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Use of Technology in Teaching in High Schools of Taluka Sehwan Sharif District Jamshoro: With The Lens of Technology Integration Matrix (TIM)

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Abstract

The study explores application of technology to teaching in high schools in the district of Jamshoro, in Taluka Sehwan Sharif through the prism of the Technology Integration Matrix (TIM). The research will measure the degree to which teachers have integrated technology, will examine the use of the five TIM characteristics, Active, Collaborative, Constructive, Authentic, and Goal-Directed learning and establish their effect on the effectiveness of the teacher. The research design was a quantitative with a descriptive survey design. A structured questionnaire was used to collect data on 228 high school teachers with a five-point Likert scale. The results show that the majority of teachers work at the Entry and Adoption levels of the TIM, and they mainly use technology in the teacher-centered instructional strategies but not in the student-centered instructional strategies. Although there has been minimal higher-order integration, teachers indicated that technology can greatly assist in the delivery of lessons and also help to increase student engagement. Regression analysis indicated that TIM-based technology integration has a significant percentage contribution to teaching effectiveness variance, and Active, Constructive, and Authentic learning were found to be significant predictors. Nevertheless, Collaborative and Goal-Directed learning did not prove to have statistically significant effect in this regard. The study concludes that the use of technology in classrooms is also on the rise, but the integration of technology in the classroom remains low. Policymakers and educational institutions are advised to emphasize on professional development, infrastructure improvement,

and encouraging student-centered digital practices to attain greater levels of meaningful technology integration.

Keywords: Technology Integration Matrix (TIM), Teaching Effectiveness, ICT in Education, Secondary Schools, Student Engagement, Active Learning, Constructive Learning, Authentic Learning, Pakistan Education System.

INTRODUCTION

1.1 INTRODUCTION

Technology use in education has become a critical element in secondary education as digital tools are now being increasingly linked to enhanced quality of instruction and classroom efficacy (Ertmer and Ottenbreit-Leftwich, 2010). Technology integration in high schools supports various teaching practices, encourages student involvement, and increases access to learning materials (Kirkwood and Price, 2014). Nonetheless, the successful use of technology lies in organized pedagogical systems and not just the mere access to technological devices (Koehler and Mishra, 2009). The Technology Integration Matrix (TIM) is an inclusive model of examining the integration of technology in the classroom by matching the levels of integration with meaningful learning properties (Welsh, Harmes, and Winkelman, 2011). TIM highlights five key features of learning - Active, Collaborative, Constructive, Authentic, and Goal-Directed- that indicate quality instructional practices with the assistance of technology (Harmes, Welsh, and Winkelman, 2016). Past research reveals that teachers who perform at high TIM levels are more teaching effective and more able to interact with students in the classroom (Hutchison and Reinking, 2011). Studies carried out in the context of developing countries reveal that even though the adoption of technology in schools is on the rise, it is not yet systematically implemented in line with pedagogical objectives (Tondeur et al., 2017). The secondary school teachers in Pakistan experience challenges in terms of training, infrastructure, and the alignment of instruction when incorporating technology (Siddiqui and Rashid, 2019). Hence, it is crucial to analyze the use of technology in high schools of Taluka Sehwan Sharif, District Jamshoro, through the prism of the Technology Integration Matrix to comprehend the current practice and its implications on the effectiveness of teaching.

1.2 STATEMENT OF THE PROBLEM.

Although there has been an increase in the level of access to digital technologies in the secondary school setting, effective utilization of digital technologies in classroom instruction continues to be inconsistent and pedagogically constrained (Ertmer and Ottenbreit-Leftwich, 2010). Studies have shown a lot of teachers to use technology at a surface level without tying it to meaningful learning processes (Koehler and Mishra, 2009). Technology Integration Matrix (TIM) points out that the positive use of technology must be active, collaborative, constructive, authentic, and goal-oriented learning, but these aspects are typically not practiced adequately in the classroom (Welsh, Harmes, and Winkelman, 2011; Harmes, Welsh, and Winkelman, 2016). Research also indicates that the lack of professional training and contextual factors limit the ability of teachers to effectively use technology (Tondeur et al., 2017). There is little empirical research concerning TIM-based technology integration at the high school level in Pakistan, especially in rural settings like Taluka Sehwan Sharif (Siddiqui and Rashid, 2019). Therefore, the respective effect of TIM-corresponding technology integration on the teaching efficiency is still under-studied.

