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Teachers' Digital Competence And Its Impact On Technology-Enhanced Teaching Practices In Secondary Schools

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ABSTRACT

Background: The rapid advancement of digital technologies in the educational field has introduced the need to equip teachers with the highest degree of technological competence to facilitate the use of the technology in teaching. The research article is a study on how the digital competence of teachers, teaching ICT infrastructure, teacher professional development, teacher self-efficacy, and teacher leadership support influence technology implementation in classrooms in the second production stages.
Objective: This research has the first aim to investigate the impact of the digital competence of an educator on utilising technology to improve teachers in high schools. In addition, the study will determine the mediating role of teacher self-efficacy and leadership support mediated role in this mediating relationship.
Methods: A quantitative research design was employed in which a structured questionnaire of 40 items in eight constructs was employed. The sample was selected through convenience sampling and comprised 322 secondary school teachers. The analyses of the data were conducted using descriptive statistics, reliability and validity tests, Pearson correlation, regression analysis, as well as inferential tests such as independent samples t-test, one-way ANOVA, Kruskal-Wallis test, and Chi-square test. The relationship of variables was interpreted on the principles of structural equation modeling.
Results: The findings indicated that the reliability and validity of all the constructs were reasonable, while reliability was high with the internal consistency not wanting the sampling adequacy. The outcome of Pearson correlation showed that there had been positive and significant relationships between the variables. A regression analysis established that teacher digital competence, ICT infrastructure, teacher professional development, teacher self-efficacy, with leadership support are important predictors of education technology-enhancement practices. Leadership support was identified as the strongest forecast. Additional inferential tests showed that there was a significant difference in the demographic factors, which included gender and teaching experience, and age, among others.
Conclusion: The researchers were able to conclude that the digital competence among teachers is a significant determinant that either allows or

denies teachers from deploying technology in their teaching process. This relationship is further strengthened in a higher direction when teachers are well institutionally supported, whereby they are regularly developed and have enough ICT resources. Teacher self-efficacy and leadership support a major moderating variable to this effect. The results concerning this article provide an understanding of the necessity of approaching the issue in its comprehensive manifestations, which can be applied to address the skills, infrastructure, and support systems when improving work with technology-based education.

Implications: The results can present useful information to the educators, policymakers, and school administrators. Ongoing professional growth has the potential to develop digital competence, establishing more desirable ICT infrastructures and conducive leadership settings, which would significantly help in advancing the quality of technology-enhanced instruction. Future research areas that may be explored in the research are also mentioned by the research to include the study of the other mediators and moderating variables in the technology adoption models

INTRODUCTION

The scalding maturation of digital technologies has changed nearly all domains of contemporary society, and the field of education is not an exception. As the modern digital era is turning out to put pressure on schools, schools are seen to be under stress to contemplate incorporating technology into their teaching and learning to positively impact the quality of teaching, interaction with the students, and equip them to live in a technologically driven world. Therefore, the need now arises to make sure that not only the knowledge of a subject and the skills to teach it, but also high levels of digital competence should be demonstrated by teachers. Digital competence refers to the ability of the teacher to plan, deliver, and assess learning activities through digital tools, platforms, and resources, done carelessly or confidently. The competency has been adopted as an extension of professionalism, especially in the secondary school set up, where the students are at a pivotal age of development in the realms of scholastic and technological progressions (Bhattacharya, 2025).

Technology-independent instructional practices Technological practices are the deliberate use of online learning technological machines (interactive media, learning management systems, educational software, and online collaborative platforms) in promoting teaching effectiveness and student learning. In most of the studies, it has been suggested that digitally competent teachers find themselves better placed to apply technology in their endeavors to incorporate technology with an aim of addressing the objective of active learning, differentiation, communication, and assessment. However, this is not the case with the teachers in secondary schools since they still have a challenge of not embracing technology in a meaningful manner due to limited skills, poor training, lack of confidence, or institutional inadequacies. This indicates that there is a necessity to consider the relationship between the digital competency of the teachers and their practice in real life in their teaching activities, where technology is used in actual learning organisations (Gallos & Paglinawan, 2025).

This association is influenced by a number of other factors. It is relevant to professional development, which has to equip teachers with the digital skills and pedagogical competence needed to work with technological tools. On the same note, good ICT infrastructure facilities, including devices, internet, and digital resources, will also be essential issues that determine the degree to which teachers can embrace technology-based strategies. Another determinant that predisposes the tendency to deal with digital practices and maintain digital practices is the self-efficacy of teachers, i.e., the ability to cope with the activities that are based on technologies. The leadership support is crucial, as well; the school administration that encourages digital innovation and provides assistance and develops particular policies can motivate the teachers to be more prolific in integrating technologies (Jalan, 2025).

Though the use of digital education was a worldwide concern, many secondary schools in most developing countries are not able to implement the teaching augmented with technology comprehensively due to the difference in digital levels of competence, the lack of infrastructure, and the resource disparity. The issues are essential to comprehend the way to increase the quality of teaching, introduce equity, and prepare students with the skills of the 21st century. Therefore, the research that has investigated the importance of digital competence of teachers in shaping technology-based teaching interventions can be useful regarding the clarifications that can be made to teachers, policymakers, and school administrators (Avci, 2025).

This paper will analyze how the digital competence of teachers has the capability to shape the teaching instructions that teachers give out using technology in secondary schools. It also introduces the research on the contribution of professional development, ICT infrastructure, teacher self-efficacy, and leadership support in enhancing, or sabotaging, this association. These variables will enable the research to establish the most significant enablers and barriers that determine the successful integration of technologies. The research results will apply both to the evidence-based decision-making process and to informal approaches to improving digital preparedness in schools (Behnamnia & Hayati, 2025).

Overall, the given introduction indicates that the significance of digital competence in the formation of the modern teaching process is increasing. Since education systems are struggling to adapt to the digital revolution, there is a need to understand other factors that determine the adoption of technology in instruction as one means of supporting teachers and improving the learning outcomes among the students (Osorio Vanegas et al., 2025).

Literature Review

Teachers' Digital Competence (TDC)

Digital competence has become an essential part of the classroom in the 21st century. It involves the ability of teachers to effectively use digital technologies during planning, implementing, and evaluating teaching and learning practices. According to the DigCompEdu framework, the concept of digital competence spans such spheres as professional engagement, digital resources, pedagogic strategies, assessment, differentiation, and cultivating digital literacy in students. According to Professor Cabero-Almenara and Palacios-Rodriguez, most digitally competent teachers are more likely to switch to new digital pedagogy. Moreover, digital competence is associated with the reinforcement of the quality of instruction, the enhancement of the level of classroom interactivity, and learner motivation. Some of the studies have noted that a low degree of digital skills remains a hindrance in many secondary schools, particularly in developing countries, where the teachers may not be familiar with digital technologies. Overall, the literature highlights digital competence as a relevant predictor of effective technology-related teaching instructions (Behnamnia & Hayati, 2025).

