



Teachers' Use of Information and Communication Technology and Its Impact on Students' Academic Performance in Private Secondary Schools

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Abstract

Present study examines the relationship between the use of Information and Communication Technology (ICT) by teachers, engagement of students and their academic performance in the schools of the state of the privatization. The proposed research is based on the social learning theory and investigates the role of ICT integration in student outcomes and the mediation role of student engagement. The research design adopted was the quantitative correlational and 70 teachers in five Karachi based schools (private secondary schools) were used to collect the data with the help of structured questionnaire. The SPSS was used to analyze the data with descriptive statistics, Pearson correlation, regression, and mediation analysis. The results found that the application of ICT by teachers is positively associated with student engagement and academic achievement in a significant way. In addition, it was also discovered that student involvement was strong with a significant impact on academic performance. There was mediation analysis that showed that student engagement acts as a complete mediator in ICT use and academic performance, indicating that ICT improves academic performance mainly through active student engagement. The research indicates the significance of the pedagogically meaningful ICT integration and the necessity of teacher training and institutional support that would improve student engagement and learning outcomes. These results are added to the existing literature on educational technology as they present context-related evidence of Pakistan-based private secondary schools.

Keywords: Teachers' Use of ICT, Student Engagement, Academic Performance, Educational Technology



Introduction

Information and Communication Technology (ICT) has emerged as part of the teaching and learning process in education in recent years (Khosro, et al., 2024; Sultana & Imran, 2024; Ahmad, Bibi & Imran, 2023). The COVID-19 pandemic has increased the pace of digitalization of education, but with this digitalization, the use of ICT in education, including computers and interactive whiteboards, learning management systems, educational programs, and online resources, has become increasingly adoptable in instruction in classrooms (Danish, Akhtar & Imran, 2025; Mankash, et al., 2025; Hafeez, Yaseen & Imran, 2019). When compared to the secondary schools of the government, especially the private ones, they are also likely to enjoy better infrastructure, financial capabilities, and autonomy, voicing their institutions to embrace ICT. Nevertheless, the inconsistent results about the direct influence that teachers' use of ICT may have on the academic process of students are inconclusive, even with more investment in the area (Valverde -Berrocoso et al., 2022). Among the most essential instruments of educational quality and performance is academic performance. Most of the policymakers and school authorities believe that with the incorporation of ICT, there will automatically be an improvement in academic performance (Ahmed, & Imran, 2024; Ahmed, 2023). Still, the latest empirical research claims that technology is not the source of learning improvement; on the contrary, its effects are dependent on how the teachers incorporate ICT into the pedagogical process and on how students participate in learning activities organized with the use of technologies (Hillmayr et al., 2020). This implies that the correlation between the ICT utilization of teachers and the performance of students in school is not simple and depends on various instructional and psychological variables. Teachers are at the center of defining the success of the integration of ICT. The choice they make about instruction determines which aspects of technology are in use: to deliver content, to engage in learning with peers, to give formative assessment, or to solve a problem. The studies conducted by some research have shown that in the cases where ICT is used as a means of presentation or as an administrative tool, little impact on learning outcomes is realized by students. Conversely, interactive and student-centered teaching approaches that incorporate ICT can increase comprehension, application and higher-order thinking (Valverde-Berrocoso et al., 2022).

Hence, it is critical to review how teachers can utilize ICT as an instructional process to determine its effectiveness on the performance of students in the context of the private secondary schools. Student engagement is one of the most important ways in which ICT can affect academic performance. The behavioral, emotional, and cognitive involvement of learners in academic activities is known as student engagement. ICT-based learning has the potential to facilitate interaction through the provision of multimedia learning resources, real-time feedback, interactive learning simulation, and collaborative learning. Research studies have demonstrated a high level of motivation, concentration, and engagement with technology in learning environments when compared to standard methods of teaching (Balalle, 2024). Technology, however, also may distract students if it is administered improperly or adjusted to the learning objectives. The recent studies also highlight that student engagement is not only a result of using ICT but also a mediator explaining the influence of ICT on academic success. Li and Zhu (2023) disc that the academic performance of students greatly anticipated with the use of ICT due to higher cognitive and motivational involvement. This implies that ICT has an