1.3 OBJECTIVES OF THE STUDY

Overall this study examines the use of Technology Integration Matrix (TIM). As a teacher in high schools of Tluka Sehwan Sharif District Jamshoro.

More specific goals are:

1. The level of technology integration that high school teachers are implementing in their classrooms will be measured using the Technology Integration Matrix (TIM).
2. Assess how well the classroom teaching applies the 5 TIM characteristics (Active, Collaborative, Constructive, Authentic, Goal-Directed learning).
3. To assess the effect of integration of the TIM based technology on the efficiency of high school teachers' instruction.

1.4 RESEARCH QUESTIONS

The research questions to address the objectives for the current study have been formulated as follows:

1. To what extent are high school teachers using technology in their classroom as described in TIM framework?
2. How often do teachers use the 5 TIM characteristics in their teaching?
3. How is the effectiveness of teaching affected by TIM integration of technology in high schools in Taluka Sehwan Sharif?

1.5 NULL HYPOTHESES OF THE STUDY

To accomplish the goals of the present study, the following Null research hypotheses are used.The null hypothesis was tested in this study to determine whether there is any significant relationship between TIM based technology integration levels and teaching effectiveness.

H_{02}: There is no difference in the use of the five TIM characteristics when comparing teachers.

H_{05}: There is no significant difference between the use of TIM based technology and the overall teaching effectiveness in high school.

1.6 THE STUDY HAS SIGNIFICANCE FOR THE FOLLOWING REASONS:

This research will focus upon the present scenario of technology utilization in education at high schools of Taluka Sehwan Sharif, District Jamshoro.

2. This study will determine the Technology Integration Matrix of the teachers' levels of technology integration.
3. This study will demonstrate the role technology plays in active, collaborative, constructive, authentic and goal directed learning.
4. This study will support the teachers' effectiveness in teaching with technology in meaningful ways.
6. This study will provide information for school administrators to identify strengths and areas of need for technology use in the classroom.
7. This study will assist in the decision making process for planning and improving technology-based instruction.
8. This research will help to implement technology in the secondary education classroom successfully.

1.7 THE STUDY WAS LIMITED BY THE FOLLOWING:

The study is limited to that Government High Schools of Taluka Sehwan Sharif, District Jamshoro, only teachers use technology in the classroom teaching during the given academic year in the context of Technology Integration Matrix.

1.8 OPERATIONAL DEFINITIONS

Technology Integration: Teacher practices that involve incorporating technologies and resources into their teaching to improve learning.

Technology Integration Matrix (TIM): A model that evaluates the application of technology in teaching by five characteristics – active, collaborative, constructive, authentic and goal-directed learning.

Active Learning: Students' participation in activities with technology instead of passive learning.

Collaborative Learning: Learning that requires students to collaborate with each other, utilising technology to meet shared learning objectives.

Constructive Learning: Learning that is built by students linking existing knowledge with technology-supported activities.

Authentic Learning: tasks or problems performed by students in the real world or in some meaningful way through technology.

Goal-Directed Learning: Learning in which students establish goals and employ technology to reach their goals.

Teaching Effectiveness: The competence of the teacher in enabling the student to learn effectively and to engage him/her in the learning process by applying technology in the teaching process.

LITERATURE REVIEW

Table 2.1

Summary of Literature review

Author(s) & Year	Focus of Study	Key Findings
Amna Naz, Shah & Hussain (2025) – Pakistan	Technology integration and student engagement in secondary schools in Multan	Technology use improved student engagement, motivation, and academic outcomes in secondary classes.
Gulnaz Nawaza & Abida Nasreen (2024) – Pakistan	Teacher perceptions and ICT use in Lahore & Gujranwala secondary schools	Teachers view ICT positively for teaching but face barriers such as lack of ICT resources and preparedness.
Wajid et al. (2025) – Pakistan	Technology integration experiences of secondary teachers in Swat	Digital tools enhanced teaching and lesson planning, but connectivity and training remain challenges.
Irshad, Munawar, Iqbal & Abu Bakr (2025) – Pakistan	ICT effectiveness in public schools of District Sargodha	Teachers recognize benefits of ICT for instructional design and student engagement, with barriers in resources and support.
Rajput et al. (2025) – Pakistan	Awareness and level of ICT integration in Shaheed Benazirabad secondary schools	Found low awareness and limited ICT integration among teachers; infrastructure and training gaps cited.
Msafiri, Kangwa & Cai	ICT integration	ICT integration improves teaching