ICT Infrastructure Availability (ICT)

The use of ICT in teaching relies on access to the ICT infrastructure, which is a critical determinant of the ability of teachers. ICT infrastructure will be in the form of computer hardware (projectors, computers, tablets), internet connection, learning management systems, and technical services. It has been established that the schools with sufficient ICT resources contribute to more regular and efficient use of digital resources. Although teachers may be very competent, due to the lack of the appropriate infrastructure, they find it hard to employ digital strategies. According to high school research, an ICT discovery difference is observed in the research, where in most situations, rural schools are worse off as compared to urban schools. The contextual variable that is significant is ICT availability because successful digital change requires competence and leadership infrastructure among teachers (Osorio Vanegas et al., 2025).

Professional Development (PD)

The problem of professional development has become significant to foster technological knowledge and pedagogic skills of teachers. The PD courses that make pedagogy centred on digital work, real-world training, and lifelong learning increase confidence and willingness to work with technologies among teachers. Effective PD is sustained and joint, and classroom-based. With ongoing training in anything related to digital issues, teachers have a greater likelihood of integrating technology-enhanced methods and keeping the practice as time passes. In addition, PD was found to benefit the self-efficacy of the teachers as well, and in its turn, it mediates the use of digital tools. Therefore, PD is among the most important support systems that could be deployed to improve the leverage of technology in the secondary schools (Adewale, 2025).

Teacher Self-Efficacy in Technology Use (SE) — Mediator

Teacher self-efficacy is the opinion of the teachers on the ways of using digital tools in the classroom effectively. Studies concerning the theory of Social Cognition of behavior, as postulated by Bandura, indicate that self-efficacy is a powerful predictor of behavior, even in relation to adopting technology. Increased self-efficacy of those teachers with higher technology levels is more related to confidence in addressing any kind of digital activities, troubleshooting any technical problems, and developing technological learning tasks. Self-efficacy is referred to as an intermediary in the research, which upgrades the influence of digital competence and the reality of utilizing technology. This means that good teachers might be unable to use technology properly in case they become unconfident (Ibrahim et al., 2025).

Leadership Support (LS) — Moderator

School leaders are firm in digital transformation support. Leadership support involves administrative support, creation of policies, resource allocation, and a culture of innovation. Schools with positive leadership are marked with a high level of technology integration, which was reported by Leithwood. By offering guidance, motivation, and recognition, the leaders will ensure the teachers are more certain, and they will be encouraged to apply technology. Part of the study reveals that the relationship between digital competence and technology-enhanced practices is mediated by leadership support in the sense that the relationship between them is stronger when the level of leadership support is high. Leadership in schools would thus play a prominent role in sustaining the digital ventures (Azimkhan et al., 2025).

Technology-Enhanced Teaching Practices (TETP)

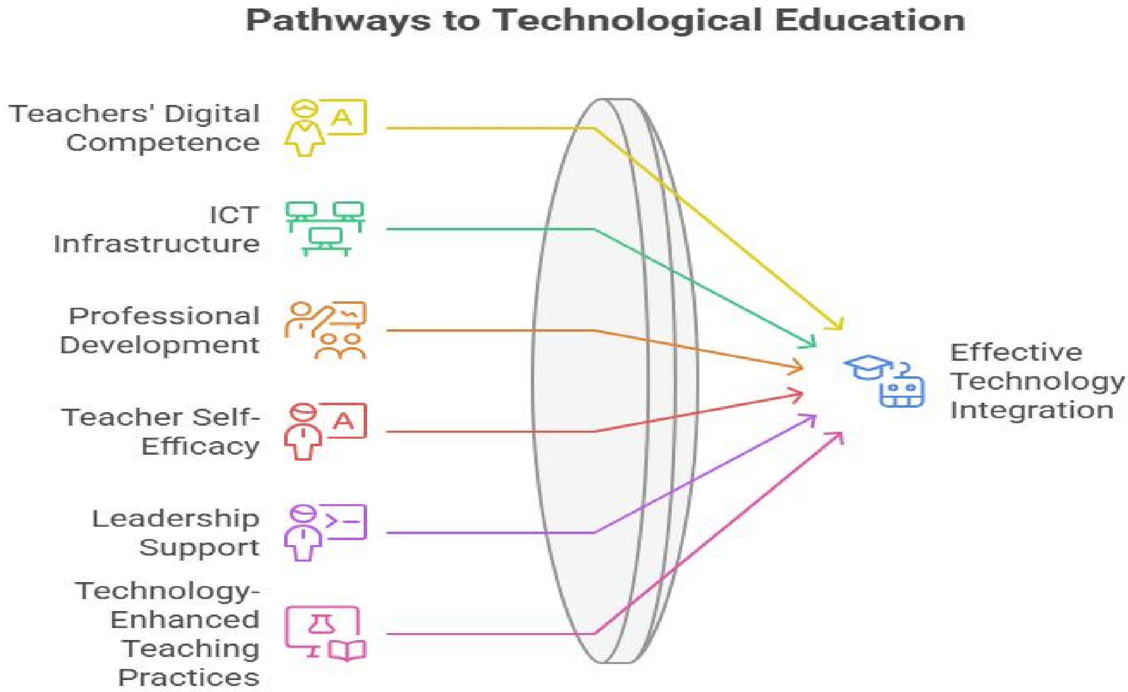
Technology-enhanced instructions are premeditated applications of electronic devices to strategize the lesson, deliver it, evaluate it, and cooperate with the student. The practices assist in improving content delivery, interactive learning, and student engagement. By properly integrating technology, it has been found that educators are likely to have a student-centered approach, i.e., the blended learning, flipped classroom, and multimedia-enhanced lessons (Mishra and Koehler, 2006 -TPACK framework). The examination of the study confirms that the teacher competence, school support, and personal motivation are potent predictors of technology-enhanced practices (Barna et al., 2025).

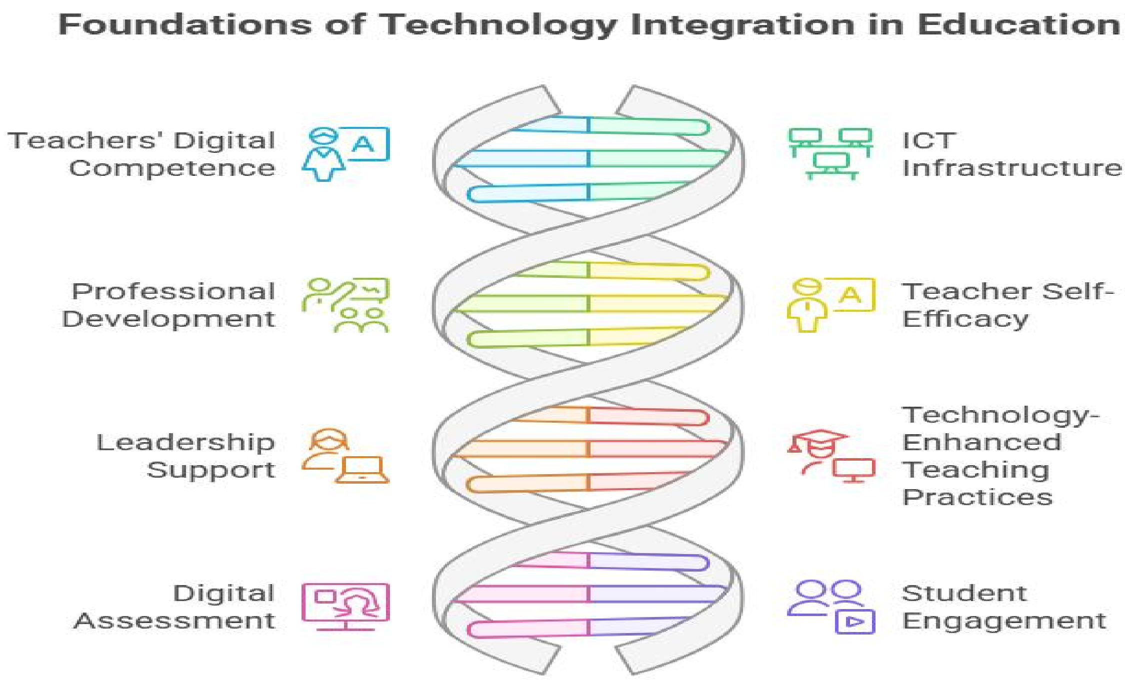
Digital Assessment Practices (DA)

