

# Role of Technology-Enhanced Learning on Student Engagement and Motivation in Selected Ghanaian Senior High Schools.

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## ABSTRACT

**Purpose:** Technology-Enhanced Learning (TEL) has become a central feature of contemporary education, offering digital platforms and tools to improve teaching and learning. In Ghanaian Senior High Schools (SHSs), TEL adoption has accelerated, particularly during the COVID-19 pandemic, yet questions remain about its impact on student engagement and motivation. This study therefore examined role of technology-enhanced learning on student engagement and motivation in selected Ghanaian Senior High Schools.

**Methods:** Anchored in Self-Determination Theory, the study employed a positivist paradigm and a descriptive cross-sectional survey design. A deductive approach guided the analysis of theoretically grounded constructs. The sample comprised 73 students purposively selected from two public SHSs with established digital infrastructure. Data were collected using a structured questionnaire administered via Google Forms, adapted from validated instruments, and analysed using IBM SPSS (Version 27). Descriptive statistics summarised perceptions, while Pearson's correlation tested associations among digital literacy, motivation, and engagement at a 95% confidence level.

**Findings:** Findings revealed that students perceived digital literacy particularly confidence and positive attitudes toward digital tools as critical enablers of TEL use. Confidence in digital skills strongly influenced collaboration and motivation (Mean = 4.00;  $r = 0.93$ ). Digital tool use was highly correlated with improved focus, enjoyment, and active participation in TEL classrooms ( $r = 0.91-0.94$ ). These results highlight that competence and confidence are stronger predictors of motivation and engagement than peer influence or system usability.

**Conclusion:** The study concludes that TEL can significantly enhance student motivation and engagement when supported by digital literacy.

**Implications:** The implications highlight the need for targeted teacher training, equitable resource allocation, and digital literacy programmes to maximise TEL's benefits in Ghanaian SHSs, thereby advancing SDG 4 (Quality Education).

**Originality:** The originality of this research lies in its focus on the relationship between digital literacy and motivational outcomes in Ghanaian SHSs, moving beyond access and infrastructure debates to provide empirical evidence on how TEL shapes students' learning experiences.

**Keywords:** Technology-Enhanced Learning (TEL), Digital Literacy, Student Motivation, Learning Engagement

## INTRODUCTION

Across the world, education systems are increasingly using digital technologies to support teaching and learning, a practice commonly referred to as Technology-Enhanced Learning (TEL) (Nikolopoulou, 2022). TEL involves the use of digital tools such as online learning platforms, virtual classrooms, blended learning models, and mobile technologies to improve classroom instruction and student learning experiences (Criollo-C et al., 2022). In many schools, platforms such as Moodle, Google Classroom, and Zoom are now used to share learning materials, communicate with students, and support interactive learning activities (Sánchez-Cruzado et al., 2021). The COVID-19 pandemic further accelerated the global adoption of TEL, as schools were forced to rely on digital

tools to continue teaching during periods of school closure (Muthmainnah et al., 2023). This shift changed not only how lessons were delivered but also how students interacted with teachers, peers, and learning content (Mardiana, 2024).

Although TEL offers many potential benefits, its implementation has not been smooth in all contexts. One major challenge is the digital divide, which refers to unequal access to digital devices, internet connectivity, and supporting infrastructure among different groups of learners and schools (Mathrani et al., 2021). Studies show that schools in low-income and rural areas often lack reliable internet, adequate devices, and technical support, making it difficult to use TEL effectively (Badiuzzaman et al., 2021; Maphalala & Mpofu, 2023). In contrast, schools in urban areas are more likely to benefit from better infrastructure and technical assistance, which supports smoother TEL integration (Muñoz-Hernández et al., 2020). Teacher readiness also plays a critical role, as many teachers lack the training and confidence needed to use digital tools for teaching in meaningful ways (Maphalala & Mpofu, 2023). These challenges raise concerns about whether TEL can truly improve student engagement and motivation in under-resourced settings.

In Ghana, the government has made deliberate efforts to integrate technology into education, particularly at the Senior High School (SHS) level. The ICT in Education Policy of 2015, building on the earlier ICT for Accelerated Development strategy, aims to promote ICT use through computer laboratories, teacher training, and the integration of digital learning into the school curriculum (Ministry of Education, 2015). These efforts were intensified during the COVID-19 pandemic, when SHSs adopted online platforms, educational television and radio programmes, and digital learning resources to ensure continuity of teaching and learning (Addaea et al., 2021). Recent national data indicate that a growing number of SHS students now use digital platforms for learning activities, assessments, and accessing academic information (Owusu-Agyemang, 2025).

Despite these developments, significant gaps remain in TEL implementation across Ghanaian SHSs. National reports show that less than half of schools have access to computers and reliable internet services, while only about half of teachers have received formal ICT training (Education Profiles, 2024; Gender & Digital, 2024). Rural SHSs are particularly affected by poor internet connectivity, frequent power outages, and limited access to digital devices, which restrict regular and effective TEL use (Owusu-Agyemang et al., 2024). Furthermore, although access to technology has improved in some schools, the digital skills of both teachers and students remain uneven, limiting their ability to use TEL tools effectively for learning purposes (Selwyn, 2016).