increase in the performance of students, mainly when it increases student engagement in the learning activities. Therefore, the study of engagement of students as a mediating variable would give a better insight into the pathways by which the ICT use by teachers would influence academic performance. Along with the engagement of the students, the digital competency of teachers has become another important part of the successful ICT integration (Imran, Zaidi, & Rehan, 2024; Khoso, et al., 2024). Digital competency of teachers includes technical, pedagogical, content, and ethical awareness concerning the application of digital technologies in the educational process (Falloon, 2020). Digitally competent educators can choose better technologies, learners can design meaningful learning experiences, can manage the use of technologies in the classroom, and be able to bridge the gap between ICT-based teaching and curriculum standards and assessment practices. There are empirical findings that indicate that the quality of ICT integration in classrooms is a major factor that depends on the digital competence of teachers. Demissie et al. (2022) found that digitally competent teachers were more inclined to adopt student-centred, interactive ICT activities, which resulted in a more successful learning experience. In the same vein, Aydin et al. (2024) constructed and confirmed a full scale of teacher digital competence and pointed out a close relationship between it and successful teaching in the context of technologies and technology-focused schools. Besides, the digital competence of teachers can act as a moderating factor in the correlation between the ICT use and the academic performance of the students. It implies that the positive academic performance of ICT use, depending on the level of teacher digital competence, can be more significant and competence lower.

Li et al. (2021) established that there was a moderate relationship between the use of technology and instructional behaviour moderated by the digital competence of teachers, indicating that the effectiveness of teaching with the help of ICT is improved by competence. And already in the case of private secondary schools, where ICT resources are a matter of opportunity, this could be caused by differences in the level of digital competence of teachers, resulting in differences in the performance of students who may have equivalent levels of technological access. The competence of teachers in digital education is also highlighted by the international bodies. Both UNESCO (2023) and the OECD (2023) point out that teachers are to be trained continuously on professional development and using competencies to guarantee sustainable growth in the learning of students through ICT usage.

Although the topic of ICT in education is growing in literature, the research has not so far investigated the different issues related to ICT application by teachers, student usage, teacher digital competency and student academic achievement as one conceptual framework, especially in the case of private secondary schools. This gap is significant to both theory and practice since it can guide the school leaders, policymakers and teacher educators on the conditions in which ICT can play a significant role in influencing student learning outcomes. This research focused on the effects of the use of Information and Communication Technology by teachers on the academic performance of students in private secondary schools by analysing students' engagement as an intervening factor and digital competence of teachers as a mediating factor. Thus, the purpose of this study is to investigate the correlation between the use of ICT by the teachers, student engagement, and academic performance of private secondary schools, and in this context, the student engagement will serve as a mediator. Addressing this gap, the



study can offer some context-specific information that can be used to inform practice in education, policy, and future research in technology-enhanced learning.

Literature Review and Theoretical Framework

The current research is based on the Social Learning Theory (SLT), which interprets learning as a socially constructed process which learning takes place in a learning environment through interaction, observation, and collaboration. Computer-based classrooms in contemporary educational institutions have avenues to social interaction, knowledge building and the modelling of classroom behaviors.

Recent research in the fields of education emphasizes that collaborative learning and the ability to interact with peers are an important part of social learning and are achieved through the use of digital learning environments (Khalid and Pedersen, 2021). In integrated classrooms that are based on ICT, teachers become the facilitators in shaping the learning of students using the digital tools, and thus allowing students to view, interact and interact with the material and other students. Contemporary research claims that technology-enhanced instruction encourages participatory learning and helps students to actively build knowledge instead of receiving and maybe passively absorbing information (Trust, Whalen, and Chen, 2022).

Therefore, the Social Learning Theory provides a suitable perspective through which the activities of the teacher using ICT could affect the engagement and academic achievement of children in the private secondary schools. In addition, ICT-based teaching is typically consistent with the constructivist principle of learning in which learners actively initiate interaction with learning resources and the social environment. The digital platforms enable communication, collaboration, and feedback, enhancing students' engagement and learning (Zhao, Pinto Llorente, and Sanchez Gomez, 2021). Thus, this theoretical framework contributes to investigating both direct and indirect links between the ICT use by the teachers, students' engagement with them and academic performance.

Academic Performance of students and the ICT usage by teachers

The ICT use by teachers is the intentional application of digital technologies in teaching activities in an attempt to aid in instruction, evaluation, and communication. The latest sources indicate that ICT integration has the potential to positively affect the academic outcomes of students in the case of its pedagogical correspondence and ability to facilitate interactive learning (Petko, Prasse, and Cantieni, 2022).