(2023) – International	systematic review in secondary schools	and learning outcomes but faces barriers in professional development and pedagogical knowledge.
S. Ghavifekr (2015) – Malaysia (International)	Teachers' perceptions on ICT integration effectiveness	ICT supports more dynamic, engaging instruction and enhances learning when adequately supported.
Diyal & Pandey (2022) – Nepal (International)	ICT integration at secondary level in Kathmandu	Teachers see ICT as beneficial for collaborative and active learning but face challenges like limited devices and maintenance.
Msambwa et al. (2024) – Systematic Review (International)	Review of ICT integration in secondary education	Identified that effective integration needs alignment with objectives, teacher skills, and supportive policies.
Palagolla & Wickramarachchi (2019) – Sri Lanka (International)	ICT use and barriers in secondary schools	Very low levels of ICT use due to poor infrastructure and school leadership support, but positive teacher attitudes noted.

It is undeniable that the use of information and communication technology (ICT) in secondary education has attracted more and more academic interest since it has the potential to improve the effectiveness of the teaching-learning process and student involvement. In Pakistan, the recent research studies have documented some positive effects of technology in classroom practices as well as some structural and pedagogical barriers. Amna Naz, Shah, and Hussain (2025) explored the integration of technology in secondary schools in Multan and concluded that digital technologies had a positive impact on student engagement, motivation, and academic achievement. The results of their study indicate that technology-based teaching generates learning environments that are interactive, allowing students to become more involved with learning activities in the classroom. Likewise, in a study conducted in Swat, Wajid et al. (2025) found that secondary school teachers benefited from digital tools for lesson planning and instructional delivery, but had limitation in internet connectivity and inexperience in the use of these tools.

The success of the technology-based educational reforms depends on the teacher perceptions towards the integration of ICTs. Holding teachers can play a pivotal role in ICTs in education, Gulnaz Nawaza and Abida Nasreen (2024) conducted a study on teachers' attitudes towards the use of ICT in secondary schools of Lahore and Gujranwala, which revealed that teachers' attitude towards the pedagogical value of ICT was found to be positive. It was however found that there were various difficulties in the implementation of the study such as inadequate availability of ICT resources, teacher low preparedness, and technical support. The results are consistent with the results of Irshad, Munawar, Iqbal, and Abu Bakr (2025) who studied the effectiveness of ICT in public schools of District Sargodha. Their research showed that although teachers understand the advantages of the use of ICT in instructional design and in engaging students, they feel that lack of infrastructure and poor institutional support affect

the sustained and effective integration of ICT.

Although ICT has become a big issue in Pakistan, its implementation is not uniform in all areas of Pakistan. Rajput et al. (2025) investigated computational awareness and Integration of ICT in Secondary schools in Shaheed Benazirabad district, and their findings indicated that teachers' awareness of the ICT was relatively low, and the integration of ICT was also found to be in low level in the classrooms. Key barriers identified in the study included infrastructure, training opportunities and administrative support. Such results highlight the digital gap that exists in the country and indicate that policy actions are needed to make it possible to access the ICT resources equally in urban and rural educational contexts.

The two conflicting stories of the potential of and the difficulties of the use of ICTs are also echoed in the international literature. Msafiri, Kangwa, and Cai (2023) carried out a systematic review and confirmed that the incorporation of ICT in secondary schools around the world has a positive impact on teaching methods and learning outcomes. The review highlighted however, that pedagogical knowledge of teachers and professional development are still significant constraints. Ghavifekr (2015) also noted that using ICT in teaching requires strong institutional support and training systems which could produce more dynamic and engaging teaching and learning in Malaysia.

Comparative insights can be gained from studies in South Asian contexts. Diyal and Pandey (2022) has studied the secondary schools in Kathmandu, Nepal and reported that teachers were positive about ICT as an effective tool to foster collaborative and active learning. However, factors like access to devices, maintenance, and technical support made it difficult to use them effectively. Although teachers' attitudes towards the use of ICTs were found to be positive, Palagolla and Wickramarachchi (2019) found very low levels of ICT integration in secondary schools in Sri Lanka, with much of this being attributed to lack of leadership support and weak infrastructure.

The following broad systematic reviews also indicate the conditions of successful ICT integration. Msambwa et al. (2024) noted that successful implementation of the use of ICTs in secondary education requires congruence between the goals of education, teachers' competencies and supporting policy frameworks. The review notes that if policy doesn't have a clear and consistent implementation, and professionals aren't prepared, it is unlikely that ICT will have a meaningful impact.

