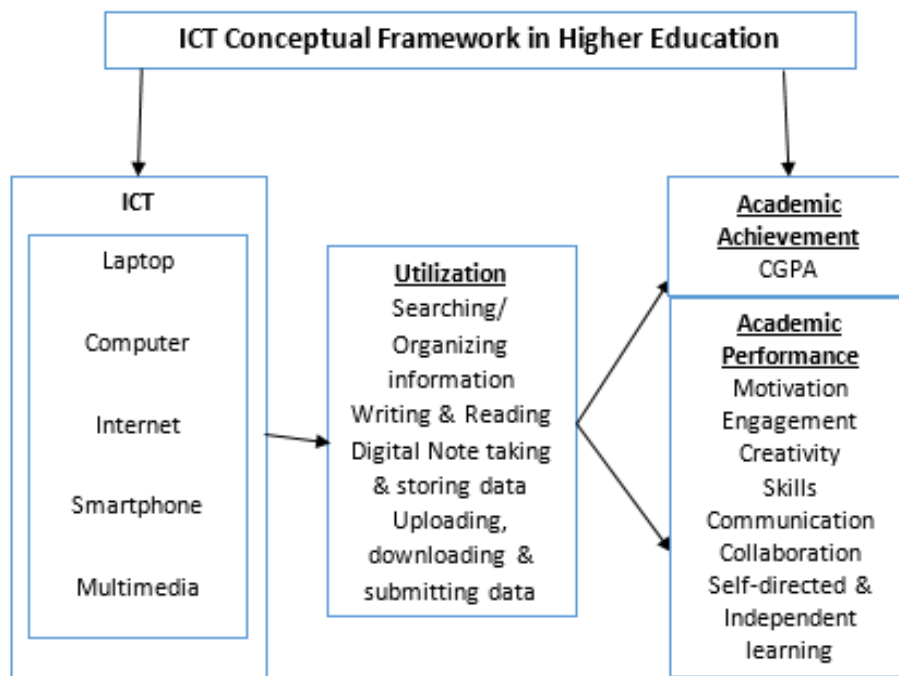


Figure 1: Conceptual framework of the utilization of ICT in higher education

**METHODOLOGY**

This study was descriptive and a quantitative method was utilized. As well as survey design was used in the study to achieve the objectives of the study.

**POPULATION AND TARGET POPULATION**

The population of this study comprised of public sector universities of Rawalpindi and Islamabad and their research students of postgraduate level. There are 18 public sector universities in Rawalpindi and Islamabad (Higher Education Commission). But target population of this study was those 8 public sector universities that have both faculty of basic and social sciences (International Islamic University Islamabad, Quaid-e-Azam University Islamabad, Air University Islamabad, COMSATS University Islamabad, National University of Science and Technology Islamabad, Bahria University Islamabad, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, Fatima Jinnah Women University Rawalpindi. So, the targeted population of the study was 5,279 MS/M.Phil and 1,650 were Ph.D. research students.

**SAMPLE SIZE**

A purposive sampling technique was used to select the sample of the study. The sample of the study was those students who were near to complete their research work. In this way sample size was 600 research students. Krejcie and Morgan (1970) in table 1 highlighted that for the 7000 population size, 364 sample size is enough.

**RESEARCH INSTRUMENT**

A questionnaire was used to collect data from research students of postgraduate. For measuring the impact of ICT, the researcher collected the data by utilizing questionnaires consisted of integer number rating questions and Likert scale rating questions, excluding the first section of questionnaires i.e. demographic information of respondents. This procedure of gathering data is following the researcher (Basak, 2015). Questionnaires of students comprised of the accompanying sections: These were: demographic information (such as the name of the participant, their gender, the name of their

university in which they study, name of their faculty, department, program enrolled, CGPA, age group, designation, and e-mail), utilization (extent of utilization of ICT devices in terms of hours in a day for general academic purposes (computer, laptop, internet, multimedia (PowerPoint presentations), and smartphone and this part were designed on Likert Scale ranging from 1-3 hours (1), 4-6 hours (2), 6 & above hours (3)), utilization of ICT for general academic purposes), and Performance. Questionnaire part utilization of ICT for general academic purposes (searching/organizing information, writing & reading, digital note-taking, uploading, downloading and submission of data), and academic performance were designed on Likert scale such as; Never' (1), Rarely (2), Most of the time (3), frequently/often (4) 'Always' (5). And academic achievement was collected on a ratio scale in the form of CGPA The questionnaire was validated by eight (8) professional experts. SPSS software version 16 was utilized to find out the reliability of the students' questionnaire. The sample of the pilot test was 100 research students of the postgraduate level of Bahria University Islamabad. The internal consistency estimate of questionnaires was 0.930. The final data of the study were collected from 600 students of the 7 universities of Islamabad and Rawalpindi.