Research work in the setting of the secondary school setting has shown that conceptual learning and academic success of students improve when teachers use ICT as a source of interactive and student-centered learning procedures. The research findings also indicate that ICT empowers educators to differentiate instructional plans, deliver timely feedback, and facilitate students to learn differently, and this leads to better academic performance (Schindler et al., 2020). The academic performance of students in private secondary schools is linked to better use of ICT by teachers than using conventional teaching methods due to the more accessible digital resources (Konig, Jager-Biela, and Glutsch, 2020). Nonetheless, researchers are warning that ICT can only be effective when the instructional quality is high and not regular. Students who experience meaningful use of ICT by teachers in lesson planning and assessment often have



improved learning results (Hattie, 2023). On this basis, it is expected that there will be a positive correlation between the application of ICT by teachers and their students with regard to academic performance.

Hypothesis 1: *Teachers' use of ICT has a positive and significant effect on students' academic performance.*

Learners and their involvement and academic performance

The interaction of students is one of the major conditions that determine performance in schools. Active learners are more attentive, motivated, and mentally engaged, and as a result, understand and achieve higher grades. According to current studies, engagement has been linked to achievement in various levels of education and learning settings (Fredricks, Filsecker, and Lawson, 2021). Engagement in ICT-supported classrooms is also especially crucial in converting instruction practice to academic performance. Research shows that students who actively participate in online learning activities have better academic results than disengaged ones (Henrie, Halverson, and Graham, 2022).

Also, involvement boosts self-regulation and perseverance among students, which are crucial in academic achievement. The existing studies in the context of secondary education suggest that the mediation of instructional strategies, such as technology-based teaching, on academic outcomes is mediated by engagement (Jeno, Vandvik, Eliassen, and Grytnes, 2021). As a result, the engagement of students and academic performance is likely to have a positive correlation.

Hypothesis 2: *Teachers' use of ICT has a positive and significant effect on students' engagement.*

ICT Usage by teachers and student engagement

Student engagement plays a paramount role towards seeing whether a learning process will be successful, and this may be the behavioral engagement of students, their emotional involvement and cognitive commitment to the learning activity. Recent research highlights that teaching with the aid of ICT can play a crucial role in increasing the engagement of the students through the interaction, cooperation, and visualization; of learning (Bond et al., 2020). ICT use by teachers supports interactive learning, in the form of online discussions, multimedia presentations, joint projects, among other methods, which practice student engagement and motivation. The studies in the field of secondary schools have identified that students are more engaged when teachers employ digital tools that allow encouraging participation and interaction with peers (Martin, Wang, and Sadaf, 2020).

Also, digital technologies enable a student to become more engaged in their learning, resulting in engagement and persistence. Empirical evidence also indicates that the use of ICT by teachers in instruction is a powerful predictor of student engagement both in a face-to-face and a blended learning setting (Howard, Ma, and Yang, 2022). Thus, the application of ICT by teachers is likely to have a positive effect on student engagement in the private secondary school.

Hypothesis 3: *Students' engagement has a positive and significant effect on students' academic performance.*



Mediation of Engagement of Students

According to recent studies into education, there is a common suggestion that the correlation between the usage of ICT by teachers and student performance is indirect and acts through student engagement. Engagement is a psychological process that elucidates the ability of instructional practices to shape the learning outcomes. Children will also be more engaged when teachers incorporate ICT successfully, and it further increases academic achievement (Bond and Bedenlier, 2019; Jeno et al., 2021). Mediation-based studies have shown that student engagement mediates to a significant level the relationship between technology-enhanced instruction and academic achievement (Howard et al., 2022). This observation leads to the argument that ICT alone cannot enhance performance unless it promotes meaningful involvement in learning related tasks. Similar to the Social Learning Theory, ICT-guided classrooms stimulate interaction, cooperation, and mutual experience of learning, which contribute to the increase of engagement and academic achievement (Sultana, Ahmed, & Imran, 2024). Hence, it is anticipated that students will act as the mediator between the ICT use by teachers and the academic achievements of the students in the private secondary schools.