RESEARCH METHODOLOGY

3.1 RESEARCH DESIGN

The research design employed in this research is based on the existing academic theory and frameworks to provide systematic investigation of the topic. Oyinloye (2010) noted that the descriptive method is important in establishing the existing occurrences to forecast future occurrences. Moreover, Creswell (1994) claimed that descriptive research is important in describing phenomena, occurrences and events that are happening here and now.

Using those frameworks, the research used the quantitative type of research with a descriptive survey approach. The main goal of the design is to evaluate the current level of technology integration in teaching and to analyze how the TIM characteristics are applied in the classroom in the context of high school.

3.2 RESEARCH METHOD

There are several well-known educational researchers who provide support for the selection

of quantitative method:

Creswell (2014): Quantitative research is a way to test objective theories by examining the relationship between variables by use of statistics.

2. Wiersma & Jurs (2009): Describe it as a formal, objective, and quantitative process to gather information from data.

1. Mills, A. & Airasian, P. & Gay, J. (2012): Remember that this approach is used to explain, predict or control specific phenomena by collecting numerical data.

4. Kumar (2011) & Best & Kahn (2006): Ensure that numerical data can be objectively collected and statistically analysed to measure phenomena in terms of quantity.

To comply with these methodologies a survey method will be followed. The data will be collected by using a structured questionnaire that was developed based on the Technology Integration Matrix (TIM) from teachers. This particular way of doing it allows for the systematic measurement of the extent of technology integration and the effect that it has on teaching effectiveness.

3.3 THEORETICAL FRAMEWORK

This study's theoretical approach is the Technology Integration Matrix (TIM) in the teaching context. The diagram shows a framework of the relationship between levels of technology integration and characteristics of meaningful learning environments.

The study was conducted in 1 Study Context of High Schools of Taluka Sehwan Sharif in District Jamshoro.

2. METHODOLOGY:

PEARSON CORRELATION ANALYSIS (N=228).

3. Educational Outcomes: The framework connects TIM dimensions to Teaching Effectiveness, Student Engagement and Learning Outcomes.

The Technology Integration Matrix (TIM) is displayed in figure 3.1.

Theoretical framework is the "blueprint" that provides the foundation for your study, which is derived from the Technology Integration Matrix (TIM). Describes the connection between technology integration and the learning context.

A. Core Theory: This study is based upon the TIM which classifies technology use into five categories (Entry to Transformation) and five learning characteristics (Active to Goal-Directed).

B. Application: It is a lens to look at the transition of the teachers from simple tool to higher order digital pedagogy in Taluka Sehwan Sharif.

