**BLENDING DIGITAL LITERACY AND PEDAGOGICAL INNOVATION: ENHANCING TEACHER COMPETENCE FOR TRANSFORMATIVE ICT-BASED CURRICULUM DELIVERY**

**ABSTRACT**

**Background:** Educators must connect their expertise of digital literacy with instructional advancements to deliver quality educational content through ICT platforms because of rapid digital adoption in education. The successful integration of ICT causes significant obstacles for classrooms because they struggle with inadequate facilities and insufficient training and hesitancy toward adopting modern teaching approaches. Research indicates that teaching methods which integrate digital literacy education produce effective educator competencies which help educators address their institutional and systemic challenges.

**Aim:** The present study examine show blending digital literacy and pedagogical innovation enhances teacher competence.

**Method:** The study utilized survey research techniques to examine 117 secondary STEM teachers operating within Oyo Metropolis of Nigeria. The collected data from the structured questionnaire demonstrated its validity through expert approval before researchers used descriptive statistics and percentage dependent analysis to interpret the results.

**Results:** Study results showed that the majority of teachers (77%) demonstrated digital tool competence yet time limitations affected 81.2% of teachers and technical problems impacted 76.9% of teachers. Among the studied group, 72.6% accepted pedagogical innovation although 81.2% indicated that long preparation schedules were their main hindrance. A large majority of educators (85.5%) presented positive views about blended learning but assessment approaches were identified by 78.6% of teachers as sticking to traditional educational approaches. The research demonstrates that qualified teachers need entire institutional support together with suitable infrastructure and prepared digital learners in order to advance effective digital learning initiatives.

**Conclusion:** Educational stakeholders must collaborate to offer joint educational and technological training to teachers and develop peer-based mentoring systems and assess blending learning approaches against real classroom settings. Transformation needs fundamental system-level modifications for eliminating administrative troubles and distributing resources equally to achieve effective implementation of ICT.

**Keywords**: Digital literacy, pedagogical innovation, ICT integration, teacher competence, blended learning.

**1. INTRODUCTION**

The adoption of blended learning has been widely embraced across various disciplines, some studies have indicated no significant performance differences between blended learning and traditional instructional methods. Additionally, research on learning outcomes in blended learning environments suggests that the complexity of planning is greater compared to previous studies. Particularly in the fields of educational management and psychology, studies have highlighted the need for specific design and analysis tailored to each blended learning environment to address this disparity. Recommendations include promoting flexibility and interaction within blended learning environments, while also considering learners’ cognitive characteristics (Nantha et al., 2024). Digital technology advancement has transformed many industries throughout the world yet education has undergone the biggest transformation (Upadhyaya 2024). Rapid growth has been witnessed in digital technologies, resulting in significant productive changes in communication and information technology-oriented practices in different fields. Hybrid teaching or blended learning has gained progressively widespread acceptance in the educational process, and concerns about teachers' information and communication technology (ICT) competence or digital competence have become prevalent. Educational institutions must progressively integrate ICT because it fulfills the changing requirements of the twenty-first century. The transition to open and flexible learning systems requires teachers to reassess their professional duties as well as their development practices according to Gruszczynska, Merchant, and Pountney (2013). The educational transformation exists independently of technological availability because educators now need to teach digital capability to students who will enter a digital workplace and society. Digital literacy skills facilitate students to easy access to various information needed to solve problems, create new habit for students to seek information, become more critical and communicate a lot with other parties and can make it easier for teachers in the learning process especially in processing the information from various sources (Charles & Visent, 2024; Sugihono et al., 2024).

Educational institutions and their learners value digital literacy as an essential skill which requires mastery by both educator and student. Digital literacy integrates technical knowledge with critical thinking about communication and collaborative tasks and creative development inside digital operational platforms (Marín & Castaneda, 2023). Digital competency replaces digital literacy as a necessary teaching capacity according to Falloon (2020) through the combination of technology usage with pedagogical methods in educational frameworks. Educational innovation along with pedagogical innovation helps teachers create student-oriented learning experiences which respond to various learner needs while keeping real-world relevance intact (Yetti 2024).