Hypothesis 4: *Students' engagement mediates the relationship between teachers' use of ICT and students' academic performance*

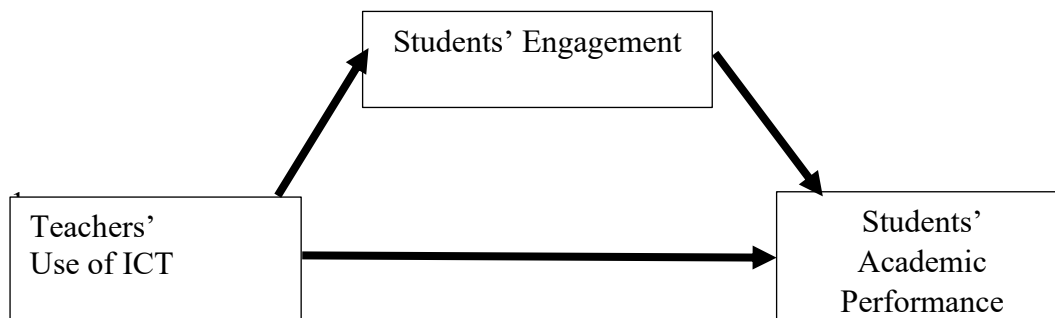
Conceptual Framework

The conceptual framework of the study is grounded in the assumption that teachers' use of ICT influences students' academic performance in secondary schools. Teachers' use of ICT serves as the independent variable, while students' academic performance is the dependent variable. Teachers' perceptions and digital competencies may act as moderating factors that affect the strength and direction of this relationship. The framework illustrates how effective ICT integration, supported by positive teacher perceptions and adequate technological skills, can enhance teaching practices, student engagement, and ultimately academic performance. Within the framework of academic learning, the impact of a child's everyday interactions with technology has grown in importance as a research area, demonstrating the intrinsic learning capacity of ICT use.

The available literature emphasizes the increased importance of Information and Communication Technology (ICT) in improving the teaching and learning in any learning environment. According to many studies, the use of ICT can enhance student engagement through facilitating interactive, collaborative, and student-centered learning activities (Bond et al., 2020; Jeno et al., 2021). Students who are engaged will have greater likelihood of portraying increased levels of motivation, participation, and academic success. Nevertheless, there has not been significant proof based on empirical studies on the direct relationship between ICT and academic achievement because some studies have indicated that technology in itself does not imply better learning results unless there is proper pedagogical implementation. Moreover, the past studies have given more and more importance to mediating variables like student engagement in the explanation of the impact of ICT on academic performance. This notwithstanding, most research concentrates on the higher education context with little empirical data in secondary schools especially in third world countries such as Pakistan. Moreover, most studies tend to investigate the direct correlation between use of ICT

and academic performance without appropriate investigation of the mechanisms underlying these effects. Hence, there is evident research gap in the knowledge of how the application of ICT by teachers affects the academic performance of the students through participation in the setting of the secondary schools privately. This paper fills this gap by considering the student engagement as a mediating factor, and therefore offers more thorough information on the role of ICT in improving educational performance.

Figure 1



Research Methodology

This research design was a quantitative correlational research design that was used to investigate the correlation between the use of Information and Communication Technology (ICT) by teachers, student engagement, and the academic performance of students in the private secondary schools. The type of design that was used was a correlational design because the study intention was to examine the direction and strength of relationships between variables without control. The sample population comprised of teachers in five sampled private secondary schools in Karachi, who were teaching subjects such as English, Mathematics, General Science, Physics, Chemistry and Pakistan Studies.

An adequate sample of 70 teachers was selected by the use of a simple random sampling technique, which is believed to be sufficient to perform the statistical analysis and generalization in the context of the study. A structured questionnaire was used to gather the data based on the previously tested instruments to measure the ICT use, student engagement (behavioral, emotional, and cognitive), and academic performance (Bond et al., 2020; Jeno et al., 2021; Henrie et al., 2022). Experts have been used to assure content validity and a pilot study being used to assure reliability with a Cronbach alpha coefficient of 0.70 or higher. The SPSS was used in the analysis of the data, where the descriptive statistics and the inferential statistics, such as Pearson correlation and regression analysis were used at the significance of 0.05.

Data Analysis and Results

The findings of an analysis of the data were presented and used to answer the research objectives of the study. The results are presented and explained under descriptive statistics, reliability analysis, correlation analysis, regression analysis, and mediation analysis to analyze the relationship between the use of ICT among teachers, student engagement, and student academic performance.



Demographic of Respondents

This section of the chapter contains the demographic details of the respondents that encompass gender-wise distribution, age-wise distribution and experience of the participants.

Table 1
Gender-Wise Distribution

		Frequency	%	Valid Percent	Cumulative Percent
Valid	Female	58	83	83	83
	Male	12	17	17	100
	Total	70	100	100	

The findings shown in the figure give the gender breakdown of the respondents. Among 70 individuals that were sampled, the vast number of participants were female (n = 58, 82.9%), and a smaller number were male respondents (n = 12, 17.1%). In general, the sample was mostly female as female representatives in the study were higher.