**DATA ANALYSIS**

The collected data of the study were analyzed by using descriptive and inferential statistics after checking the validity and reliability tests. Frequency, percentages, mode, the standard deviation was computed for achieving the objective, to determine the extent of utilization of ICT for academic purposes by SPSS 16. For analysis data was categorized into four categories such as; low, average, high, and very high which were collected on 5 points Likert scale. Frequency, percentages, mode, standard deviation, and chi-square were calculated to achieve the objective, to find out the performance of research students. In this study performance of research, students were taken as academic performance and academic achievement. Academic performance was assessed by a sum of scores of indicators (motivation, engagement, skills, creativity, communication, collaboration, self-directed and independent learning). Data of sum of academic performance was categorized as low, average, high, and very high. Data of academic achievement was also categorized in four categories but the form of grades on the same procedure as given by the Higher Education Commission of Pakistan. The limits of CGPA & based on these grades are presented in table 1. Simple Linear regression was used to predict the impact of ICT (independent variable) on the performance of research students (dependent variable).

*Table 1- Limits of CGPA for converting into Grades (HEC)*

Grade	Grade Points
A	3.67-4.00
A-	3.34-3.66
B+	3.01-3.33
B	2.67-3.00
B-	2.34-2.66

**RESULTS**

*Table 2: Determination of extent of utilization of ICT by research students for general academic purposes*

Utilization of ICT	Low	Average	High	Very High	Total	Mode	Remarks	SD
Utilization of ICT for general Academic & Research activities	f 162	141	147	150	600	1	Low Extent	1.14
	% 27%	24%	25%	25%	100%			

Table 2 uncovered that, out of 600 research students, (n=162, 27%) students utilize low, (n=141, 24%) utilized on average, (n=147, 25%) students used highly, (n=150, 25%) utilized very high for their academic purposes. Most of the responses fall in the low category (n=162, 27%) and the value of mode (1) also falls in the low category. Which pointed out that most of the research students utilized ICT to a low extent for their academic purposes. The standard deviation is 1.14, which depicted a deviation in the use of ICT for general academic purposes.

*Table 3: Extent of utilization of ICT devices by research students for general academic activities*

Utilization of ICT devices	No	1-3 hours	4-6 hours	6 & above hours	Total
Computer	f 305	152	112	31	600

	%	51%	25%	19%	5%	100%
Laptop	f	2	198	233	167	600
	%	0.3%	33%	39%	28%	100%
Internet	f	0.00	203	188	209	600
	%	0.0%	34%	31%	35%	100%
Smartphone	f	08	249	159	184	600
	%	1.3%	42%	27%	31%	100%
Multimedia	f	65	433	64	38	600
	%	11%	72%	11%	6%	100%

Table 3 pointed out that among 600 research students the majority of the students not used the computer (n=305, 51%), majority of the research students reported that they used laptop 4-6 hours a day (n=233, 39%), the greater number of respondents used the internet (n=209, 35%) for 6 and above hours, most of the respondents (n=249, 42%) used smartphone 1-3 hours, and most of the respondents(n= 433, 72%) used multimedia (PowerPoint presentations) 1-3 hours for general academic purposes.

Table 4: Academic performance of research students

		Academic performance				Total	$\chi^2$	df	Sig.	Mode	SD	
		Low	Average	High	Very High							
Program Enrolled	Ms/M.Phil.	f	130	111	125	117	483	1.874	3	0.599	1	1.12
		%	27%	23%	26%	24%						
Enrolled	PhD	f	26	33	30	28	117					
		%	22%	28%	26%	24%						
Total		f	156	144	155	145	600					
		%	26%	24%	26%	24%						

P<0.05, P<0.01

Table 4 demonstrated that according to the value of chi-square ( $\chi^2(3) = 1.874, p(0.599) > 0.05$ ) there exists no significant association between program enrolled and academic performance of research students. According to the above table, among 600 respondents (100%) rated that among 483 research students of Ms/M.Phil. ranked; (n=130; 27%) low, (n=111, 23%) average, (n=125; 26%) high, and (117; 24%) very high their academic performance. Likewise, out of total 117 PhD research students; (n=26; 22%) have low, (n=33; 28%) have average, (n=30; 26%) ranked high, and (n=28; 24%) rated very high their academic performance. Moreover, as per the results of the table majority of the responses of Ms/M.Phil. students fall in the low category. Whereas most of the responses of Ph.D. students fall in the average category. In total research students of postgraduate have low academic performance as the value of mode (1) falls in the low category. The standard deviation is 1.12. It described deviation in program enrollment as well as in academic performance.