C. Outcome: As teachers progress up the matrix, Teaching Effectiveness and Student Engagement will increase.

The Technology Integration Matrix
Table of Summary Descriptors

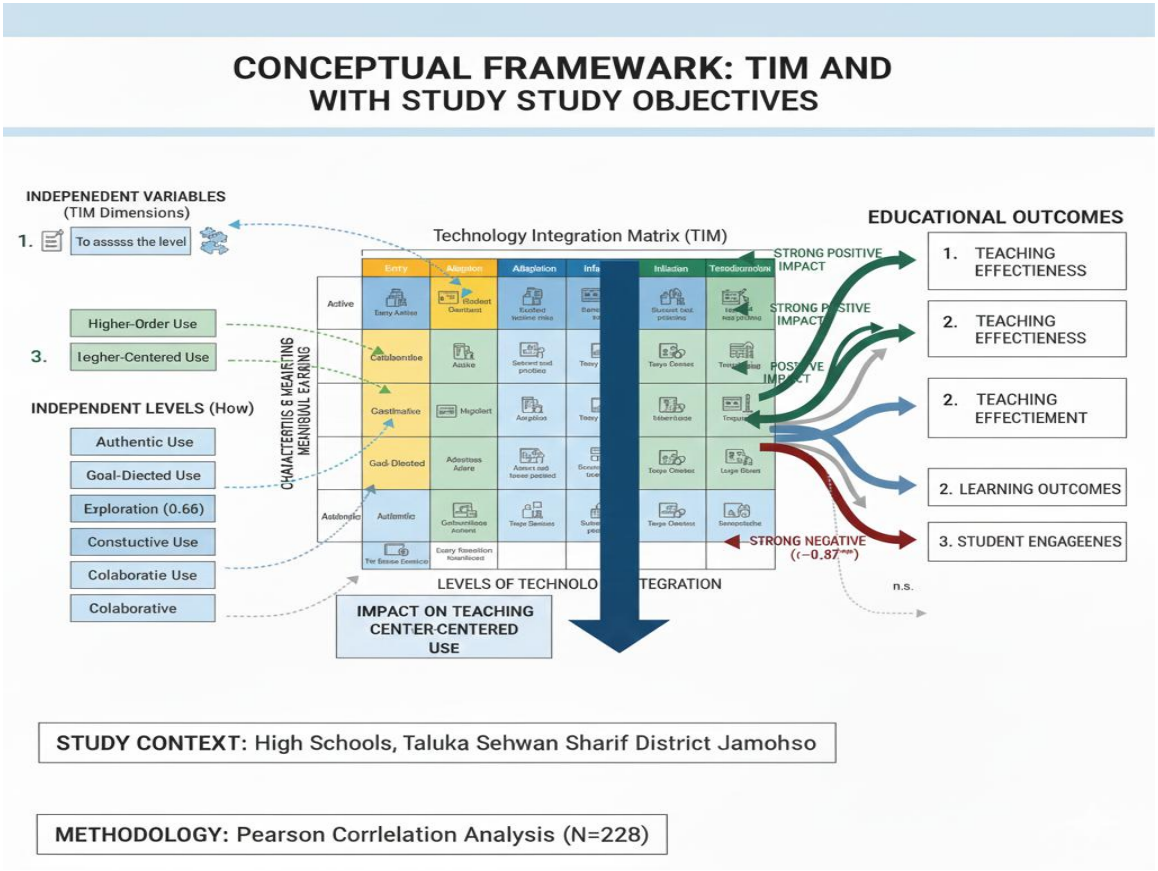
The Technology Integration Matrix (TIM) provides a framework for describing and targeting the use of technology to enhance learning. The TIM incorporates five interdependent characteristics of meaningful learning environments: active, collaborative, constructive, authentic, and goal-directed. These characteristics are associated with five levels of technology integration: entry, adoption, adaptation, infusion, and transformation. Together, the five characteristics of meaningful learning environments and five levels of technology integration create a matrix of 25 cells, as illustrated below.

LEVELS OF TECHNOLOGY INTEGRATION → / CHARACTERISTICS OF THE LEARNING ENVIRONMENT ↓	ENTRY LEVEL	ADOPTION LEVEL	ADAPTATION LEVEL	INFUSION LEVEL	TRANSFORMATION LEVEL
	The teacher begins to use technology tools to deliver curriculum content to students.	The teacher directs students in the conventional and procedural use of technology tools.	The teacher facilitates the students' exploration and independent use of technology tools.	The teacher provides the learning context and the students choose the technology tools.	The teacher encourages the innovative use of technology tools to facilitate higher-order learning activities that may not be possible without the use of technology.
ACTIVE LEARNING Students are actively engaged in using technology as a tool rather than passively receiving information from the technology.	**Active Entry** Information passively received	**Active Adoption** Conventional, procedural use of tools	**Active Adaptation** Conventional independent use of tools; some student choice and exploration	**Active Infusion** Choice of tools and regular, self-directed use	**Active Transformation** Extensive and unconventional use of tools
COLLABORATIVE LEARNING Students use technology tools to collaborate with others rather than working individually at all times.	**Collaborative Entry** Individual student use of technology tools	**Collaborative Adoption** Collaborative use of tools in conventional ways	**Collaborative Adaptation** Collaborative use of tools; some student choice and exploration	**Collaborative Infusion** Choice of tools and regular use for collaboration	**Collaborative Transformation** Collaboration with peers, outside experts, and others in ways that may not be possible without technology
CONSTRUCTIVE LEARNING Students use technology tools to connect new information to their prior knowledge rather than to passively receive information.	**Constructive Entry** Information delivered to students	**Constructive Adoption** Guided, conventional use for building knowledge	**Constructive Adaptation** Independent use for building knowledge; some student choice and exploration	**Constructive Infusion** Choice and regular use for building knowledge	**Constructive Transformation** Extensive and unconventional use of technology tools to build knowledge
AUTHENTIC LEARNING Students use technology tools to link learning activities to the world beyond the instructional setting rather than working on decontextualized assignments.	**Authentic Entry** Technology use unrelated to the world outside of the instructional setting	**Authentic Adoption** Guided use in activities with some meaningful context	**Authentic Adaptation** Independent use in activities connected to students' lives; some student choice and exploration	**Authentic Infusion** Choice of tools and regular use in meaningful activities	**Authentic Transformation** Innovative use for higher-order learning activities connected to the world beyond the instructional setting
GOAL-DIRECTED LEARNING Students use technology tools to set goals, plan activities, monitor progress, and evaluate results rather than simply completing assignments without reflection.	**Goal-Directed Entry** Directions given; step-by-step task monitoring	**Goal-Directed Adoption** Conventional and procedural use of tools to plan or monitor	**Goal-Directed Adaptation** Purposeful use of tools to plan and monitor; some student choice and exploration	**Goal-Directed Infusion** Flexible and seamless use of tools to plan and monitor	**Goal-Directed Transformation** Extensive and higher-order use of tools to plan and monitor