Table 2
Age-Wise Distribution

		Frequency	%	Valid Percent	Cumulative Percent
Valid	25-34	23	32.9	32.9	32.9
	35-44	16	22.9	22.9	55.7
	45-54	25	35.7	35.7	91.4
	55+	6	8.6	8.6	100.0
	Total	70	100.0	100.0	

The findings that have been given in Table 2 indicate the age distributions of participants. In the total sample of 70 respondents, 25 respondents (35.7%) were aged between 45 and 54 years, and 23 respondents (32.9%) were between the ages of 25 and 34 years. The highest number of respondents was 16 (22.9%) in the age range of 35-44 years, and the lowest number was 6 respondents (8.6%) in the age range of 55 years and above. In general, the sample was composed mainly of individuals aged 25-54 years.

Table 3
Experience of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-3 years	3	4.3	4.3	4.3
	13+ years	40	57.1	57.1	61.4
	4-7 years	8	11.4	11.4	72.9
	8-12 years	19	27.1	27.1	100.0
	Total	70	100	100	



The experience-wise distribution of the participants is revealed in a set of results provided in Table 3. Among the sample size of 70 respondents, most of them had 13 years of experience or more in the field of teaching (n = 40, 57.1%).

This was then preceded by respondents who had experience of 8-12 years (n = 19, 27.1%). The respondents with experience of between 4-7 years of experience included 8 respondents (11.4%), and a minor fraction of the sample taught between 1-3 years (n=3, 4.3%). In general, the sample was mostly made up of the highly experienced teachers.

Descriptive Statistics of the Variables

Table 4
 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
ICT Use	70	1.00	5.00	3.4771	.86631
Student Engagement	70	1.00	5.00	3.8714	.82990
Academic Performance	70	1.00	5.00	3.7457	.85324

The above table shows the descriptive statistics that provide the most important features of the variables in the study. The findings suggested that teachers used ICT with an average score of M = 3.48 (SD = 0.87) which is moderate and high level of ICT use by teachers. The mean of the student engagement was rather high M = 3.87 (SD = 0.83) and referred to the fact that students were generally engaged in the learning process.

On the same note, the student academic performance recorded a mean of M = 3.75 (SD = 0.85) which was moderately high in terms of academic performance. All the variables were measured at the Rate of Five-point scale, whose scores would be between 1-5, and the valid sample size of all variables was 70 respondents.

Pearson Correlation

The Pearson Correlation analysis technique was used to test the relationship among the variables such as teachers’ use of ICT, students’ engagement and students’ academic performance. This analysis indicates the strength, direction and significance relationship among the variables.



Table 5
 Correlations

		Teachers' Use of ICT	Student Engagement	Student Academic Performance
Teachers' Use of ICT	Pearson Correlation	1		
	Significance Value			
	N	70		
Student Engagement	Pearson Correlation	.482**	1	
	Significance Value	.000		
	N	70	70	70
Student Academic Performance	Pearson Correlation	.436**	.864**	1
	Significance Value	.000	.000	
	N	70	70	70

** . Correlation is significant at the 0.01 level (2-tailed).

The table provides a correlation between Teachers Use of ICT, Student Engagement and Student Academic Performance in a sample of 70 respondents. The data show moderate and positive correlation between ICT use by teachers and their engagement ($r = .482$, $p < .01$). This implies that the higher the use of ICT by teachers, the more student engagement will be witnessed. Equally, the academic performance of students is also positively and significantly correlated with the use of ICT among teachers ($r = .436$, $p < .01$), meaning that the higher the level of integration of ICT in teaching practices, the higher the academic performance of the students. In addition, student engagement and student academic performance had a high positive correlation ($r = .864$, $p < .01$). This translates to the fact that learners who are more engaged in the learning process are expected to show good academic performance. All the correlations were found to be significant at the 0.01 level, which observed a meaningful relationship among the variables in the study.

Hypothesis Testing

Hypothesis 1: Teachers' use of ICT has a positive and significant effect on students' academic performance.

Table 6
 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.436 ^a	.190	.178	.77337

a. Predictors: (Constant), Teachers Use of ICT

According to the model summary, the relationship between the use of ICT by teachers and the student performance is moderate and positive ($R = .436$). In addition, the coefficient of determination ($R^2 = 0.190$) indicates that the application of ICT by teachers explains the differences in student academic achievement by 19%.