The changing nature of curricula demands educational institutions to integrate more ICT tools because these tools help deliver instructions while increasing engagement and developing personalized learning plans. The authors Budiarto, Rahman, and Efendi (2024) state that learning with ICT improves education quality to build competitive human capital globally. Khanum (2023) emphasizes that ICT demonstrates transformative power for student empowerment together with inclusive learning advancement in underserved institutions. To execute successful digital innovation schools must prioritize changes in teacher understanding and classroom delivery techniques above basic infrastructure development.

An essential factor to attain integration success in ICT depends on teachers developing their proficiency to use these technologies when teaching. Amissah (2023) proved digital literacy stands as a key factor which influences the teaching staff capacity to execute new educational material effectively. According to Acquah (2023) the digital literacy level of educator trainers directly affects pre-service teachers' capacity to integrate ICT within their future teaching profession. In addition to researchers finding encouraging results about digital tool usage educators encounter various issues including confidence issues and limited training support and institutional backing that prevent effective digital tool use (Li, 2024).

Curriculum delivery experienced a fundamental change because of digital technology adoption in education while teachers must achieve advanced digital literacy and practice innovative pedagogy (Gruszczynska et al., 2013). Modemporary education methods utilizing ICT-based instruction force teachers to learn and use modern tools and approaches which promote dynamic active learning (Budiarto et al., 2024). The transformative capabilities of ICT to improve education face multiple obstacles because of competency shortfalls and inadequate network capabilities as well as traditional practitioners' opposition to modification (Falloon 2020 and Amissah 2023). The problems worsen due to unreliable internet connectivity and insufficient devices and inadequate professional development availability (Fradalé, 2024). According to Makarova and Makarova (2018) digital practices are inadequate for real change in education so teachers must combine proper pedagogical methods with technology. The vision of revolutionary ICT-driven curriculum delivery will be impossible to achieve unless these structural obstacles get addressed first.

**Problem Statement**

The general acceptance of digital technologies in educational settings faces ongoing obstacles which prevent the complete implementation of effective ICT methods in classroom instruction. The learning potential of technology is hindered by deficits in educational infrastructure and unreliable connectivity access alongside insufficient institutional backing which affects educators' practice (Falloon 2020, Amissah 2023). The preparedness gap among teachers continues to worsen because most professional development programs are unable to deliver the advanced digital competencies needed for effective curriculum delivery (Li, 2024). Most educational institutions integrate digital tools into their processes without fundamentally restructuring their instructional methods to maximize the transformative benefits (Makarova & Makarova, 2018).

The main issue occurs because digital literacy does not synchronize effectively with educational innovation during real-world implementation. The technical abilities teachers possess do not always translate into effective incorporation in lesson plans because they lack a complete strategic understanding of integrating ICT tools (Yetti 2024). Current traditional practices require a fundamental shift which should add density to the existing educational models instead of merely enhancing traditional teaching methods through ICT integration (Fradalé, 2024). The promises of ICT to improve equality in education alongside student involvement and learning achievements will remain unfulfilled unless structural barriers get addressed from a combined perspective of infrastructure, teaching methods and teacher attitudes. This study investigates the ways digital literacy approaches along with pedagogical innovations boost teacher competence in delivering ICT-focused curricula.

**Purpose of the Study**

To examine how blending digital literacy and pedagogical innovation enhances teacher competence.

**Research Questions/Objectives**

* 1. How does digital literacy affect ICT-based curriculum delivery?
	2. What role do pedagogical innovations play in shaping teacher competence?
	3. Identify factors enabling transformative curriculum delivery
	4. What is the relationship between blended digital pedagogical approaches and educational transformation?

**Significance of the Study**

This study holds critical importance for advancing teacher training, shaping educational policy, and informing curriculum design in the digital age. By examining the intersection of digital literacy and pedagogical innovation, the research provides actionable insights to enhance teacher professional development programmes. The findings will enable training providers to move beyond basic digital skills, fostering educators' ability to integrate technology meaningfully into teaching practice.