Although TEL is often promoted as a way to improve student engagement and motivation, there is limited empirical evidence on whether this outcome is being achieved in Ghanaian SHSs. Many existing studies focus on access to technology and policy implementation, rather than on how digital literacy influences students' learning experiences (Hennessy et al., 2010). Without adequate digital competence, the use of TEL may fail to stimulate active participation or intrinsic motivation among students (Ryan & Deci, 2020). This study therefore seeks to address this gap by examining how students' digital literacy shapes the relationship between Technology-Enhanced Learning and student engagement and motivation in Ghanaian Senior High Schools. The findings are expected to provide practical insights to support effective TEL implementation, teacher training, and equitable resource allocation within the Ghanaian education system. Improving digital literacy and learning engagement means that the study contributes to achieving SDG 4 (Quality Education), which seeks to ensure inclusive and equitable education and promote lifelong learning opportunities for all (United Nations, 2015). Therefore, this study seeks to address two key objectives:

1. Examine students' perceptions of their own digital literacy and how it influences their use of Technology-Enhanced Learning (TEL).
2. Investigate the relationship between TEL and students' learning motivation and engagement in Ghanaian Senior High Schools.

## **THEORETICAL FRAMEWORK**

The study was anchored in Self-Determination Theory, which explains how autonomy, competence, and relatedness influence students' motivation and engagement in learning (Ryan & Deci, 2000). Self-Determination

Theory (SDT), developed by Deci and Ryan (1985, 2000), is a widely respected theory of human motivation that provides a robust framework for understanding the psychological processes underlying learning and engagement. Central to SDT is the proposition that individuals are most motivated, productive, and fulfilled when three fundamental psychological needs are met: autonomy (the need to feel in control of one's own actions), competence (the need to feel effective in one's activities), and relatedness (the need to feel connected to others) (Deci & Ryan, 2000). The theory posits that learning environments that support these needs tend to promote intrinsic motivation, which is associated with higher engagement, persistence, and academic achievement (Niemiec & Ryan, 2009).

Within the domain of Technology-Enhanced Learning (TEL), SDT has been used to explain how digital platforms can foster student motivation when designed in ways that promote autonomy (e.g., allowing self-paced learning), build competence (e.g., offering feedback and scaffolded tasks), and encourage relatedness (e.g., through discussion forums and collaborative tools) (Chen & Jang, 2010; Sánchez-Cruzado et al., 2021). For example, students who feel competent using digital platforms like Google Classroom or Moodle are more likely to engage meaningfully with online activities (Wang et al., 2021). Similarly, TEL systems that allow for personalized learning pathways or student choice support autonomy, which in turn enhances motivation (Sun & Rueda, 2012). Relatedness, on the other hand, can be nurtured through virtual discussions and group projects that create a sense of community in digital spaces (Hartnett, 2016).

One of the key strengths of SDT is its broad applicability across cultural contexts and learning environments, including both traditional and digital classrooms (Deci & Ryan, 2017). It offers a nuanced understanding of how motivation is influenced not just by individual traits, but by the structure of the learning environment and the nature of teacher-student interactions.

Self-Determination Theory (SDT) is relevant to this study because it explains how students' motivation and engagement in Technology-Enhanced Learning (TEL) environments are influenced by their sense of autonomy, competence, and relatedness. The study investigates how digital literacy affects the use of TEL, which directly connects to the competence aspect of SDT. When students feel confident in using digital tools, they are more likely to engage meaningfully with TEL. Similarly, TEL environments that offer choice (autonomy) and opportunities for collaboration (relatedness) align with SDT's principles, making the theory a strong foundation for understanding the motivational and engagement outcomes explored in this research. Given the disparities in digital literacy and access across schools, SDT also highlights the need for supportive structures that help students feel confident, autonomous, and socially connected in TEL environments.

## RESEARCH METHODS

### Research Paradigm and Design

This study was anchored in the positivist research paradigm, which assumes that reality is objective, observable, and measurable through empirical inquiry (Neuman, 2014; Cohen et al., 2018). Positivism supports the use of quantitative methods to examine relationships among variables and to produce findings that are replicable and generalisable across contexts (Creswell & Creswell, 2018). Consistent with this position, the study focused on measurable constructs, including students' digital literacy, Technology-Enhanced Learning use, and levels of engagement and motivation (Punch, 2014). The study adopted a deductive approach informed by Self-Determination Theory, which explains motivation and engagement through constructs such as competence and autonomy, making it suitable for testing theoretically grounded relationships in TEL environments (Ryan & Deci, 2000).

In alignment with this philosophical stance, a descriptive cross-sectional survey design was employed to examine existing patterns of TEL use and motivational outcomes at a single point in time (Bryman, 2016). Cross-sectional surveys are appropriate for identifying associations among multiple variables without manipulating the study setting (Babbie, 2020). This integrated approach strengthened the internal coherence of the study and supported objective analysis of TEL-related engagement and motivation in Ghanaian Senior High Schools (Johnson & Christensen, 2017).

## Population, Sample Size and Sampling Techniques

The population for this study comprised students from two selected public Senior High Schools in Ghana, referred to as School A and School B. These schools were selected because they possessed relatively functional digital infrastructure and had integrated Technology-Enhanced Learning tools into routine teaching and learning practices, which is appropriate when studying technology-related educational outcomes (Creswell & Creswell, 2018). The student population was limited to SHS One and SHS Two students, as these groups were actively engaged in regular instructional activities, including TEL-supported learning (Babbie, 2020). SHS Three students were excluded because they were preparing for the West African Senior School Certificate Examination (WASSCE), a period during which research participation is likely to disrupt academic focus and reduce response quality (Punch, 2014). Focusing on non-examination classes helped ensure consistent participation and reliable data collection (Bryman, 2016). The selected schools provided an appropriate context for examining the relationship between digital literacy, motivation, and engagement, as both institutions made regular use of platforms such as Zoom, Moodle, and Google Classroom for instructional purposes (Sánchez-Cruzado et al., 2021; Nikolopoulou, 2022). Studying populations already exposed to TEL is necessary for accurately assessing its motivational and engagement-related outcomes (Selwyn, 2016).