Table 7
ANOVA^a

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	9.563	1	9.563	15.989	.000 ^b
	Residual	40.671	68	.598		
	Total	50.234	69			

a. Dependent Variable: Student Academic Performance

b. Predictors: (Constant), Teachers Use of ICT

Based on the outcomes of the ANOVA, the regression equation to predict student academic achievement with the utilization of ICT among teachers has been statistically significant ($F(1, 68) = 15.99, p < .001$). This observation implies that the academic performance of students is strongly predicted by the use of ICT by teachers and that the model is a good fit to the nature of the data.

Table 8
Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error			
1	(Constant)	2.251	.385		5.849	.000
	Teachers Use of ICT	.430	.107	.436	3.999	.000

a. Dependent Variable: Student Academic Performance

Regression coefficients show that the application of the ICT by the teachers has a positive and significant impact on the academic performance of students. $B = 0.43$ ($SE = 0.11$) was the unstandardized coefficient of teachers using ICT, and the standardized beta of $b = .44, t(68) = 3.99, p < .001$. This fact may indicate that the higher teachers use ICT, the higher are the academic performance of students. According to the results of the regression, the hypothesis was accepted, and the practices of teachers using ICT has a great importance that significantly influence the academic performance of students in a positive way ($p < .001$).

Hypothesis 2: *Teaches' use of ICT has a positive and significant effect on students' engagement.*

Table 9
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.482 ^a	.233	.221	.73225

a. Predictors: (Constant), Teachers Use of ICT

The model summary shows that there is a moderate positive correlation between the use of ICT by teachers and engagement of the students ($R = .482$). The coefficient of determination ($R^2 = .233$) indicates that the students' engagement can be explained by 23.3% percent of the teacher using ICT.



Table 10
ANOVA^a

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	11.062	1	11.062	20.632	.000 ^b
	Residual	36.460	68	.536		
	Total	47.523	69			

a. Dependent Variable: Student Engagement

b. Predictors: (Constant), Teachers Use of ICT

According to the findings presented in the ANOVA, the regression model explaining the engagement of students based on the application of ICT by the teachers is significant, $F(1, 68) = 20.63$, $p < .001$. This observation indicates that the use of ICT by teachers has a significant predictive value on the interaction between students and that the model has a good match to the data.

Table 11
Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error			
1	(Constant)	2.264	.364		6.212	.000
	Teachers Use of ICT	.462	.102	.482	4.542	.000

a. Dependent Variable: Student Engagement

The regression outcome validated that the use of ICT by teachers positively and statistically significantly influences the engagement of students ($B = 0.46$, $b = .48$, $t(68) = 4.54$, $p < .001$). These results give empirical backing to the hypothesis put forward to assert that the adoption of ICT by teachers has a positive and significant impact on the engagement of the students. Thus, this hypothesis is accepted that using ICT by teachers does make a difference in the engagement of the students.

Hypothesis 3: Students' engagement has a positive and significant effect on students' academic performance.

Table 12
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.864 ^a	.747	.743	.43224

a. Predictors: (Constant), Student Engagement



Student academic performance and student engagement have a very high positive relationship as explained by the model summary ($R = .864$). Student engagement according to coefficient of determination ($R^2 = .747$) can explain 74.7 percent of the variance on student academic performance.

Table 13
 ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.529	1	37.529	200.872	.000 ^b
	Residual	12.705	68	.187		
	Total	50.234	69			

a. Dependent Variable: Student Academic Performance

b. Predictors: (Constant), Student Engagement

The ANOVA values show that the regression model that predicts the student academic performance based on the student engagement level is statistically significant, $F(1, 68) = 200.87, p < .001$. This observation implies that the student engagement is a significant predictor of student academic performance and that the model fits the data quite well.

Table 14
 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error			
1	(Constant)	.305	.248		1.230	.223
	Student Engagement	.889	.063	.864	14.173	.000

a. Dependent Variable: Student Academic Performance

The regression coefficients show that student engagement positively and statistically significantly affects the academic performance of students ($B = 0.89, b = .86, t(68) = 14.17, p < .001$). These findings have serious empirical grounds for the proposed hypothesis, according to which engagement of students has a positive and significant impact on the academic performance of students. Accordingly, the hypothesis is accepted.

Hypotheses 4: Students' engagement mediates the relationship between teachers' use of ICT and students' academic performance.