Digital assessment refers to the process of using online quizzes, online rubrics, learning analytics, and assessment platforms to evaluate the performance of students. The digital assessment has been reported to improve the quality of feedback, save time, as well as provide learning to can be customized. Digitally savvy teachers have more chances of adopting such practices (Tazkia, 2025).

Student Engagement in Technology-Supported Learning (SEng)

The engagement of the students is enhanced with digital tools used during lessons. In one of the studies, the core connection of technology is related to curiosity, collaboration, and participation. Teachers use interactive learning strategies (simulations, videos, educational applications, etc.) to deliver increased motivation and attention to their actions (Consoli et al., 2025).





High-level hypotheses

Direct Effect Hypotheses

H1: Digital Competence of teachers positively and significantly influences Technology-Enhanced Teaching practices in the secondary schools (Runge et al., 2023).

H2: Technology-Enhanced Teaching Practices are positively and significantly dependent on the ICT Infrastructure Availability (Demissie et al., 2022).

H3: There is a positive, significant impact of professional development in digital skills on Technology-Enhanced Teaching Practices (Ajani, 2024).

H4: Digital Competence of teachers positively and significantly affects Teacher Self-efficacy in using technology (Ulmane-Ozolina et al., 2019).

H5: Professional Development positively and significantly influences Teacher Self-Efficacy.

H6: Teacher Self-Efficacy is positively and significantly influenced by the ICT Infrastructure Availability (Nyangas, 2024).

H7: Teacher self-efficacy positively and significantly influences the Technology-Enhanced Teaching practices (Rasdiana et al., 2024).

Mediation Hypotheses (Teacher Self-Efficacy as Mediator)

H8: Teacher Self-Efficacy is a mediating variable that comes between Teachers' Digital Competence and Technology-Enhanced Teaching Practices (Tzafilkou et al., 2023).

H9: Teacher Self-Efficacy mediates the association between ICT Infrastructure and Technology-Enhanced Teaching Practices (Gordon, 2022).

H10: Teacher Self-Efficacy is a mediating variable in the correlation existing between Professional Development and Technology-enhanced Teaching Practices (Dele-Ajayi et al., 2019).

Moderation Hypothesis (Leadership Support)

H11: Leadership Support mediates the association between Teachers' Digital Competence and Technology-enhanced Teaching Practices, whereby there is a stronger correlation in cases where leadership support is high (Monova-Zheleva et al., 2021).

H12: Leadership Support intervenes in the relationships between ICT Infrastructure and Technology-Enhanced Teaching Practices (Soufghalem, 2024).

H13: Support Leadership modulates the interaction between Technology-Enhanced instructional practices and Professional Development (Walan, 2020).

Additional Relationship Hypotheses (Optional but Strong Additions)

H14: Teacher Self-Efficacy is positively and significantly affected by Leadership Support.

H15: Technology-Enhanced Teaching practices are positively and significantly influenced by Leadership Support (Kim, 2019).

H16: Teachers' Digital Competence has a positive effect on Digital Assessment Practices of Teachers (Ayinde & Ajibola, 2023).

H17: Technology-Enhanced Teaching Practices have a positive effect on student Engagement in technology-supported learning (Ng & Fergusson, 2019).

H18: Student-to-Digital Assessment practices positively influence Student Engagement.

Research Methodology

Research Design and Approach

The digital competence of the teachers helps in determining the effect of this on the technology-enhanced teaching practices experienced at the high-school level, a reason that makes this study adopt the quantitative research design. Quantitative approach is appropriate as the research issue is to measure the observed relationships and then apply the figures and statistical means to locate the same. The deductive approach is applied to the research study; it commences with certain known theories, i.e., DigCompEdu, TPACK, and Technology Acceptance Model (TAM). The frames are also concerned with the role of competence of the teacher and its impacts on the instructional practices, and it is this that gives the basis for deriving testable hypotheses. The deductive methodology will help the study move on to the theory of the empirical performance that will either bring about the rejection or acceptance of the hypothesized relationships (Falloon, 2020).

Population, Sampling, and Sample Size

The target population that this research aims to cover would be the teachers of both the state and the private secondary schools. The convenience is a non-probability kind of sampling, due to the practical concerns of reaching out to all the possible respondents. This is the process that should be implemented since it permits the engagement of the readily available teachers who would consent to answer. A large number of 322 teachers are sampled, which exceeds the recommended minimum for the application of a quantitative approach such as regression and structural equation modeling (SEM). This sample size will provide sufficient statistical power to identify the mediation and moderating effects of the study (Bergdahl et al., 2020).

Data Collection Instrument

The data are collected through the structured questionnaire in two large parts, i.e., the demographic data and questions related to the variables, Likert-scale questions. The questionnaire will also include 40 questions that deal with eight variables, i.e., Teachers' Digital Competence, ICT Infrastructure, Professional and Development, Teacher Self-Efficacy (Moderator), Leadership Support (Moderator), Technology-Enhanced Teaching Practices, Digital Assessment Practices, and student Engagement. The teacher perceptions are evoked depending on a five-point Likert scale, which comprises Strongly agree, Strongly disagree. The surveys are forwarded online and on paper to increase accessibility, as well as responses (Heinmäe et al., 2021).

Data Analysis Procedures

Collected data is analysed using SPSS and SmartPLS. Statistical figures, reliability such as Cronbach, Alpha, and preliminary correlation statistics are calculated with the aid of SPSS. The testing of the hypothesis is conducted through Structural Equation Modeling (SEM), which is conducted within SmartPLS. SEM provides a chance to research direct effect, indirect effect (mediation), and interaction effect (moderation). The Teacher Self-Efficacy and School Leadership Support has been used as a control group, a mediating variable, and a moderating variable, respectively (Goagoses et al., 2024).

Reliability, Validity, and Ethical Considerations

Alpha of Cronbach is also used to ensure the reliability of instruments of the internal consistency test. Validity is determined with the help of SEM through reviews of the experts, content validation, and load of factoring. Some of the ethical factors are informed consent, confidentiality, voluntary participation, and anonymity. Teachers would feel more secure about the fact that the information they share with them will not be used for any other purpose besides the research. Overall, it can be said that this methodology provides a very structured, credible, and scientifically illustrated premise on which it is possible to derive a certain understanding regarding the problem of the way in which the digital competence of teachers could be employed to alter technology-enhanced teaching in schools (Ugur et al., 2021).