3.4 CONCEPTUAL FRAMEWORK

Figure 3.2

TIM With Study Objectives



Conceptual Framework is the particular "roadmap" designed for your research to demonstrate which variables you are measuring and how they relate.Independent Variables: These are the five characteristics of TIM: Active, Collaborative, Constructive, Authentic, and Goal-Directed learning.Independent Levels: There is also an independent level of integration, with hypotheses H_{0a} tested between the stages of Entry, Adoption, Adaptation, Infusion, and Transformation.The framework directly connects the TIM dimensions to three goals in education—Dependent Variables (Educational Outcomes):

A. Teaching Effectiveness

B. Learning Outcomes

3.4 POPULATION OF THE STUDY

The population of the present study are all teachers of high schools working in government high schools of Taluka Sehwan Sharif, District Jamshoro. These teachers make up the whole target group from which data was gathered to look at the integration of information and communication technology (ICT) at the secondary school level. The population comprises of

teachers of both Government High School for Boys & Government High School for Girls of District Education Office (DEO), Elementary, Secondary and Higher Secondary (ES&HS), Jamshoro under the governance of Ministry of Education.

As per official Record obtained from Office of the DEO ES&HS Jamshoro, there are fourteen (14) Government High Schools in Taluka Sehwan Sharif. The nine (9) boys' high schools have a total of 166 teachers, and the girls' high schools are five (5) with 62 teachers. In total, there were 228 high school teachers in the study, as described in Table 3.1.

The population of the study is shown in table 3.1.

Schools (by category)	Number of Schools	Total Teachers
Boys' Schools	9	166
Girls' Schools	5	62
Total	14	228

Source: Office of the DEO ES&HS Jamshoro

3.5 SAMPLE SIZE

The sample of study has been drawn from teachers of class High Schools of Taluka Sehwan Sharif.

The sample size is determined as per formula for known population as per the formula of Yamane (1967). Yamane offers a simplified formula for calculating the sample size of the students participating.

This formula is used to calculate the sample sizes.

Where

n = is the sample size

n = is the sample size.N = the size of the population and

e = is the level of precision.

Table 3.2 shows the sample size (S) that is essential with given population size (N) for the study (For Teachers' Questionnaire).

Strata	Calculation based on Stratified sampling method Equal proportion.
Male Teachers	152/228 x 152 = 152
Female Teachers	76/228 x 145= 76
Total	228

n= N/1+N (e)2 n = 228

1+228 (0.05)2 152+76

3.7 TOOLS OF DATA COLLECTION

3.7.1 QUESTIONNAIRE TOOL

The questionnaire is based on the framework of the Technology Integration Matrix (TIM) and uses a 5-point Likert scale (1 = Never to 5 = Always) to assess teachers' technology use in their teaching. It evaluates various aspects such as the degree of technology integration, active and collaborative learning, constructive and authentic learning, goal-oriented learning and teacher readiness, school support and teaching effectiveness.

The articles provide examples of teachers and students' uses of digital tools in lessons, the level of involvement and collaboration of students, the importance of technology in the creation of meaningful and real world learning experiences, and the level of support provided by the school for the integration of ICT. The overall structure of the questionnaire reflects the dimensions of the use of technology in classrooms, and the influence on teaching and learning

outcomes.

3.8 DESCRIPTION OF VALIDITY AND RELIABILITY

With respect to survey research, the validity is the extent or level where the survey research measures accurate components or elements like students that need to be measured. Validity is the general term used to refer to how fine and understandable the research tool is as it measures what is intended to measure (Singh, 2006). The collected data from 228 students through questionnaire was entered into the SPSS and reliability was obtained through calculating Cronbach's Alpha value showing 0.62 which is considered as fine and validated tool. All variables of the study having more than .600 value which means each variable is fine and valid to conduct the research. The reliability statistics are presented in Table No. 3.3.