Table 15
 Regression Analysis: Effect of ICT on Self-Efficacy (SE)

Predictor	B	SE	t	p	LLCI	ULCI
Constant	2.264	0.365	6.21	.000	1.537	2.992
ICT	0.462	0.102	4.54	.000	0.259	0.665



Model Fit: $R = .483$, $R^2 = .233$, $F(1,68) = 20.63$, $p < .001$

The findings in Table 4.15 indicate that ICT positively affects the self-efficacy, statistically significant ($b = 0.462$, $p < .001$). The model accounts for 23.3 per cent of the difference exhibited in self-efficacy, which implies that ICT has significant predictive power on self-beliefs and confidence of students regarding their academic skills and abilities.

Table 16
 Regression Analysis: Effect of ICT and Self-Efficacy on Academic Performance (AP)

Predictor	B	SE	t	P	LLCI	ULCI
Constant	0.268	0.271	0.99	.327	-0.274	0.809
ICT	0.025	0.069	0.36	.721	-0.113	0.163
Self-Efficacy	0.876	0.072	12.16	.000	0.732	1.020

Model Fit: $R = .865$, $R^2 = .748$, $F(2,67) = 99.21$, $p < .001$

Table 16 further identified self-efficacy as a significant predictor of academic performance when both ICT and self-efficacy were included in the regression equation ($b = 0.876$, $p < .001$). The positive impact of ICT on academic performance was however not significant ($b = 0.025$, $p > .05$). The model explained 74.8 percent of the academic performance, which indicated that the model had a significant explanatory power.

Table 17
 Total Effect of ICT on Academic Performance

Predictor	B	SE	t	P	LLCI	ULCI
Constant	2.252	0.385	5.85	.000	1.483	3.020
ICT	0.430	0.108	4.00	.000	0.215	0.644

Model Fit: $R = .436$, $R^2 = .190$, $F(1,68) = 15.99$, $p < .001$

Table 17 shows that ICT produces much effect on academic performance ($b = 0.430$, $p < .001$) when it is not accompanied by self-efficacy in the model. This is an indication that ICT positively relates to academic performance in the bivariate level.

Table 18
 Mediation Analysis: Total, Direct, and Indirect Effects of ICT on Academic Performance

Effect Type	Effect	SE / BootSE	t	P	LLCI	ULCI
Total Effect	0.430	0.108	4.00	.000	0.215	0.644
Direct Effect	0.025	0.069	0.36	.721	-0.113	0.163
Indirect Effect (via SE)	0.405	0.144	—	—	0.140	0.709

According to the mediation results that are illustrated in Table 4.18, one can see that self-efficacy perfectly mediates the relationship between ICT and academic performance. Though the overall impact of ICT on academic performance was significant, the direct one became insignificant when self-efficacy was taken into consideration. Besides, the indirect impact of



ICT on academic performance via self-efficacy was strong, as the bootstrapped confidence interval was not within the zero mark. These results demonstrate that ICT leads to an increase in academic performance due to the increase in self-efficacy among students. Therefore, self-efficacy is significant towards the explanation of the effect of ICT on academic performance, which proves full-mediation effect.

Reliability Analysis

Table 19
Reliability Analysis of Study Variables

Variable	No. of Items	Cronbach's Alpha (α)
Teachers' Use of ICT (ICT)	5	.864
Student Engagement (SE)	5	.917
Student Academic Performance (AP)	5	.945
Overall Scale	15	.937

Note. Cronbach's alpha values above .70 indicate acceptable internal consistency.

The analysis of reliability Table (19) shows that all the variables used in the study showed high internal consistency. The use of teacher ICT had a good reliability coefficient of Cronbach's alpha of .864 indicating good reliability among the five items. Internal consistency in Student Engagement was also very high having a Cronbach's alpha of .917 with the use of five items. Equally, the Student Academic Performance had very high reliability with a Cronbach alpha of 5 items standing at .945. In addition, the total scale of 15 items produced the Cronbach alpha of .937 indicating the excellent internal consistency. These findings prove that all measurement scales that are employed in the research are good and can undergo the subsequent statistical process because all alpha coefficients were higher than the generally accepted level of .70.

Discussion and Conclusion

Conclusion

The aim of current research was to investigate the effect of ICT use on students' engagement and academic performance of students. The current research concludes that the way ICT is used by teachers is relevant in improving the engagement of students and hence better performance in academic activities. The results show that the use of ICT by teachers is largely positively related to academic performance, but the effect is mediated largely by the student engagement. This underscores the need to bring ICT on board in learning significant aspects that would actively engage the students in learning. In general, the research revealed that good application of ICT coupled with high engagement of students can lead to improved performance.