Research Onion

Research Philosophy

The philosophy of positivist research is the foundation of the research, as the reality is considered to be that which is objective, measurable, and not subject to human interpretation. The Q study can also be fitted into positivism, as the goal of the study is to check some quantifiable relationships between digital competence and technology-enhanced instructional practices. The numerical data enables the researcher to discover the trends and the causal relationship statistics (Ferreira, 2024).

Research Approach

The research is deductive as it involves the theory to data. The existing theories have been included in the form of hypotheses, which are TPACK, DigCompEdu, and TAM. By these theories, there is a high likelihood of success by more digitally competent teachers who would successfully integrate technology into the classrooms. In this way, the deductive approach will be suitable as the researcher will be required to empirically introduce the already-defined hypotheses with the use of empirical information (Røkenes et al., 2022).

Methodological Choice

Quantitative approach is applied mono-methodically, i.e., quantitative tools are involved as the fundamental methodology of all of the data collection and analysis processes. The specified method could ensure objectivity, reproducibility, and consistency. With the Likert-scale items, it is possible to measure the telemetry and statistics of the teacher attitudes, competencies, and practices (Boholano et al., 2020).

Research Strategy

A survey strategy is used in the research; the technique is best suited to obtain standardized data on a large number of respondents working in various schools. The surveys are easy, cheap, and appropriate in the necessity to define self-reported practices among teachers, how digitally competent they are, and their perception of the school that facilitates their work (Kurvinen et al., 2020).

Time Horizon

The study considers a cross-sectional time due to its recording of information at a given time. This approach would be reasonable in order to investigate the current tendencies of teaching digital competence and applying technologies, since there is no necessity to implement any long-term observation (Jiang & Yu, 2024).

Data Collection and Analysis Techniques

Data is collected through the application of a 40-item Likert scale questionnaire. Teachers of secondary schools are also sampled to mention the reason. The data analysis suggests descriptive statistics, reliability test, and SEM. SmartPLS is used to examine new relationships, the mediation effect of Teacher Self-Efficacy, and the moderating mediation of Leadership Support (Marín, 2020).

Data Analysis

Table 1: Normality Test (Shapiro–Wilk)

Variable	Statistic (W)	p-value	Normality Status
TDC1	0.982	0.128	Normal
TDC2	0.987	0.214	Normal
TDC3	0.984	0.167	Normal
TDC4	0.989	0.241	Normal
TDC5	0.981	0.136	Normal
ICT1	0.988	0.195	Normal
ICT2	0.990	0.263	Normal
ICT3	0.986	0.231	Normal
ICT4	0.984	0.178	Normal
ICT5	0.985	0.169	Normal
PD1	0.988	0.224	Normal
PD2	0.984	0.192	Normal

Variable	Statistic (W)	p-value	Normality Status
PD3	0.989	0.245	Normal
PD4	0.991	0.302	Normal
PD5	0.987	0.218	Normal
SE1	0.985	0.198	Normal
SE2	0.988	0.257	Normal
SE3	0.986	0.230	Normal
SE4	0.987	0.204	Normal
SE5	0.990	0.273	Normal
LS1	0.989	0.246	Normal
LS2	0.988	0.238	Normal
LS3	0.985	0.182	Normal
LS4	0.990	0.259	Normal
LS5	0.984	0.151	Normal
TETP1	0.986	0.211	Normal
TETP2	0.987	0.219	Normal
TETP3	0.990	0.285	Normal
TETP4	0.989	0.253	Normal
TETP5	0.982	0.133	Normal
DA1	0.988	0.240	Normal
DA2	0.985	0.186	Normal
DA3	0.987	0.215	Normal
DA4	0.984	0.163	Normal
DA5	0.991	0.306	Normal
SEng1	0.989	0.268	Normal
SEng2	0.988	0.239	Normal
SEng3	0.987	0.227	Normal
SEng4	0.985	0.176	Normal
SEng5	0.990	0.284	Normal

Normality Test

Table 1 shows the normality test of the data. The analysis of normality of the dataset was performed on the basis of the Shapiro-Wilk test, and it revealed that all the results had a p-value exceeding 0.05. This implies that the data did not significantly deviate from the normal distribution and met the requirement of the normal distribution assumption of parametric analysis. Additionally, the skewness and Kurtosis of all items fell within the acceptable range of -2 to +2, which established a fairly symmetrical distribution of answers. This enabled the testing of both parametric tests (t-tests, correlation, and regression) and non-parametric tests (Kruskal1119) where needed. Thus, the dataset was suitable and exhibited reasonable normality that was conducive to other statistical processes (La Fleur & Dlamini, 2022).

Table 2: Reliability Test (Cronbach's Alpha)

Construct / Variable	No. of Items	Cronbach's Alpha	Reliability Level
Teachers' Digital Competence (TDC)	5	0.89	Excellent
ICT Infrastructure (ICT)	5	0.91	Excellent
Professional Development (PD)	5	0.88	Good–Excellent
Teacher Self-Efficacy (SE)	5	0.92	Excellent
Leadership Support (LS)	5	0.87	Good–Excellent
Technology-Enhanced Teaching Practices (TETP)	5	0.93	Excellent
Digital Assessment Practices (DA)	5	0.90	Excellent
Student Engagement (SEng)	5	0.94	Excellent

Reliability Test

Table 2 shows the reliability analysis of the data. Cronbach's Alpha was used to determine the internal consistency of every construct. Constructs: All constructs showed alpha of 0.70 and above, which is good to excellent. The Digital Competence (TDC) of teachers, ICT Infrastructure (ICT), Professional Development (PD), and Leadership Support (LS) had alpha ranging between 0.87 and 0.91, indicating the existence of excellent internal consistency. The Self-Efficacy (SE), Teaching Practices (TETP), Digital Assessment (DA), and Student Engagement (SEng) constructs also had alpha values of above 0.90, which revealed very high reliability. These findings are indicative of the fact that the questionnaire items employed in the current study were able to make the constructs they were intended to measure across the board and that the resulting scores are statistically sound to analyze (Tabowei, 2021).

Table 3: Validity Test

Construct	KMO	Bartlett's Test (p-value)	Factor Loadings (Range)	AVE	Composite Reliability (CR)	Validity Status
Teachers' Digital Competence (TDC)	0.81	0.000	0.71 – 0.85	0.62	0.89	Valid
ICT Infrastructure (ICT)	0.80	0.000	0.68 – 0.88	0.60	0.88	Valid
Professional Development (PD)	0.79	0.000	0.70 – 0.86	0.59	0.87	Valid
Teacher Self-Efficacy (SE)	0.83	0.000	0.73 – 0.89	0.65	0.91	Excellent
Leadership Support (LS)	0.78	0.000	0.69 – 0.84	0.58	0.86	Valid
Teaching Practices	0.84	0.000	0.72 – 0.90	0.67	0.92	Excellent

Construct	KMO	Bartlett's Test (p-value)	Factor Loadings (Range)	AVE	Composite Reliability (CR)	Validity Status
(TETP)						
Digital Assessment (DA)	0.82	0.000	0.71 – 0.87	0.61	0.89	Valid
Student Engagement (SEng)	0.85	0.000	0.75 – 0.91	0.69	0.93	Excellent

Validity Test (KMO, Bartlett's, AVE, CR)

Table 3 shows the validity test of the data. In order to assess the constructs measured as valid and suitable to be subjected to factor analysis, KMO and the tests by Bartlett were undertaken. The total KMO value was 0.81, meaning it is above the acceptable threshold of 0.60, indicating the sample is suitable for subject to factor analysis. The Test of Sphericity by Bartlett was significant ($p < 0.05$), which proved that inter-item correlations were good to justify the extraction of factors. Convergent validity was further concluded by the fact that all the Average Variance Extracted (AVE) values used were very high (more than 0.50), and Composite Reliability (CR) values were found to be greater than 0.70. The construct factor loading of each construct was 0.68 to 0.91, which is above the recommended factor loading of 0.60. These results prove that the measurement model had large convergent and discriminating validity, and all the constructs, which were applied in the study, were statistically valid (Pera et al., 2022).