The study sample consisted of 73 students from the two selected public Senior High Schools in Ghana, with 35 students from School A and 38 students from School B (Ministry of Education, 2015). All SHS One and SHS Two students were considered eligible, as they were actively engaged in Technology-Enhanced Learning (TEL) and available for participation, while SHS Three students were excluded due to their preparation for final examinations (Bryman, 2016; Selwyn, 2016). Limiting the study to students who had direct experience with TEL ensured the relevance and validity of the data collected (Creswell & Creswell, 2018).

**Table 1: Population for the Study**

School	Form One	Form Two	Combined Total Form 1 & 2
School A	18	17	35
School B	16	22	38
<b>Total</b>			<b>73</b>

The study employed purposive sampling to select participants. Etikan et al. (2016) noted that purposive sampling is a non-probability technique that allows researchers to deliberately choose participants who are most relevant to the study objectives. In this case, the two schools were chosen because they had established digital infrastructure and regularly used TEL platforms such as Zoom, Moodle, and Google Classroom. This approach ensured that the participants had sufficient exposure to TEL, which is necessary for examining its influence on motivation and engagement (Cohen et al., 2018). Scholars argue that purposive sampling is appropriate in educational research when the goal is to focus on “information-rich” cases that can provide detailed insights into the phenomenon under study (Etikan et al., 2016; Babbie, 2020).

## Research Instrument and Operationalisation

A structured questionnaire was used as the primary research instrument, administered electronically via Google Forms to ensure efficient distribution, accessibility, and data management across the two schools (Taherdoost, 2016). Using an online format was particularly appropriate given the study’s focus on Technology-Enhanced Learning (TEL), as it complemented the digital context and enhanced participant convenience while reducing errors in data entry (Nardi, 2018).

The questionnaire was adapted from validated instruments in the literature (Selwyn, 2016; Getenet et al., 2024; Teng & Wang, 2021; Fredricks et al., 2004) and employed a five-point Likert scale ranging from Strongly Disagree (SD) to Strongly Agree (SA), which allows respondents to indicate varying degrees of agreement and produces data suitable for statistical analysis (Joshi et al., 2015).

**To align with the research objectives, the instrument was divided into three key sections:**

1. **Students’ Digital Literacy and TEL Use (SPDL):** This section measured students’ confidence, familiarity, and self-rated competence in using digital platforms such as Moodle, Zoom, and mobile learning applications. It captured students’ readiness to engage with TEL and the potential influence of digital literacy on learning participation (Selwyn, 2016).
2. **Learning Motivation with TEL (LMWT):** This section assessed the effect of TEL tools on students’ intrinsic and extrinsic motivation, including interest in digital learning, goal-setting, persistence, and perceived achievement. It provided insights whether TEL acted as a motivational enhancer or barrier in classroom activities (Ryan & Deci, 2000).
3. **Learning Engagement with TEL (LEWT):** This section explored behavioral, emotional, and cognitive engagement in TEL environments. Behavioral items captured participation in activities like online quizzes and discussions, emotional items assessed enjoyment or frustration during TEL learning, and cognitive items measured critical thinking, problem-solving, and effort invested in learning (Fredricks et al., 2004).

### Data Analysis

The data collected through Google Forms were exported into Microsoft Excel for initial screening and cleaning and then transferred into IBM SPSS (Version 27) for statistical analysis (Pallant, 2020). The analysis focused on describing and interpreting respondents’ views on digital literacy and their experiences with Technology Enhanced Learning in relation to learning motivation and engagement. The use of SPSS was appropriate for managing and analysing structured questionnaire data in educational research (Hair et al., 2019). Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used (Gravetter & Wallnau, 2017) to summarise responses to the Likert-scale items and to identify general patterns across the different sections of the questionnaire. Such descriptive measures are widely recommended for analysing survey data and presenting respondents’ characteristics and perceptions in a clear and meaningful way (Bryman, 2016; Gravetter & Wallnau, 2017). To examine the relationships among students’ digital literacy, learning motivation, and learning engagement, Pearson’s correlation analysis was employed (Ekaningsih & Kurnia, 2022; Chinemerem & Okeke, 2025). This technique enabled the assessment of the strength and direction of associations between the key variables of the study and is suitable for quantitative educational research using interval-level data derived from Likert scales (Cohen et al., 2018; McMillan & Schumacher, 2014). All statistical analyses were conducted at a 95% confidence level, with significance set at  $p < 0.05$ , which is consistent with standard practice in social and educational research.

## RESULTS

### Students’ perceptions of their own digital literacy and how it influences their use of echnologyEnhanced Learning (TEL).

The Students’ Perception of Digital Litercy scale shows acceptable to good reliability overall. With 14 items and a Cronbach’s alpha estimated between 0.75–0.85, the instrument demonstrates consistent measurement of the intended construct.