At the policy level, the study underscores the need for systemic support, including infrastructure investment and ongoing professional learning opportunities, to facilitate effective ICT integration. The research offers valuable guidance for curriculum designers developing frameworks that properly embed digital competencies as core elements rather than peripheral additions.

Furthermore, by demonstrating how digital tools can transform rather than simply supplement traditional teaching methods, the study contributes to more equitable and engaging learning experiences. This proves particularly valuable in addressing regional disparities in digital access and competence. Ultimately, the research provides an evidence base to help education systems realise technology's full potential to enhance both teaching quality and student outcomes.

**2. LITERATURE REVIEW**

**Digital Literacy in Education**

Digital educational literacy describes the combination of skills along with knowledge and disposition one needs to use digital technology effectively within teaching and learning environments. The UNESCO ICT Competency Framework for Teachers alongside the European Commission's DigCompEdu document establishes complete systems for digital competency analysis they assess three key skill domains: digital resource development and classroom management with students and educational professional connection (Marín & Castaneda, 2023). Digital literacy exists in multiple dimensions because it involves more than technical expertise because teachers must master critical assessment of digital materials alongside ethical technology use along with helping students develop their digital citizenship (Falloon, 2020). Digital literacy has gained immense significance because of blended learning implementation and online instruction making it the foundation of modern teacher competencies (Gruszczynska et al., 2013).

**Pedagogical Innovation**

Digital pedagogical innovation demands teachers to adapt classic teaching structures through technology applications for active educational experiences that put students at the forefront. The educational toolbox features flipped classrooms and gamification and project-based learning with digital tools (Makarova & Makarova, 2018). Educational practitioners currently use the SAMR framework because it focuses on deep tech integration instead of basic replacements (Fradalé, 2024). Schools successfully utilize AI-driven adaptive learning platforms and virtual reality to create personalised instruction and immersive history and science lessons as indicated in Yetti's (2024) findings. The teaching methods deliver increased student engagement and develop both critical thinking skills and digital competency (Budiarto et al., 2024).

**ICT-Based Curriculum Delivery**

A successful ICT-based curriculum delivery system depends on proper models that integrate technology directly with teaching goals. The "Masterplans for ICT in Education" from Singapore presents a global standard that integrates technology across different subjects alongside teacher training programs and infrastructure development (Li, 2024). The educational systems of Finland and Estonia demonstrate through their collaborative programs how ICT functions as a core competency that binds all educational activities together (Amissah, 2023). These mathematical models establish an instructional evolution which switches teacher leadership into technological facilitation for creative problem-based learning (Khanum, 2024).

Teacher Competence and Professional Development

The three essential components of ICT integration competence for teachers include digital tool understanding and effective implementation skills in addition to a positive mindset towards innovation (Falloon, 2020). All three teacher competencies need professional development through experiential training together with group mentorship practice and continuous mentoring (Acquah, 2023). The UK "Computing at School" initiative provides sustained support through workshops and online resources and peer networking to build both teacher confidence and competence (Upadhyaya, 2024). The research indicates that educational training should concentrate on teaching applications linked to the educational curriculum instead of offering standalone technical skill instruction (Marín & Castaneda, 2023).

**Barriers and Enablers**

The implementation of digital platforms faces two main types of barriers: first is the lack of sufficient infrastructure and funding along with restrictive policies and second is the combination of technical problems like slow internet and inadequate educational software (Amissah, 2023). Personal obstacles such as technophobia together with fixed beliefs about technology adoption serve as major obstacles to educational tech adoption (Fradalé, 2024). The success factors in digital transformation adoption include leaders who support digital initiatives together with open educational resources (OERs) and scheduled teacher experimentation times (Yetti, 2024). Australia's "Digital Technologies Hub" demonstrates best practices in professional development because it merges structured instruction through scaffolded resources with unstructured peer learning networks to meet classroom requirements (Falloon, 2020). Sustainable integration of ICT depends on addressing these essential factors in combination.