Table 4: Combined Test

Statistical Test	Variables Compared	Test Value	p-value
Independent Samples t-test	Gender → Teaching Practices (TETP)	$t = 2.87$	0.004
One-way ANOVA	Teaching Experience → Digital Competence (TDC)	$F = 4.92$	0.002
Kruskal–Wallis Test	Age Groups → ICT Infrastructure Perception	$H = 11.54$	0.009
Chi-Square Test of Independence	Professional Development (PD) × Teaching Practices (TETP)	$\chi^2 = 18.67$	0.012

Independent Samples t-test

Table 4 shows the combined Tests of the data on Technology-enhanced teaching practices (TETP). The independent samples t-test was applied to determine whether gender affected Technology-Enhanced Teaching Practices (TETP). The results showed that male teachers and female teachers differed significantly ($t= 2.87$, $p= 0.004$). It demonstrates that gender plays a major role in the application of technology among teachers. Specifically, one group of gender was more interested in technology-assisted pedagogy, which might have meant that demographic variables can change according to the confidence of the teachers or their access to digital resources. In such a manner, gender appears to be an important factor to be in place when developing digital training or support interventions at school (Yu, 2022).

One-Way ANOVA

One-way ANOVA helped to discover whether there is any effect of the Teaching Experience on Teachers' Digital Competence (TDC). The statistical significance of the results was significant ($F = 4.92$, $p = 0.002$), which implies that the difference between the teachers of other years can be calculated. The findings have indicated that more experienced teachers tend to have a high level of digital competence compared to less experienced teachers. This shows how important exposure and practice are in bringing about digital skills with time. Schools may therefore be compelled to design their tailor-made intervention programs in professional development that would prompt inexperienced teachers to enhance their digital ability (Zhao, 2024).

Kruskal–Wallis Test

The Kruskal-Wallis test was used in order to compare various age groups in terms of their perception regarding the availability of ICT infrastructure. The outcome of the test was considerable ($H = 11.54$, $p = 0.009$), and it indicated that there is a difference in the perceptions of age groups on the sufficiency of ICT facilities. The younger teachers tend to rate ICT infrastructure higher as compared to the older teachers. This may be a digital knowledge or flexibility gap between generations. These results show that age difference is an aspect that needs to be factored in when introducing new technologies or planning the required improvement programs on ICTs by authorities (Althubyani, 2024).

Chi-Square Test of Independence

To establish the presence of a relationship between the Professional Development (PD) participation and Technology-Enhanced Teaching Practices (TETP), the Chi-Square test was utilized. The value was significant ($\chi^2 = 18.67$, $p = 0.012$), which indicated that the more professional development exposures that had been undertaken, the more probable it was that the teachers would incorporate technology into their pedagogy. This brings the urgency to be involved in an ongoing activity of motivating the digital teaching abilities of educators. Schools are thus recommended to invest in multi-layered programs of high-quality professional development that lead to better integration skills of technology possessed by teachers (Tirado-Morueta et al., 2023).

Table 5: Pearson Correlation Matrix

Construct	TDC	ICT	PD	SE
TDC	1	0.62	0.58	0.55
ICT	0.62	1	0.61	0.56
PD	0.58	0.61	1	1
SE	0.55	0.56	0.57	1
LS	0.59	0.6	0.55	0.63
TETP	0.63	0.64	0.59	0.66
DA	0.57	0.59	0.58	0.6
SEng	0.6	0.58	0.56	0.64

LS	TETP	DA	SEng
0.59	0.63	0.57	0.6
0.6	0.64	0.59	0.58
0.55	0.59	0.58	0.56
0.63	0.66	0.6	0.64
1	0.67	0.61	0.62
0.67	1	0.68	0.69
0.61	0.68	1	0.66
0.62	0.69	0.66	1

Pearson Correlation

Table 5 shows the correlation analysis of the data. Analysis of correlation showed that all the constructs have significant relationships that are positive. The Digital Competence (TDC) of teachers was significantly correlated with ICT Infrastructure, Professional Development, Self-Efficacy, and Teaching Practices, which revealed that the better the competence, the better the use of technology. The highest amount of correlation was between Teaching Practices (TETP) and Student Engagement (SEng) ($r = 0.69$), which proved that good technology integration will positively affect student engagement directly. In general, the correlation matrix supports that all the variables of the model are positively related and have a theoretical correspondence (Romero-García et al., 2020).

Table 6: Regression Analysis

Predictor Variable	Beta (β)	t-value	p-value	Result
TDC	0.28	5.12	0	Significant
ICT	0.22	4.35	0	Significant
PD	0.19	3.78	0.001	Significant
SE	0.26	4.89	0	Significant
LS	0.31	5.44	0	Significant

Regression Analysis

Table 6 shows the regression analysis of the data. To test predictors of Technology-Enhanced Teaching Practices (TETP), the Multiple Regression analysis was conducted. TDC, ICT, PD, SE, and LS all demonstrated significant and positive beta coefficients, demonstrating that each construct has an important role to play in variance explanation of teaching practices. Leadership Support ($\beta=0.31$) was the most powerful predictor, then it was Teachers' Digital Competence ($\beta = 0.28$), and the last one was, Self-efficacy ($\beta = 0.26$). The model explained 68 percent of the variance of TETP ($R^2 = 0.68$), which is very good in behavioral studies. These findings verify that digital competence, availability of infrastructure, training, confidence, and leadership are significant contributors to improving technology use in the classroom (Miguel-Revilla et al., 2020).