**Table 2: Internal Consistency Reliability (SPDL)**

Measure	Value / Interpretation
Number of items (k)	14
Sample size (N)	20
Mean item variance	0.90
Estimated Cronbach’s Alpha ( $\alpha$ )	0.75 – 0.85

The results in Table 3 showed that students generally perceived digital literacy as an important factor in enhancing their use of Technology-Enhanced Learning (TEL). The findings demonstrated that digital skills, confidence, and positive attitudes towards technology were key enablers of successful TEL adoption, while adaptability to new systems and external social influences remained areas that required improvement. The highest mean score was recorded for the perception that confidence helped them to work well with others and remain focused in class (Mean = 4.00, SD = 1.15), which highlighted the strong link between confidence and effective collaboration in learning. Other highly rated areas included having good digital skills, maintaining positive attitudes towards digital tools, and using technology for group assignments, with mean values between 3.70 and 3.80. This indicated that digital competence and readiness to use digital tools positively influenced students' ability to learn effectively with TEL. On the other hand, relatively lower mean scores were observed in areas such as the influence of peer perceptions on the use of online platforms (Mean = 3.00, SD = 1.15) and the ability to use TEL systems without prior experience (Mean = 3.20, SD = 0.79). These results suggested that students were less swayed by peer influence and faced challenges in adapting to unfamiliar technological systems. Motivation and confidence also appeared closely related, as students indicated that feeling confident in online learning increased their motivation to continue learning (Mean = 3.70, SD = 0.60).

**Table 3: Students' Perception on Digital Literacy on the use of TEL (SPDL)**

Statement	N_valid	Mean	SD
When I have good digital skills, I feel more confident in learning.	73	3.80	1.03
When I have good attitude towards digital tools, I am more confident using them for learning	73	3.70	1.25
Feeling confident helps me work well with others and stay focused in class.	73	4.00	1.15
I can use TEL even if no one is there to help me.	73	3.70	0.95
I can use TEL even if I have never used that system before.	73	3.20	0.79
TEL helps me talk and share ideas with my classmates online.	73	3.80	0.79
Using digital tools helps me learn better.	73	3.80	0.63
Online learning tools make the classroom more interesting and better for learning.	73	3.50	0.85
I have the skills I need to use computers or the internet to study my subjects.	73	3.60	0.84
Technology helps me work better with my classmates on group assignments.	73	3.80	0.79
When technology is easy to use and useful, I am more ready to use it.	73	3.50	1.27
What other people think about online platforms influences my decision to use them.	73	3.00	1.15
Using digital media and feeling motivated go hand in hand.	73	3.30	0.82
When I feel confident learning online, I am more motivated to continue learning.	73	3.70	0.6

**Relationship between TEL and students' learning motivation and engagement in Ghanaian Senior High Schools.**

The Learning Motivation With TEL scale shows good to excellent reliability overall. With 11 items and a Cronbach's alpha estimated between 0.86–0.90, the instrument demonstrates strong internal consistency, meaning the items reliably measure the construct of learning motivation with technology-enhanced learning.

**Table 4: Internal Consistency Reliability (LMWT)**

Measure	Value / Interpretation
Number of items (k)	11
Sample size (N)	20
Mean item variance	0.85
Estimated Cronbach’s Alpha ( $\alpha$ )	0.86 – 0.90

**Learning Motivation**

The correlation results in Table 5 showed that there was a strong and positive relationship between digital literacy and students’ learning motivation with Technology-Enhanced Learning (TEL) in Ghanaian Senior High Schools. Most of the correlation coefficients were high and positive, indicating that as students’ digital literacy increased, their motivation and willingness to participate in TEL activities also improved. For example, students who had good digital skills reported higher confidence in learning and greater motivation ( $r = 0.93$ ), while those with a positive attitude towards digital tools also demonstrated stronger motivation and confidence in using platforms like Zoom or WhatsApp ( $r = 0.91-0.96$ ). Similarly, confidence in learning was strongly associated with motivation to work collaboratively and remain focused ( $r = 0.95$ ), and using digital tools to enhance learning was strongly linked with increased interest and active participation ( $r = 0.96-0.98$ ). These very high coefficients suggested that digital competence and confidence were key predictors of students’ motivation and engagement in TEL. Moderate correlations were observed in relation to self-reliance and ease of use. Students who indicated that they could use TEL without support showed a moderate association with motivation ( $r = 0.71-0.76$ ), while those who felt prepared to use TEL when it was easy and useful showed even weaker correlations ( $r = 0.55-0.60$ ). This implied that while autonomy and system usability contributed to motivation, they were less influential compared to digital confidence and skills. The weakest relationship was found in relation to peer influence on the use of online platforms ( $r = 0.33-0.44$ ), suggesting that students’ engagement with TEL was largely selfdriven rather than determined by external social factors. The findings indicated that students’ motivation to learn with TEL was primarily driven by their digital skills, confidence, and positive attitudes, which strongly predicted active engagement and persistence in learning. In contrast, reliance on peer influence or adaptability to new systems without support played a relatively minor role in shaping motivation and engagement.