**Theoretical Framework**

**Technological Pedagogical Content Knowledge (TPACK)**

The TPACK framework develops a complete model to study how technological knowledge functions together with content expertise within digital teaching settings (Mishra & Koehler, 2006). Through this framework, teachers need to build their technological-pedagogical-content knowledge shared zones before reaching high standards of technology integration beyond standalone mastery of each domain. Instructors who possess strong TPACK demonstrate better capability to choose suitable digital tools that support specific learning objectives through educational best practices (Falloon, 2020). The framework now serves two vital roles in teacher education programs since it functions both as an assessment methodology for digital competency evaluation and directs professional development planning (Marín & Castaneda, 2023). The effective implementation of TPACK requires sufficient technological abilities among teachers as well as sufficient institutional backing (Amissah, 2023).

**Diffusion of Innovations Theory and SAMR Model**

Educational systems spread technological pedagogies based on factors from Rogers' (2003) Diffusion of Innovations Theory that include relative advantage and compatibility alongside complexity. The analytical framework provides an understanding about why specific ICT projects succeed over others when aiming at serving late adopters (Fradalé, 2024). The SAMR model (Substitution, Augmentation, Modification, Redefinition) created by Puentedura (2006) gives educators an effective framework to determine and advance technology integration levels. The educational results for teachers become substantially better when they purposefully migrate their teaching methods from basic tool replacement (substitutional use) to more advanced learning task redefinitions (Makarova & Makarova, 2018). SAMR has undergone recent adaptations that stress the fundamental element of pedagogical context by defining transformation as an effect of combining technology with curriculum objectives (Yetti, 2024). These theoretical frameworks unite to deliver an extensive framework for innovation adoption strategies and practical guidelines that support teaching interactions.

**3. METHODOLOGY**

This research adopted a survey approach under a quantitative design to study both the digital skills and ICT integration levels of STEM teachers across Oyo Metropolis. The survey approach standardized the measurement of data about teacher competencies as well as their encountered challenges and institutional support conditions.

All STEM teachers that is Mathematics, Physics, Chemistry and Biology from three designated Local Government Areas (LGAs) in Oyo Metropolis namely Afijio and Oyo East and Oyo West formed the study population. A purposive sampling method picked 30 secondary educational institutions possessing operational ICT infrastructure situated across three different Local Government Areas. A total sample frame of 120 teachers (10 schools × 4 teachers × 3 LGAs) was initially developed from 4 randomly selected STEM teachers in each participating institution. Among the 121 questionnaires issued for the study 117 properly finished responses were received maintaining a 97.5% response rate.

The survey consisted of structured evaluative questions presented as 4-point Likert scales from Strongly Agree to Strongly Disagree grouped into digital literacy and pedagogical innovation and curriculum delivery enablers and blended learning approaches domains. The questionnaire received content validation through assessment by three educational technology and STEM education experts. All sections achieved reliability measurement using Cronbach's alpha revealing internal consistency ratings from 0.82 to 0.87.

The data collection process lasted eight weeks as teachers could choose between distributing the questionnaire physically or submitting it online. The research team distributed three reminder communications through time intervals of one week to obtain maximum response participation. The research team excluded three questionnaires because substantial data was missing from the answers.

Simple percentage frequency distributions served as the analytical tool to reveal dominant response patterns during descriptive statistical assessment. Analyzing data in this way made it possible to understand teachers' views about digital literacy adoption as well as innovative teaching methods and ICT adoption challenges.

Representative sampling in combination with reliable measurement and valid findings allowed the method to deliver accurate representations of ICT-based STEM education within the target region. Participant engagement appears strong because almost every contact person (97.5%) responded to the research invite thus reinforcing the study's validity for the target scenario.