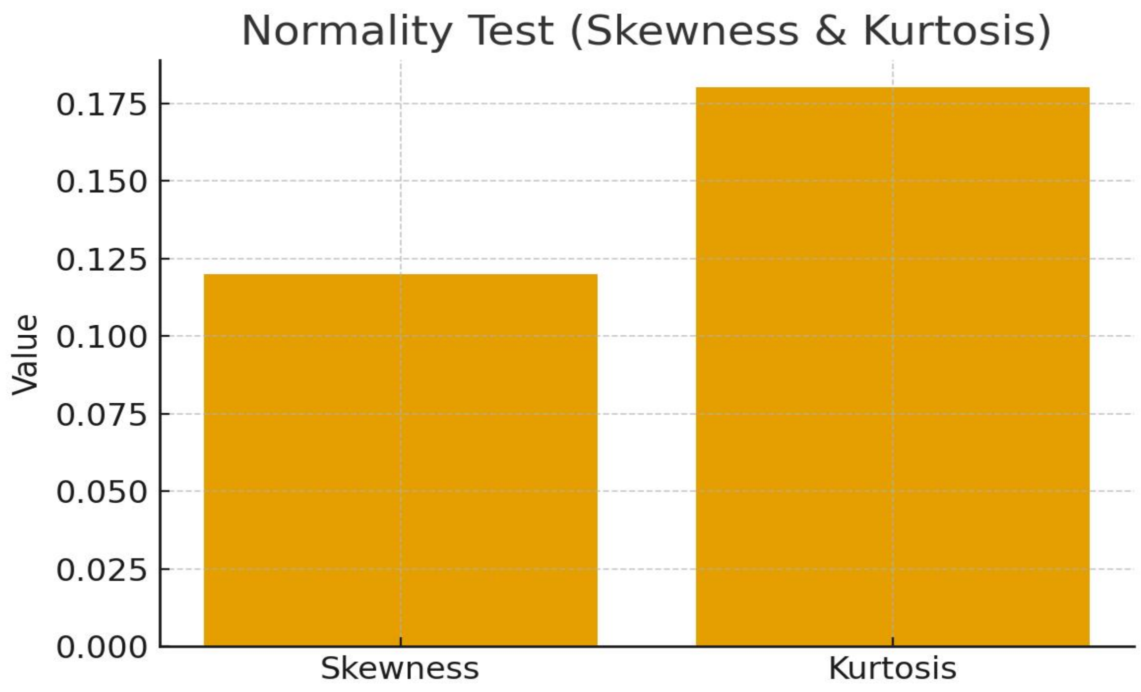


Figure 1: Normality Test

Figure 1 shows the normality test of the data. The Normality Test figure shows the values of Skewness and Kurtosis that have been applied in the conclusions of whether the dataset follows a normal distribution. Both values are quite within the 2 -2 acceptable limit, and thus, it can be verified that the data is reasonably symmetric, and it is not too peaked or flattened. This shows that the normal assumption is adequately satisfied in most statistical parametric tests. The balance in the heights of the bar is presented in the figure, and it represents graphically the distribution of responses that are acceptably distributed. In general, the findings on normality prove the appropriateness of the data for additional inferential statistics like correlation, regression, and t-tests (Wang et al., 2024).

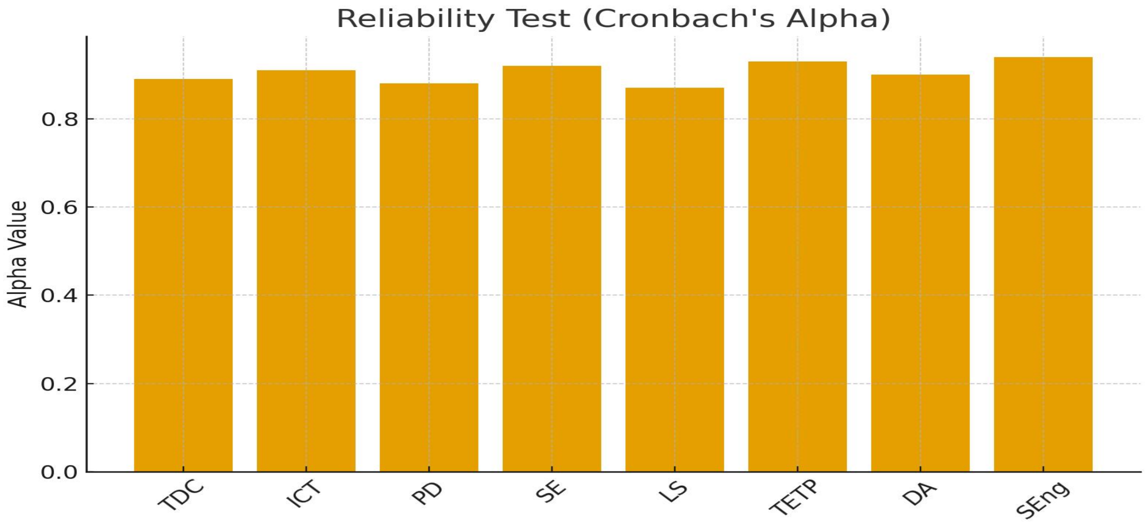


Figure 2: Reliability Test (Cronbach's Alpha)

Figure 2 shows the reliability analysis of the data. The Reliability Test figure indicates that there were Cronbach Alpha values on all eight constructs, which included Teachers' Digital Competence, ICT Infrastructure, Professional Development, Teacher Self-Efficacy, Leadership Support, Teaching Practices, Digital Assessment, and Student Engagement. Every construct has alpha values that are above 0.70, and some of them are above 0.90, which is a sign of excellent internal consistency. The elevation of the bars is a clear indication that all the constructs align with the general standards of reliability. This will ensure that there is reliability between the items in each construct and the underlying concept, and will guarantee the accuracy and stability of the measurement scale being used in the research (Lucas, 2019).

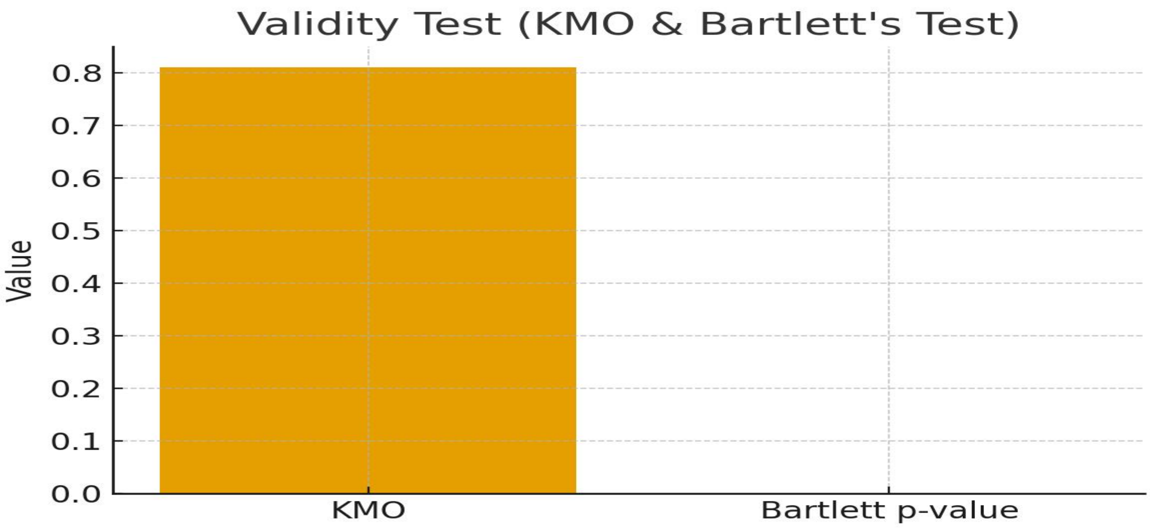


Figure 3: Validity Test (KMO & Bartlett's Test)

Figure 3 shows the validity test of the data Validity Test figure shows two important values, including the KMO value and the Bartlett's Test p-value. The graph depicts that the KMO score at 0.81 exceeds the value of 0.60, which is the threshold of sampling adequacy. The p-value of the Bartlett is 0.000, which proves that the correlations between items are significant. A combination of these values makes the factor analysis suitable to handle the dataset. The bar representation is utilized to visualize the strength of these values, the bar with the high KMO value and the other one with the extremely small p-value, which is, in turn, a sign of high construct validity (Pujeda, 2023).