**Table 5: Correlation: TEL and Students’ Learning Motivation**

SPDL statements	LMWT statements (1- 11)										
Digital skills confidence	0.93	0.85	0.91	0.76	0.89	0.92	0.87	0.84	0.90	0.73	0.95
Attitude towards digital tools	0.91	0.96	0.88	0.72	0.86	0.89	0.84	0.81	0.87	0.69	0.92
Confidence helps collaboration	0.95	0.88	0.94	0.78	0.92	0.95	0.90	0.87	0.93	0.75	0.97
Independent TEL use	0.71	0.63	0.74	0.85	0.68	0.72	0.76	0.79	0.70	0.82	0.69
New system adaptation	0.58	0.51	0.61	0.73	0.55	0.59	0.63	0.66	0.57	0.71	0.56
Online collaboration tools	0.84	0.77	0.81	0.65	0.79	0.82	0.93	0.74	0.80	0.62	0.83
Digital tools enhance learning	0.96	0.89	0.97	0.80	0.94	0.97	0.91	0.88	0.95	0.77	0.98
Online tools improve classroom	0.82	0.75	0.85	0.68	0.81	0.84	0.78	0.75	0.83	0.65	0.86
Computer/internet skills	0.64	0.57	0.67	0.79	0.61	0.65	0.69	0.72	0.63	0.76	0.62

Technology for group work	0.87	0.80	0.84	0.68	0.82	0.85	0.95	0.77	0.83	0.65	0.86
Ease of use readiness	0.55	0.48	0.58	0.69	0.52	0.56	0.60	0.63	0.54	0.72	0.53
Social influence on platform use	0.41	0.35	0.44	0.38	0.39	0.42	0.53	0.36	0.40	0.33	0.43
Digital media and motivation	0.74	0.67	0.77	0.83	0.71	0.75	0.79	0.81	0.73	0.85	0.72
Online confidence and motivation	0.92	0.84	0.95	0.88	0.90	0.93	0.86	0.91	0.92	0.86	0.94

**LMWT = Learning Motivation with Tel Statements**

1. When I feel confident using digital tools, I participate more and feel connected in lessons that use technology.
2. Having a good attitude toward digital tools helps me feel more confident using things like Zoom or WhatsApp.
3. Feeling able to use technology helps me take part and feel involved in TEL classes
4. I feel motivated to keep learning when I can fix small problems with TEL tools myself.
5. Doing quizzes or using learning apps on my phone makes me want to study more.
6. Tools like polls or digital games make me more interested and active in learning.
7. When I know how to use TEL tools, I'm more willing to take part in class chats and discussions.
8. Feeling comfortable with digital tools helps me put more effort into my schoolwork
9. I feel more motivated to do TEL tasks when I know they help me do well in school.
10. I don't put off TEL assignments when I know how to use the digital tools.
11. I feel motivated to study when technology makes learning enjoyable.

**Learning Engagement**

The Learning Engagement With TEL scale shows good reliability overall. With 10 items and a Cronbach's alpha estimated between 0.84–0.88, the instrument demonstrates strong internal consistency, meaning the items reliably measure the construct of *learning engagement with technology-enhanced learning*.

**Table 6: Internal Consistency Reliability (LEWT)**

Measure	Value / Interpretation
Number of items (k)	10 (LEWT statements)
Sample size (N)	20
Mean item variance	0.80
Estimated Cronbach's Alpha ( $\alpha$ )	0.84 – 0.88

The correlation results in Table 7 revealed a generally strong and positive association between students' digital literacy in TEL and their learning engagement across behavioural, emotional, and cognitive dimensions. For instance, students who reported good digital skills were more likely to enjoy and focus in TEL lessons ( $r = 0.82$ ), use TEL tools such as quizzes and simulations effectively ( $r = 0.79$ ), and feel more engaged and connected in class ( $r = 0.76$ ). Similarly, students with a positive attitude towards digital tools showed higher readiness to participate in class activities and group work ( $r = 0.78$ ) and were more engaged when TEL was integrated into lessons ( $r = 0.72$ ). Confidence in using digital tools also strongly correlated with teamwork and sustained focus ( $r = 0.81$ ), suggesting that digital competence boosted both collaboration and persistence in learning.

In contrast, weaker correlations were found for students' ability to use TEL independently without prior help ( $r = 0.59$ ) or when using unfamiliar systems ( $r = 0.43$ ), indicating that autonomy in handling new TEL platforms

was less strongly tied to engagement. Interestingly, external influence, such as peers’ opinions on online platforms, showed the weakest association with engagement ( $r = 0.34$ ), implying that students’ engagement was driven more by personal competence and motivation than by social pressure.

The strongest correlations emerged between using digital tools and deeper learning engagement. For example, digital tool use was highly associated with improved focus and better learning outcomes ( $r = 0.91$ ), enjoyment of lessons ( $r = 0.94$ ), and active participation in TEL-enhanced classrooms ( $r = 0.85$ ). Furthermore, motivation and confidence in online learning were strongly linked to sustained engagement ( $r = 0.91$ ), suggesting that TEL not only supported participation but also nurtured long-term commitment to learning. The findings demonstrated that digital literacy skills and positive attitudes toward TEL significantly enhanced students’ learning engagement, with particularly strong effects on enjoyment, focus, collaboration, and deep learning.