Table 5: Academic achievement of research students

		Academic achievement					Total	$\chi^2$	df	Sig.	
		A	A-	B	B+	B-					
Program Enrolled	Ms/M.Phil.	f	106	135	121	118	3	483	71.105**	4	0.000
		%	22%	28%	25%	24%	1%				
Enrolled	PhD	f	68	31	4	14	0	117			
		%	58%	27%	3%	12%	0%				
Total		f	174	166	125	132	3	600			
		%	29%	27%	21%	22%	1%				

P<0.01\*\*, P<0.05\*

In the table 5 the value of chi square ( $\chi^2(4) = 71.105, p(0.000) < 0.01$ ) revealed that program is highly significant with the academic achievement of research students of postgraduate. Moreover, results of above table demonstrated that out of total 483 research students of Ms/M.Phil. Ranked; (n=106; 22%) 'A grade', (n=135, 28%) 'A- grade', (n=121; 25%) 'B', (n=118; 24%) 'B+', and (n=3; 1%) rated 'B- grade'. Similarly, Out of total 117 PhD research students have; (n=68; 58%) 'A', (n=31; 27%) 'A-', (n=4; 3%) 'B', (n=14; 12%) 'B+ grade'. In addition, table above pointed out that among total 600 respondents of Ms/M.Phil./PhD have; (n=174; 29%) 'A grade', (n=166; 28%) 'A-grade', (n=125; 21%) 'B', (n=132; 22%) B+, and (n=3; 1%) have B- grade.

**REGRESSION ANALYSIS ON IMPACT OF USE OF ICT ON ACADEMIC PERFORMANCE OF RESEARCH STUDENTS**

It involves the model summary, ANOVA, and coefficient values.

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate
1	0.107	0.012	0.010	26.527

Predictors: (Constant), the sum of devices of ICT i.e. Computer, laptop, Internet, Smartphone, Multimedia

Table 6 displayed the results of the model summary of the impact of ICT on the academic performance of research students of postgraduate. The value of R2 is 0.012 which denoted a 1.2% variation in the academic performance of research students of postgraduate is due to the usage of ICT.

Table 7: ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	4896.948	1	4896.948	6.959	0.009
1 Residual	420803.312	598	703.684		
Total	425700.260	599			

a. Predictors: (Constant), the sum of devices of ICT i.e. Computer, laptop, Internet, Smartphone, Multimedia

b. Dependent Variable: performance

The table above presented the values of ANOVA such as  $F(1,598) = 6.959, p(0.009) < 0.05$  that is significant. It showed that usage of ICT has a significant impact on the academic performance of research students of postgraduate.

Table 8: Coefficients

Model	Unstandardized Coefficients			Standardized Coefficients	t	Sig.
	B	Std. Error	Beta			
1 (Constant)	130.631	3.811			34.278	0.000
1 Sum of devices of ICT	1.248	0.473	0.107		2.638	0.009

a. Dependent Variable: sum of performance

The accompanying model was obtained in this study:

$$Y = 130.631 + 1.248X_1$$

The model acquired denoted that there is a direct impact of utilization of ICT on the academic performance of research students of postgraduate. This implicit that by keeping all other variables constant increase in the model results increases in the academic performance of research students of postgraduate. In the table above the value of t-test also demonstrated that  $t(598) = 2.638$  is significant as  $p(0.009) < 0.05$ . Moreover, model on the base of beta coefficient that ICT causes positive 124, 8% variance in the academic performance of research students of postgraduate, and the t-test value is also significant. Due to these results accept H1 that "there is a significant relationship between use of ICT and academic performance of research students".

**REGRESSION ANALYSIS ON ACADEMIC ACHIEVEMENT OF RESEARCH STUDENTS**

It encompasses model summary, ANOVA, and coefficient values.

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate
1	0.093	0.009	0.007	0.331

Predictors: (Constant), the sum of devices of ICT i.e. Computer, laptop, Internet, Smartphone, Multimedia

The table above displayed the model summary of regression analysis of the impact of the use of ICT on the academic achievement of research students of postgraduate. The value of R2 is 0.009 which denoted 0.9% variation in the academic achievement of research students is because of the utilization of ICT.

Table 10: ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	0.571	1	0.571	5.204	0.023



Residual	65.676	598	0.110
Total	66.248	599	

a. Predictors: (Constant), the sum of devices of ICT i.e. Computer, laptop, Internet, Smartphone, Multimedia

b. Dependent Variable: CGPA

In the table above the value of ANOVA displayed the regression i.e.  $F(1,598) = 5.204, p(0.023) < 0.05$  which is significant. It depicted that usage of ICT has a significant impact on the academic achievement of research students.