Discussion

The results of this research have significant implications on how the use of Information and Communication Technology (ICT) by teachers can help to improve the engagement and academic performance of students in the private secondary schools. The findings show that there is a positive influence of ICT use on student engagement and academic performance. The result of this observation is in line with the earlier studies indicating that ICT integration does



not only increase the effectiveness of teaching but also gives students access to various and interactive learning resources (Bond et al., 2020; Jeno et al., 2021). ICT based instructional practices facilitate the active learning conditions, which are beneficial to the enhanced academic performance. Moreover, the research validates the fact that student engagement is very important in determining academic performance. Behaviorally, emotionally, and cognitively involved students have the higher chances of showing greater motivation, involvement, and educational achievement. The result is in line with other literature that mentions engagement as one of the primary predictors of learning outcomes. The important input of the research is that it defined student engagement as the mediating variable between the connection between ICT use and academic performance. The mediation study shows that ICT has no direct positive effects on academic performance but indirectly it impacts through an increase in student engagement. This observation has been consistent with social learning theory which says that interaction, participation and active involvement are necessary elements of effective learning. ICT aids these processes because it allows working together, interchange of ideas, and information access, which results in improved engagement and learning outcomes. Such findings indicate that it is the integration of ICT that has pedagogical meaning and not technological adoption. Educators should apply ICT in order to encourage interaction and promote active learning. In general, the research will be relevant to the existing body of literature on educational technology in that it offers the context-related evidence based on the Pakistani context of the private secondary schools where few empirical research has been conducted.

Implications of the Study

This study has extensive implications on educational practice, policy, and research in the future. To the teachers, the study highlights the essence of using ICT in pedagogically significant manners that will improve student engagement and learning outcomes. Instead of technology being used to deliver content, interactive and student-centered forms of technology should be considered by teachers to ensure participation and critical thinking.

On the institutional level, the schools are to invest in the continuous professional development programs that will provide the teachers with both technical and pedagogical skills to effectively integrate ICT in their work. ICT-based learning strategies and digital tools must also be included in the lesson planning and assessment practice by curriculum developers.

Policy wise, educational governments are supposed to formulate effective rules and policies to use ICT in secondary education to make technological services accessible to all. Future research based on the advanced models of technology integration and processes of student learning in various educational settings also has a foundation in the study.

Recommendations and Limitations

According to the conclusion of the research, it is recommended that:

1. Educators must incorporate the ICT tools both interactively and student centered to promote a higher degree of engagement and learning.
2. The ICT-based tasks that should be created by teachers (e.g. quizzes, simulations, collaborative tasks) should encourage critical thinking and involvement.



3. Digital pedagogy should be continuously developed to make good use of technology in classroom training.
4. Regular professional development programs of schools should be organized on pedagogical use of ICT rather than on technical training.
5. The institutions are supposed to have good technological facilities (internet, smart classes, digital devices) so that the integration of ICT is achieved effectively.
6. School administrations ought to have enabling policies and surveillance systems that help promote efficient ICT utilization in the instructional practices.
7. Lessons and evaluation techniques should be included in the curriculum planners which involve ICT-based instructional strategies.
8. Digital material and interactive learning content should be included in the learning materials, to improve student engagement and learning results.
9. The education administrators must come up with a clear national and provincial guideline on how ICT should be integrated in high schools.
10. The government is supposed to facilitate fair access to online resources in schools to curb the digital divide.
11. Other variables that should be considered in future studies include digital competence, teacher self-efficacy and institutional support.
12. Longitudinal or experimental research designs are recommended because they provide researchers with a chance to determine causal relationships.
13. They should be carried out in comparative studies involving the public and private schools to obtain more insight.

Although it made contributions, the study has some weaknesses and limitation that need to be mentioned. Enhancing the practical use of the study results, it is important to note that it was quite small and focused on a particular situation, which might limit the transfer of the findings on other educational backgrounds. which may restrict the generalizability of the findings to other educational settings. Second, the researcher used self-reports in data collection, which are prone to response biases. Lastly, the cross-sectional research design does not allow reaching causal conclusions amongst the research variables. Future studies can improve on these shortcomings by adopting a larger and more heterogeneous sample, a longitudinal design, and qualitative or mixed-method procedures to learn more about the effect of ICT on student engagement and academic achievement.

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