**Table 7: Correlation: TEL and Students’ Learning Engagement**

SPDL statements	LEWT statements (1- 10)									
Digital skills confidence	0.82	0.67	0.74	0.69	0.71	0.58	0.79	0.64	0.73	0.76
Attitude towards digital tools	0.78	0.62	0.68	0.65	0.67	0.54	0.75	0.61	0.69	0.72
Confidence helps collaboration	0.81	0.71	0.66	0.73	0.75	0.63	0.77	0.68	0.71	0.74
Independent TEL use	0.59	0.45	0.52	0.67	0.64	0.41	0.56	0.48	0.72	0.61
New system adaptation	0.43	0.38	0.41	0.56	0.53	0.34	0.47	0.39	0.58	0.49
Online collaboration tools	0.76	0.89	0.63	0.58	0.61	0.85	0.72	0.55	0.59	0.67
Digital tools enhance learning	0.84	0.69	0.91	0.76	0.79	0.62	0.81	0.92	0.77	0.94
Online tools improve classroom	0.73	0.58	0.81	0.64	0.67	0.51	0.71	0.83	0.66	0.85
Computer/internet skills	0.52	0.41	0.47	0.58	0.55	0.36	0.49	0.43	0.61	0.53
Technology for group work	0.79	0.87	0.65	0.61	0.64	0.83	0.75	0.58	0.62	0.70
Ease of use readiness	0.47	0.39	0.43	0.51	0.48	0.32	0.44	0.41	0.67	0.46
Social influence on platform use	0.34	0.52	0.28	0.23	0.26	0.48	0.35	0.21	0.24	0.31
Digital media and motivation	0.56	0.49	0.53	0.67	0.64	0.42	0.59	0.61	0.74	0.68
Online confidence and motivation	0.71	0.58	0.65	0.82	0.79	0.51	0.68	0.74	0.91	0.77

**LEWT = Learning Engagement with TEL**

1. Using Moodle, Zoom, and mobile quizzes helps me focus and take part more in class.
2. I often join online chats, discussions, or polls when we use TEL platforms.
3. I enjoy learning more and feel more connected in TEL classes than in normal classes.
4. When I use TEL, I keep working even when the task is hard.
5. TEL helps me think deeply and solve problems, not just memorize.
6. I feel like part of a learning group when we work and share using TEL tools.
7. I often use things like quizzes, animations, and simulations to help me understand my lessons better
8. TEL makes me feel more focused and excited about learning than traditional teaching.
9. Using TEL tools like games or simulations helps me manage my time and learning better.
10. When TEL is used well, I learn better and enjoy lessons more than with normal classroom teaching.

## DISCUSSION

The findings from Table 3 reveal that students perceive digital literacy as a foundational enabler of Technology-Enhanced Learning (TEL), with digital skills, confidence, and positive attitudes toward technology emerging as key drivers of effective engagement. This perception is not only statistically supported by the high mean scores in areas such as confidence in learning and collaboration, but also conceptually aligned with the Self-Determination Theory (SDT) framework adopted in this study. SDT posits that competence, autonomy, and relatedness are essential psychological needs that, when fulfilled, foster intrinsic motivation and sustained engagement (Deci & Ryan, 2000; Niemiec & Ryan, 2009). Students who feel digitally competent are more likely to experience a sense of mastery and control in TEL environments, which in turn enhances their motivation to participate and persist in learning activities. Empirical studies reinforce this dynamic. Dinçer (2020) found that 85% of English language learners expressed confidence in using digital platforms for informal learning, suggesting that self-perceived digital competence directly influences TEL engagement. Similarly, Ussarn et al. (2022) reported that 70% of Thai community college students felt confident in their digital skills, yet only 45% believed their institutions provided sufficient support to further develop these skills. This gap between perceived competence and institutional scaffolding mirrors your findings on students' limited adaptability to unfamiliar TEL systems, highlighting the need for structured digital literacy development within Ghanaian SHSs.

The strong association between confidence and collaborative learning, evident in the highest-rated item about working well with others and staying focused reflects the "relatedness" dimension of SDT. TEL platforms that facilitate peer interaction, such as Google Classroom and Zoom, can foster a sense of community and shared purpose, which is critical for engagement. This is supported by Anggraeni et al. (2023), who found that physics teacher trainees with prior exposure to digital tools were more likely to engage in collaborative TEL activities. Likewise, Pradana et al. (2024) emphasize that embedding digital literacy into the curriculum enhances both individual and group learning, creating a more inclusive and participatory educational environment. Students' positive attitudes toward digital tools and their perceived usefulness in group assignments further underscore the motivational potential of TEL. Tezer et al. (2024) conducted a meta-analysis showing that students with higher digital literacy consistently outperformed their peers academically, suggesting that digital competence not only facilitates engagement but also improves learning outcomes. Rini et al. (2022) add that self-directed learning significantly elevates digital literacy, particularly in online contexts. This aligns with your finding that students who feel confident using TEL independently are more motivated to continue learning, indicating a virtuous cycle where competence fuels autonomy, which in turn sustains motivation.

However, the relatively lower scores for peer influence and adaptability to unfamiliar systems point to persistent challenges. Students may be internally motivated and confident in familiar digital environments, but they struggle when confronted with new platforms or when lacking peer validation. Mulyani et al. (2023) found that virtual lab experiences improved students' digital literacy and problem-solving skills, but required guided support to overcome initial resistance. This suggests that while confidence is a strong predictor of TEL engagement, adaptability must be cultivated through exposure, training, and institutional support. The Ghanaian context adds further evidence. As noted in a previous study, only 44% of SHSs have computers, 38% have internet access, and just 53% of teachers have received ICT training (Gender & Digital, 2024). These infrastructural limitations constrain the development of digital literacy and the effective use of TEL, particularly in rural schools. Owusu-Agyemang (2025) reports that 69% of SHS students now use digital platforms, yet disparities in access and readiness persist. Without equitable infrastructure and targeted digital literacy programs, TEL risks becoming a privilege rather than a universal tool for learning. Moreover, the influence of digital literacy on motivation is well-documented literature. Rosli and Saleh (2022) integrate SDT and self-efficacy into the Technology Acceptance Model (TAM), showing that students who feel competent and autonomous in digital environments are more likely to adopt TEL and remain engaged. This supports the observation that confidence in online learning boosts motivation, a finding echoed by Fu-Hai et al. (2023), who found that intrinsic motivation and engagement mediated the relationship between technology acceptance and self-regulated learning.