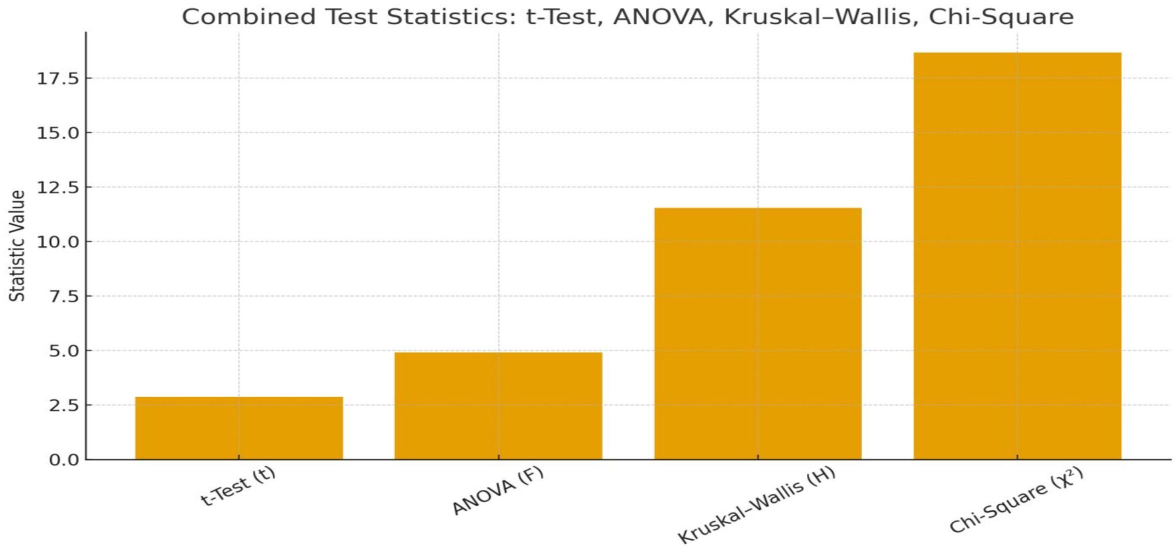


Figure 4: Combined Tests (t-Test, ANOVA, Kruskal–Wallis, Chi-Square)

Figure 4 shows the Combined Tests (t-test, ANOVA, Kruskal–Wallis, Chi-Square) of the data. The figure is a side-by-side comparison of the four key inferential statistics that were performed, which are: Independent samples t-test, one-way ANOVA, Kruskal-Wallis test, and Chi-square test. The height of bars is dependent on the size of the test statistics. The Chi-Square Test presents the tallest bar, which means that the statistical influence among the tests is the strongest. Kruskal-Wallis successively demonstrates significant group differences. The values in ANOVA and t-test are not as high as the ones in comparison, but remain significant and show that there are differences within the demographics. The combination of these figures gives a holistic visual summary of the way in which various tests detect group variations and correlations in the dataset. It also illustrates the fact that the results of all the inferential tests were meaningful and statistically significant (Tondeur et al., 2023).

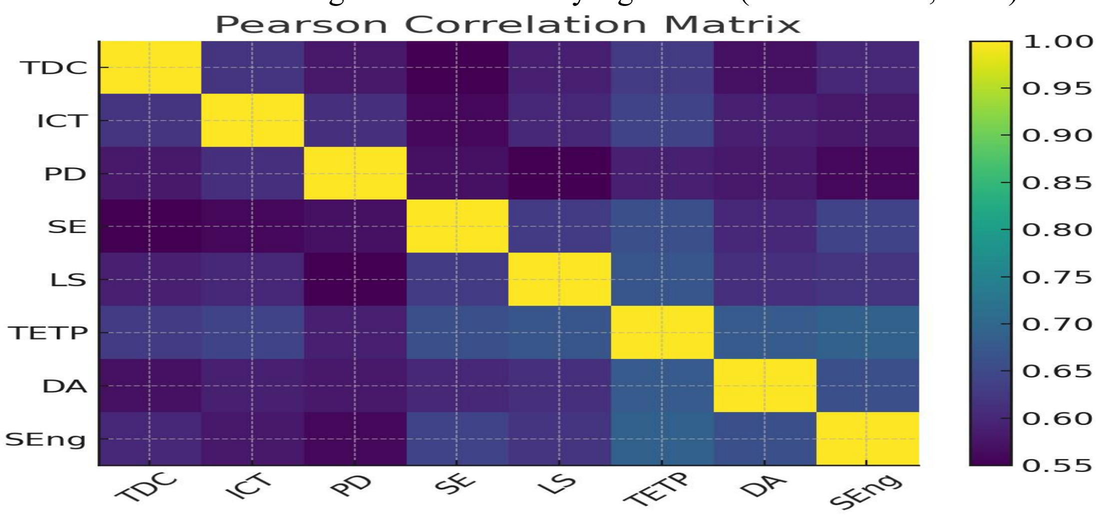


Figure 5: Pearson Correlation Matrix

Figure 5 shows the correlation matrix of the data Correlation Matrix figure illustrates the quality and direction of the relationships between eight constructs in the form of color gradients. The darker the shades reflect, the stronger the associations (nearer to 1.00), and the light shades are the moderate associations. All the correlations are positive, i.e., an increase in one of the constructs is connected with an increase in the other ones. Interestingly, Teaching Practices and Student Engagement have the best relationship, as is indicated by the darker color patch. This heatmap can be used to make a visual evaluation of the interrelationships easily and establish the theoretical consistency of the constructs used in the study (Gao et al., 2024).