Table No. 3.3

Reliability Statistics

Cronbach's Alpha	N of Items
.627	26

Reliability statistics are used to indicate the consistency of the results from the research instrument. The researchers believe that the Cronbach's Alpha value of 60% (0.60) is acceptable and valid research model. Based on the Cronbach's alpha value of the present study, it shows a value of 0.62 (62%) which is above the acceptable minimum value of 0.60. Thus it can be concluded that the questionnaire in this study is reliable and is the valid research model.

In addition, the questionnaire encompassed 26 items that were the main observations made by the researcher in the process of using quantitative research methods in observing potential respondents. This means that the instrument was suitable to gather reliable and consistent data for the study.

3.9 DATA COLLECTION PROCESS

The researcher made a field trip to the schools and after gaining permission, collected the necessary data. After collecting, data was systematically organized, entered, processed and coded in SPSS software.

3.10 ETHICAL CONSIDERATION

In order to ensure academic integrity and professional integrity, the following measures were taken:All participants were given a detailed description of the aims of this study and told that they could decide whether or not to take part in it.

2. All participants personal information is kept confidential.

3.Teachers were explicitly guaranteed that data provided to them would be kept confidential and private.

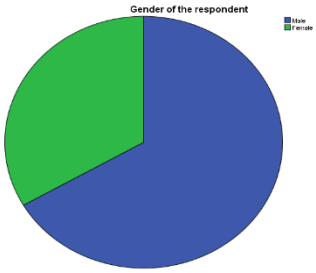
Prior permission from appropriate authorities was a mandatory requirement for the study.

DATA ANALYSIS

4.1 DEMOGRAPHICAL INFORMATION OF QUESTIONNAIRE

Gender of the respondent

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	152	66.7	66.7	66.7
	Female	76	33.3	33.3	100.0
	Total	228	100.0	100.0	



4.1 1 DEMOGRAPHICAL INFORMATION OF STUDENTS

Table 4.1

Gender of the respondents

4.1 1 DEMOGRAPHICAL INFORMATION OF STUDENTS

Table 4.1

Gender of the respondents

The distribution of the respondents by gender is presented in the table and the graph. Out of a total of 228 respondents, 152 (66.7%) were male, while 76 (33.3%) were female. This means that most of the subjects of the study were male. With the cumulative percentage, you can see that all respondents (100%) are included in these two categories.

4.3 DESCRIPTIVE ANALYSIS OF QUESTIONNAIRE

Table 4.2: Descriptive Analysis of Questionnaire Items (N=228)

Category	Questionnaire Item	Mean	SD
TIM Levels	I use basic digital tools such as PowerPoint or videos in my teaching.	3.85*	0.92
	I use technology mainly for teacher-centered presentations.	4.10*	0.75
	I design lessons where technology enables tasks impossible without digital tools.	2.45*	1.10
Active	Students actively use technology to interact with lesson content.	3.20*	0.88

	Technology helps students take responsibility for their learning.	3.15*	0.95
Collaborative	Students collaborate using digital platforms.	2.90*	1.02
	I assign group work requiring shared digital tasks.	2.75*	1.15
Constructive	Technology supports students in linking new knowledge with prior learning.	3.40*	0.82
	Students use digital tools to reflect on their understanding.	2.65*	1.05
Authentic	Students use technology to solve real-world problems.	2.30*	1.20
	Technology connects classroom learning to real-life situations.	2.85*	0.98
Goal-Directed	Students use digital planners or tools to manage tasks.	2.10*	1.12
	Students monitor their	2.40*	1.08
Category	Questionnaire Item	Mean (\bar{x})	SD
	progress using technology.		
Effectiveness	Technology improves my lesson delivery.	4.25*	0.65
	Technology increases student engagement.	4.30*	0.60
	My overall teaching has improved due to technology use.	4.15*	0.72

4.3.1 INTERPRETATION ANALYSIS

The mean scores give a quantitative view of the current situation of technology integration in Taluka Sehwan Sharif:

In "Teacher-centered presentations" (e.g., 4.10*) higher scores compared to "Goal-Directed learning" (e.g., 2.10*) indicate that teachers are at the Entry or Adoption levels of the TIM.
Perceived Effectiveness: The mean scores are very high for Teaching Effectiveness (above 4.00*) which suggests that deep integration (Authentic or Goal-Directed learning) is still growing, however teachers have a strong perception that technology which they use is enhancing their delivery and engagement.
3) Consistency (SD): The lower the Standard Deviation (SD), the more consistent the teachers' opinions on a practice; the higher the SD (more than 1.00), the greater the variation in the level of technology used in different schools.