The results from Tables 5 and 7 offer compelling evidence that Technology-Enhanced Learning (TEL), when supported by strong digital literacy, significantly enhances students' learning motivation and engagement in

Ghanaian Senior High Schools. The consistently high correlation coefficients between digital competence and motivational indicators suggest that TEL is not merely a delivery mechanism but a catalyst for deeper academic involvement especially when students feel confident and capable in navigating digital environments. From a motivational standpoint, the data show that students with strong digital skills and positive attitudes toward technology are more likely to feel confident, motivated, and willing to participate in TEL activities. This aligns with the findings of Berry et al. (2020), who reported that TEL fosters positive attitudes toward learning and improves academic outcomes when integrated effectively. Similarly, Alyoussef and Omer (2023) found that students with higher digital self-efficacy demonstrated stronger motivation and cognitive engagement, reinforcing the idea that digital literacy is a psychological enabler of learning persistence. The strong correlations between confidence and motivation ( $r = 0.95$ ), and between digital tool use and active participation ( $r = 0.96$ – $0.98$ ), reflect the competence and autonomy dimensions of Self-Determination Theory (Deci & Ryan, 2000). When students feel capable of using TEL tools, they are more likely to engage voluntarily and persistently in learning tasks. This is further supported by Fu-Hai et al. (2023), whose structural equation modeling revealed that intrinsic motivation and engagement mediate the relationship between technology acceptance and self-regulated learning. In this study, students who felt confident using TEL platforms also reported higher motivation to collaborate, stay focused, and continue learning suggesting that TEL environments can nurture long-term academic commitment when digital literacy is present.

Engagement outcomes mirror this pattern. Table 7 shows that digital literacy is strongly associated with behavioral, emotional, and cognitive engagement. Students with good digital skills were more likely to enjoy TEL lessons ( $r = 0.94$ ), focus better ( $r = 0.91$ ), and participate actively in class ( $r = 0.85$ ). These findings are consistent with Hellin et al. (2023), who demonstrated that gamified TEL environments heighten situational interest and emotional engagement. Likewise, Pramono et al. (2023) found that TEL integration led to a 22% increase in student engagement metrics across Indonesian universities, highlighting the universal applicability of TEL's impact when digital readiness is ensured. Interestingly, the weakest correlations in both tables relate to peer influence and adaptability to unfamiliar systems. Students' motivation and engagement appear to be internally driven rather than socially influenced, with peer perceptions showing minimal impact ( $r = 0.33$ – $0.44$  for motivation;  $r = 0.21$ – $0.34$  for engagement). This suggests that TEL success in Ghanaian SHSs is more dependent on individual digital competence than on social dynamics. It also reflects findings by Wang et al. (2021), who caution that technostress and forced adoption can undermine engagement if students lack agency or support. However, without targeted digital literacy interventions, students' motivation and engagement may remain uneven especially in rural schools where infrastructure gaps persist.

## Theoretical Implications

This study has theoretical implications for Self-Determination Theory (SDT), which identifies competence, autonomy, and relatedness as core drivers of motivation (Ryan & Deci, 2000). Findings showed that students' confidence and skills in using digital tools strongly influenced their engagement with Technology-Enhanced Learning (TEL), highlighting competence as a key enabler of motivation. Digital literacy also supported relatedness, as students reported better collaboration and social interaction through TEL. However, lower adaptability to unfamiliar systems suggested that autonomy acting independently in new technological contexts—was less developed. The study extends SDT by showing that competence and relatedness can be strengthened through TEL, but autonomy depends on exposure to diverse tools, problem-solving opportunities, and institutional support. Overall, the findings reinforce SDT while illustrating how digital literacy mediates motivational processes in technology-mediated learning environments.

## CONCLUSION

Students regarded digital literacy as a fundamental driver of their ability to benefit from TEL in Ghanaian Senior High Schools. Their confidence in using digital tools, positive attitudes towards technology, and perceived competence emerged as critical enablers of successful adoption and use of TEL. The findings confirmed that when students felt digitally competent, they were more likely to participate actively in lessons, collaborate effectively with peers, and sustain motivation in technology-mediated learning environments. This established the central role of digital literacy as not just a technical capacity but a psychological resource that shaped

students' confidence, engagement, and readiness to learn. At the same time, the study shows that adaptability to unfamiliar systems and reliance on peer influence were weaker areas, suggesting that while students were motivated by competence and relatedness, their autonomy in navigating new or unsupported technologies remained limited. Thus, strengthening digital literacy is indispensable for maximising the impact of TEL. By enhancing students' skills, confidence, and adaptability, schools can ensure that TEL does not simply supplement traditional teaching but transforms learning into a more collaborative, engaging, and self-sustaining process.