*Table 4.27: Coefficients*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error			
1	(Constant)	3.322	0.048		69.773	0.000
	the sum of devices of ICT	0.013	0.006	0.093	2.281	0.023

a. Dependent Variable: CGPA

The model attained in this study was:

$$Y = 3.322 + 0.013X_1$$

The achieved model denoted that there is a positive impact of ICT on academic achievement of research students of postgraduate. This showed that keeping all other factors constant increase in the variable attained in the regression model consequently increase the academic achievement of research students of postgraduate. Moreover, the value of t represented that  $t(598) = 2.281$  is significant as  $p(0.023) < 0.05$ . Furthermore, the model showed a positive 1.3% variance in the academic achievement of research students due to ICT, and the t-test value is also significant. That is why accept H2 that "there is a significant relationship between uses of ICT and academic achievement of research students".

### **FINDINGS AND DISCUSSION**

It was found from the results of objective 1 that the extent of use of research students of postgraduate was low for academic purposes. And the majority of the research students mostly used the internet for 6 and above hours and laptops for 4 to 6 hours per day for their academic purposes. The results of this study conformed with the results of previous studies that university students used low ICT for their learning purposes but utilized it frequently for their social and personal purposes (Lai, 2011). Moreover, the findings of a study by Warriach and Tahira (2014) are also in line with the findings of this study that students did not use ICT appropriate for accomplishing their academic needs. From the findings of this study and previous studies, it was found that the majority of university students used ICT for satisfying their matters but not for academic purposes.

Another finding was that level of academic performance of research students of postgraduate was low. It means that the use of ICT did not enhance the academic performance of research students in terms of motivation, engagement, creativity, skills, collaboration skills, communication skills, self-directed & independent learning. But findings of accompanying previous studies were not in conformity with the findings of this study that use of ICT: sustained the level of engagement of students in learning (Chenoby, 2014; Rashid & Asghar, 2016); enhances the creativity of students (Charaya et al. 2017); improves the motivation of students towards academic learning (Habib & Shah, 2017); increase the independent and self-directed learning (Talebian, Mohammadi & Rezvanfar, 2014); improves skills of digital, writing, and reading (Stockwell, 2012; Bakeer, 2018; Fairlie & London, 2012); provides the opportunities for collaboration and communication (Aminu, 2014).

Moreover, it was found that level of academic achievement of research students of postgraduate was very high. Along these lines, the findings of the previous study also demonstrated that utilization of ICT enhanced their academic achievement (Al-hariri & Al-hattami, 2017; Akinoso, 2018). Furthermore, the benchmark of admission for postgraduate students is that they should have at least 3.00 CGPA. Therefore, their level of achievement was very high.

Moreover, it was found that utilization of ICT has a significant and positive impact on the academic performance and academic achievement of research students of postgraduate. It highlighted that ICT is an important predictor of academic performance and academic achievement of research students. The findings of the study were consistent with the findings of previous studies that the use of ICT has a significant and positive impact on the: academic performance of students (Basri et al. 2018; Sari, 2012; Khattak & Jan, 2015; Ishaq et al. 2020; Adegbite, 2017; Eguavoen, 2016; Drain et al., 2012; Akinoso, 2018; Soegoto & Tjokroadiponto, 2018; Jibrin et al. 2017; Asdaque, Nasir Khan &



Abbas Rizvi, 2010; Ogedebe, 2012; Chen, & Tzeng, 2010), and academic achievement of research students (Norries, Hossain & Soloway, 2011; Aristovnik, 2012; Charaya et al. 2017; Castano-Munoz et al., 2013).

### **CONCLUSIONS**

It was concluded that the extent of utilization of ICT and academic performance of research students was low. The academic achievement of research students was very high. It was also concluded that utilization of ICT for academic purposes has a significant impact on the performance of research students and there exists a significant relationship between uses of ICT and performance of research students. In this way, the study concluded that utilization of ICT is the best predictor of the performance of postgraduate research students.

### **RECOMMENDATIONS**

Based on results it is recommended that:

1. University administration and management should provide training to research students that how best they can utilized ICT at high to a very high extent for their academic purposes.
2. Management of universities should check properly that the infrastructure of ICT is being properly used or not on their premises to prohibit misuse or waste of university resources. Then we can achieve a very high level of performance of research students so they can compete at the global level.
3. University administrators or management might make an online group for research students where they can share their ideas and transmit knowledge and get benefited from each other to enhance their performance.
4. In future studies, more emphasis should be given to organization strategies and policies to address the obstacles confronted by students in using ICT tools in learning. If the obstacles confronted by students can be overwhelmed, it will be a step onward to heighten our students' performance.
5. And now after the pandemic period scenario of working is transformed, so future studies should be conducted to assess that how extent research students utilized ICT devices for their academic purposes.

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