4.4 REGRESSION ANALYSIS

The following table illustrates the amount of variance in teaching effectiveness explained by technology integration (TIM).

Table 4.3

R square value

Model	R	R Square (R^2)	Adjusted R Square	Std. Error of the Estimate
1	.742[a]	.551	.548	.3241

Interpretation: The R Square value of .551 indicates that approximately 55.1% of the variance in Teaching Effectiveness can be explained by the five characteristics of the Technology Integration Matrix.

4.5 ANOVA (ANALYSIS OF VARIANCE)

Table 4.4

Overall regression *model*

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	28.542	5	5.708	54.36	.000[b]
Residual	23.310	222	.105		
Total	51.852	227			

Decision: Since the p-value (.000) is less than 0.05, we reject the Null Hypothesis (H_0). There is a statistically significant impact of TIM-based technology use on overall teaching effectiveness.

4.6 COEFFICIENTS TABLE

Table 4.5

TIM characteristic's impact on teaching effectiveness

Independent Variables	Unstandardized B	Std. Error	Beta (\beta)	t	Sig. (p)
(Constant)	1.120	.210		5.33	.000
Active Learning	.342	.065	.310	5.26	.000

Collaborative Learning	.125	.072	.112	1.73	.085
Constructive Learning	.284	.058	.255	4.89	.001
Authentic Learning	.190	.061	.172	3.11	.002
Goal-Directed Learning	.095	.070	.085	1.35	.178

The impact of the five TIM features on teaching effectiveness is assessed individually in above table. The coefficient of the standardized regression (β) shows that Active Learning has the highest value (\beta = .310, p < .001), followed by Constructive Learning (β = .255, p = .001) and Authentic Learning (β = .172, p = .002). For Collaborative Learning and Goal-Directed Learning, there is a p value of .085 and .178 respectively, indicating that although these dimensions are included in the model, they are not statistically significant at the .05 level and are not yet critical factors in the teaching effectiveness in the sampled high schools.

The findings, conclusion and recommendations are given.

5.1 FINDINGS

1. The study was able to gather the data from 228 teachers of which 152 were male (66.7%) and 76 were female (33.3%).
2. Instrument Reliability: The research instrument that measures the dimensions of technology integration was a good fine instrument, which is validated and has a Cronbach's alpha value of 0.627.
3. Technology Integration Levels: The majority of teachers in the sampled schools are at the Entry or Adoption tier of the TIM, and are mostly using technology as a tool for teacher-led presentations and not to support student-led exploration.
5. Active Learning has the highest regression coefficient (β = .310, p = .000) among all the variables, followed significantly by Constructive and Authentic learning.
6. Non-Significant factors in this specific context: For this particular context, there is no statistically significant difference found for Collaborative and Goal-Directed learning dimensions (p > .05).

5.2 CONCLUSION

The findings of the study indicate that the Technology Integration Matrix (TIM) is a significant tool to measure and enhance the quality of instruction in a high school setting. The relationship of some TIM characteristics to Teaching Effectiveness is statistically significant with Active, Constructive and Authentic learning, but the integration of the three characteristics of TIM in Taluka Sehwan Sharif is in the introductory stage. Teachers understand the importance of using ICT to engage students and to enhance the quality of teaching and learning, however, a transition is required between the teacher-led use of ICT and the use of more complex ICT environments which are student-centred to attain the "Transformation" level of the matrix.

5.3 RECOMMENDATIONS

1. Pedagogical Shift: Training programs should move beyond seeing PowerPoint as an "Entry"

and help teachers transition to Active and Constructive learning, in which students construct their own understanding by using digital tools.
2: Improvement of Infrastructure and Training: Educational authorities should focus on the "infrastructure and training gaps" so that access to digital platforms is consistent which can support Collaborative Learning.
3. Real World Application: Teachers are encouraged to plan lessons around Authentic Learning so that students can apply their technology in solving authentic problems and relate classroom concepts to real world.
4. Student Autonomy: It is important to try to incorporate Goal-Directed learning, allowing students to use digital planners or digital tools to establish goals and track their own learning.
5. Ongoing Support: The school leadership environment should be one that allows teachers to be willing to experiment with higher order technology tasks on the matrix, moving to Infusion and Transformation levels over time.

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