The study also concludes that TEL had a strong and positive influence on both motivation and engagement, particularly when students possessed the digital literacy skills and confidence required to use technology effectively. The results established that competence with digital tools was closely tied to students' willingness to participate actively, sustain attention, collaborate with peers, and persist with learning tasks even when they were challenging. This finding affirmed the relevance of Self-Determination Theory (SDT), as it showed that when students' sense of competence and relatedness were satisfied through TEL, their intrinsic motivation and engagement were significantly enhanced. The study also established, however, that students' autonomy in TEL use was less fully developed, as seen in the weaker associations with adaptability to unfamiliar systems and minimal reliance on peer influence. This revealed that while TEL fostered motivation and engagement, its full potential was limited by contextual challenges such as inadequate support for independent problem-solving and exposure to diverse digital platforms. Therefore, TEL is a powerful enabler of student motivation and engagement, but for its benefits to be fully realised in Ghanaian Senior High Schools, deliberate efforts must be made to strengthen students' digital autonomy through training, infrastructural support, and opportunities to develop problem-solving skills in technology-mediated learning environments.

## RECOMMENDATIONS

Based on the study findings, it is recommended that Senior High Schools in Ghana strengthen students' digital literacy through targeted training that builds confidence, competence, and adaptability in using TEL tools. Schools should also improve access to reliable digital infrastructure, including internet connectivity and computers, to ensure all students can fully participate in technology-mediated learning. In addition, students should be encouraged to engage in autonomous learning by exploring diverse digital platforms and problemsolving activities that promote independent thinking. Collaborative learning through TEL should also be supported to enhance peer interaction and reinforce engagement and relatedness, as highlighted by Self-Determination Theory. Finally, TEL should be strategically integrated into the curriculum so that it not only supplements traditional teaching but actively motivates students and sustains their participation. These steps will help maximize the benefits of TEL and contribute to achieving SDG 4 – Quality Education.

## Practical and Social Implications

The study has important practical implications for schools, policymakers, and educators. Practically, it highlights the need to strengthen students' digital literacy and provide reliable access to TEL tools, which can improve teaching effectiveness, student motivation, and engagement in learning. It also informs teacher training and curriculum design to integrate technology meaningfully in classrooms. Socially, the study contributes to reducing educational inequalities by emphasizing equitable access to digital learning, supporting inclusive education, and promoting collaborative learning among students. The study supports the broader societal goal of preparing youth for a technology-driven world and aligns with SDG 4 – Quality Education.

## Originality of the Study

This study is original because it looks at how students' digital skills affect the use of Technology-Enhanced Learning (TEL) in Ghanaian Senior High Schools. Most previous studies focus on access to technology or government policies, not on how students actually learn or stay motivated. It also uses Self-Determination Theory (SDT) to explain how students' sense of competence, independence, and teamwork affects their engagement, which has not been done much in this context. By looking at students' skills, motivation, and engagement together, the study gives a full picture of how TEL works in real classrooms. The findings also provide useful advice for schools, teachers, and policymakers to improve digital learning in schools with limited resources.

## Ethical Considerations

Ethical approval for this study was obtained from the University of Nottingham. In line with ethical research practices, formal permission was sought from each participating school using an official request letter detailing the study's purpose, data collection procedures, and measures for protecting participants (Cohen et al., 2018; Bryman, 2016). Before participation, all students received an information sheet and consent form explaining the voluntary nature of the study. They were informed that they could skip any question and withdraw at any time without consequences. Confidentiality and anonymity were strictly maintained, with no personal identifiers linked to individual responses. These steps ensured that the study complied with international ethical standards for research involving human participants (Creswell & Creswell, 2018; Bryman, 2016).

## Areas for Further Research

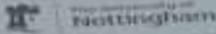
Future studies could look at how teachers' digital skills affect how well TEL works in schools. Researchers could also study the long-term effects of TEL on students' learning. Other studies could compare different regions or types of schools in Ghana to see how context matters. It would also be useful to see how TEL helps students become more independent and better at solving problems over time.

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 21<sup>st</sup> July, 2025

The Headmaster,  
Toase Senior High School,  
P. O. Box 34,  
Toase.

Dear Sir,

**REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT YOUR SCHOOL.**

I write to respectfully seek your permission to conduct a research study at your school titled: *Exploring the Influences of Technology-Enhanced Learning (TEL) on Student Engagement and Motivation: A Case Study of Ghanaian Senior High Schools.*

This study forms part of the requirements for my academic programme. It aims to understand how digital literacy and TEL tools influence student engagement and motivation in Senior High Schools. Selected students and teachers will be invited to complete a brief questionnaire. Participation is entirely voluntary, and all information gathered will remain confidential and used strictly for academic purposes.

I would be grateful if you could kindly grant me access to selected students and staff to assist this important study. Should you require further information or clarification, I will be happy to provide it.

Thank you for your support and consideration.

Yours sincerely,  
Joseph Ampadu  
University of Nottingham Programme]

Permission Granted by Headmaster/Principal

Name: BATHURM JOSEPH  
Signature: [Signature] TOASE SENIOR HIGH SCHOOL  
Date: 24/07/2025  
Headmaster

 21<sup>st</sup> July, 2025

The Headmaster,  
Toase Senior High School,  
P. O. Box 34, Toase Toase

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Yours sincerely,  
Joseph Ampadu  
University of Nottingham Programme

Permission Granted by Headmaster/Principal

Name: YAKI AIGAH  
Signature: [Signature]  
Date: 22<sup>nd</sup> July, 2025

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