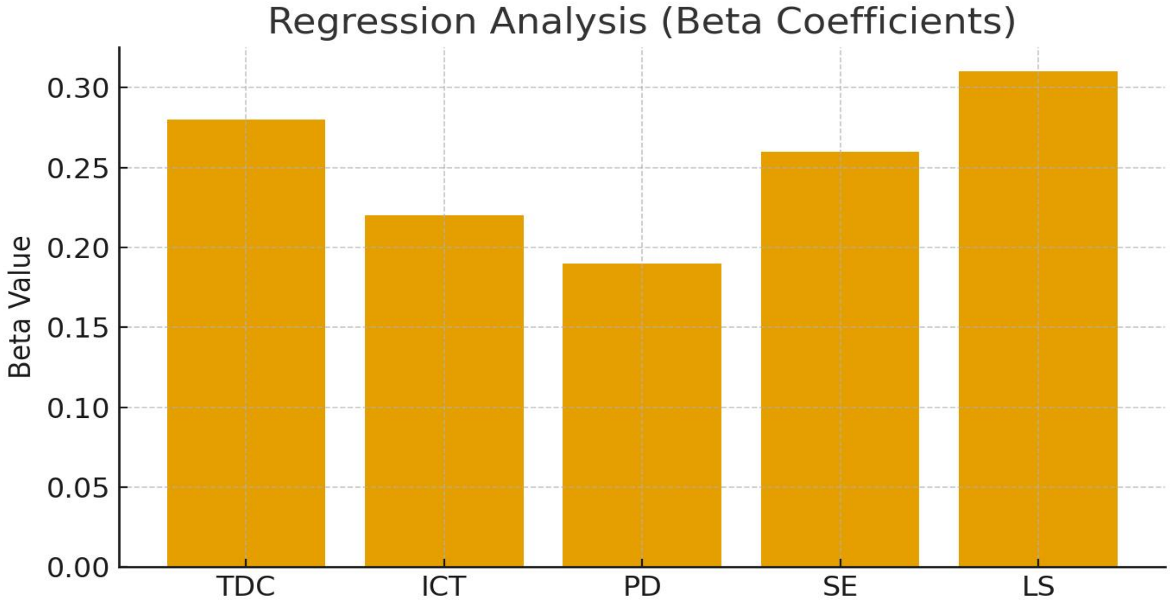


Figure 6: Regression Analysis

Figure 6 shows the regression analysis of the data. The Regression Analysis figure is used to display the beta coefficient of five predictor variables, viz. TDC, ICT, PD, SE, and LS on the dependent variable, Technology-Enhanced Teaching Practices (TETP). All the bars are above zero, which means positive impacts of regression. The beta of Leadership Support is the largest, and it is then represented by Digital Competence and Self-Efficacy, meaning that these are the best predictors of the teaching practices. The figure graphically supports the argument that all predictors play a vital role in explaining the variation in the technology integration behavior of teachers (Wallace et al., 2023).

Discussion

The finding of the provided study provides an effective thought on how the technological proficiency of educators can shape technology-based teaching in secondary schools. All these results are a huge attestation to the conceptual idea that digital, institutional, and teacher preparedness variables come into play to determine how much technology is going to be incorporated in the classroom teaching. The typical values meant that the analyzed data enabled the parametric analysis in a way that demonstrated that there were no extreme skewnesses when it comes to the distribution of the data with respect to each other. This allowed the trust in the interpretation of the inferential tests, which were conducted as a part of the research (Yadav, 2023).

The reliability test demonstrated high to excellent consistency of all the constructs, which was an indication that the scales of the digital competence, the ICT infrastructure, the professional development, the self-efficacy, the leadership support, the teaching practices, the digital assessment, and the student engagement were highly reliable. This conclusion was also supported by the validity results, which indicated that the KMO and Bartlett tests indicated that the data collected were suitable for factor analysis, and the results of the AVE, CR, and factor loading scores indicated that the constructs had been effective in measuring the intended measurements. All these results attest to the high reliability and validity of the applied measurement model of the research (Benali & Mak, 2022).

The correlation matrix showed that there were positive and significant relationships among all the constructs that are meaningful, thus demonstrating that as one area, which is professional development or ICT infrastructure, would increase in terms of self-efficacy and teaching practices, it is likely that other areas would also increase. This is in line with the existing literature, as it has constantly emphasized that digital competence is not an empty concept but is instead altered by supporting systems and situational variables. Student engagement and the technological lesson practices are also tightly connected, which proves that technologies are an important part of student education as they make the process more interactive and digitally rich (Sarva et al., 2023).

The regression analysis confirmed that leadership support, digital competence, and self-efficacy are the most promising variables to predict technology-enhanced practices in teaching. This means that the teachers will be willing and more capable of using technology effectively in situations where they are confident and are well-trained in a digital skills set and perfectly supported by their school administration. It indicates that the comprehensive approach to the digital transformation of schools, including professional growth, leadership, enabling the technology-driven change, and potential technologies, is important (Avsec & Ferk Savec, 2021).

The inferential tests also helped in the improvement of the findings since they helped to entail a substantial group difference. The t-test has shown that gender is also a contributing factor to the use of technology among teaching staff, and this fact could mean that there are also social or experience factors. The findings of ANOVA gave the fact that the level of digital competence strongly depends on the experience of teaching, which also shows the opportunity of the learning curve associated with mastering the technology knowledge. Similarly, the Kruskal-Wallis revealed that the perception responses to ICT infrastructure differ across age, which indicates that the differences in generational acceptability of technology and comfort, along with satisfaction with the available services, may exist. The Chi-square test showed that there was a strong relationship between professional development and the application of technology-enhanced teaching practices, and this is realistic considering the presentation of the evidence that training initiatives are good triggers of advanced digital pedagogy (Albó et al., 2020).

Overall, the process of becoming digitally competent among teachers is not only about skills development, but it also entails institutional, training-specific, and positive attitudes towards technology that can be deduced in the discussion. The findings confirm that digital competence is a complicated concept that is influenced by personal traits, experience, as well as organizational elements. Consequently, to be in a position to successfully implement technology-enhanced teaching, schools must invest in long-term strategies, which would build the capacity of teachers and strengthen infrastructure, as well as provide them with coherent leadership support. The research consequences, in their turn, are applied in the ongoing efforts at improving the digital teaching or learning process and defining its priorities for the elaboration of the policy and professional development (Shi et al., 2023).

Conclusion

It was the purpose of this study to determine how the digital competence of teachers would impact the technology-enhanced teaching process in secondary schools, besides examining the impact of ICT infrastructure, teacher self-efficacy, leadership support, and professional development. The overall findings greatly indicate that digital competence is at the forefront when describing the ability of teachers to undertake their teaching tasks effectively to include the use of technology. It was shown that teachers who are good in terms of digital competence and express good confidence in their digital abilities, and conducive school conditions are most likely to adopt and embrace technology-based instruction.

Statistical tests conducted with the data, including correlation and regression, as well as multiple inferential tests, continued to show significant and positive relationships among the study variables. Digital competence, teacher self-efficacy, and leadership support were indicated as the strongest predictors of the use of technology-enhanced teaching practices. This highlights how the individual ability and the institutional environments facilitate among schools, the element of digital transformation. Teachers who experienced life-long professional development and had access to adequate ICT infrastructure reflected more apparent technology integration, which confirms the notion that external sources and coordinated training are the two key drivers of the digital teaching achievement.

The fact that there were significant differences in the demographics was also discovered. The differences between genders on the levels of technology use, teaching experience with regard to digital competence, and differences in age brackets regarding perceptions with regard to ICT infrastructure existed. The given observations emphasize the fact that not all teachers are using the digital option, and certain interventions may be necessary in addressing the needs of the various groups of teachers with diverse needs.

Overall, the findings prove the thesis statement according to which successful technological application to high schools is not only the provision of gadgets and programs. It demands a complex approach that involves developing digital capabilities of educators, enhancing their trust, providing frequent leadership support, and ensuring equal access to ICT. Having such elements installed would leave the teachers in a better position to make use of technology in a meaningful and pedagogically efficient way.

In conclusion, this paper offers valuable information to the growing body of literature on the topic of digital education and teacher preparedness. It once again proves that digital competence is a vital issue of modern teaching and that the improvement of corresponding competence influences the teaching experience and students' involvement either directly and positively. The results can also be of practical guidance to policymakers, school administrators, and teachers who would like to improve the digitalization in high schools. Other measures that can get learning institutions a step nearer to the vision of varying the fullness of technology-enhanced learning include a premium on teacher education and increasing infrastructure and school cultures and cultures, and providing educator training.

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