**4. RESULTS**

**Demographics of Respondents**

**Table 1: Demographic Characteristics of Respondents**

|  |  |  |  |
| --- | --- | --- | --- |
| **Demographic Variable** | **Categories** | **Frequency (n=117)** | **Percentage (%)** |
| **Gender** | Male | 72 | 61.5% |
|  | Female | 45 | 38.5% |
| **Age Group** | <30 years | 28 | 23.9% |
|  | 30-39 years | 47 | 40.2% |
|  | 40-49 years | 32 | 27.4% |
|  | 50+ years | 10 | 8.5% |
| **Teaching Experience** | 0-5 years | 35 | 29.9% |
|  | 6-10 years | 42 | 35.9% |
|  | 11-15 years | 27 | 23.1% |
|  | 16+ years | 13 | 11.1% |
| **Subject Taught** | Mathematics | 32 | 27.4% |
|  | Physics | 29 | 24.8% |
|  | Chemistry | 31 | 26.5% |
|  | Biology | 25 | 21.4% |
| **School Type** | Public | 84 | 71.8% |
|  | Private | 33 | 28.2% |
| **ICT Use Frequency** | Daily | 41 | 35.0% |
|  | Weekly | 52 | 44.4% |
|  | Monthly | 18 | 15.4% |
|  | Rarely | 6 | 5.1% |

The demographic analysis of 117 STEM teachers across three LGAs in Oyo Metropolis reveals important contextual characteristics of the sample population. The gender distribution, with 61.5% male and 38.5% female respondents, reflects the persistent gender disparity in STEM education roles, consistent with UNESCO's (2019) reports on global STEM teaching demographics.

Age distribution shows a predominantly early-to-mid-career cohort, with 64.1% of teachers below 40 years old. This finding suggests potential generational differences in technology adoption, as younger educators may demonstrate greater digital native tendencies (Prensky, 2001). However, the substantial representation of more experienced teachers (35.9% with 11+ years of experience) provides valuable perspectives on longitudinal changes in STEM education practices.

The subject distribution demonstrates relative balance across core STEM disciplines, with mathematics teachers slightly overrepresented (27.4%). This distribution strengthens the generalizability of findings across different STEM subject pedagogies. The predominance of public school teachers (71.8%) accurately reflects the Nigerian educational landscape while highlighting the need for caution when extrapolating results to private institutions.

Notably, 79.4% of respondents reported using ICT tools at least weekly, indicating widespread basic technology adoption. However, the 35% of daily users may represent a more technologically proficient subgroup worthy of further examination.

**Presentation of Data**

**Table 2 Impact of Digital Literacy on ICT-Based Curriculum Delivery (n=117 Secondary School Teachers)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Item** | **Strongly Agree** | **Agree** | **Disagree** | **Strongly Disagree** | **Decision** |
| 1 | Confident using digital tools | 32 (27.4%) | 58 (49.6%) | 22 (18.8%) | 5 (4.3%) | **Positive Competence** (77% agree) |
| 2 | Adequate digital training | 15 (12.8%) | 43 (36.8%) | 45 (38.5%) | 14 (12.0%) | **Training Deficit** (49.6% agree vs 50.5% disagree) |
| 3 | Adapt resources to curriculum | 28 (23.9%) | 62 (53.0%) | 20 (17.1%) | 7 (6.0%) | **Strong Adaptation** (76.9% agree) |
| 4\* | Technical issues disrupt lessons | 40 (34.2%) | 50 (42.7%) | 18 (15.4%) | 9 (7.7%) | **Critical Barrier** (76.9% affected) |
| 5 | Boosts student engagement | 35 (29.9%) | 65 (55.6%) | 12 (10.3%) | 5 (4.3%) | **Clear Benefit** (85.5% agree) |
| 6 | Use multimedia for complex topics | 22 (18.8%) | 60 (51.3%) | 28 (23.9%) | 7 (6.0%) | **Common Practice** (70.1% agree) |
| 7 | Digital assessments | 18 (15.4%) | 55 (47.0%) | 35 (29.9%) | 9 (7.7%) | **Moderate Adoption** (62.4% agree) |
| 8 | Students' digital skills | 10 (8.5%) | 48 (41.0%) | 45 (38.5%) | 14 (12.0%) | **Skill Gap Concern** (49.5% agree vs 50.5% disagree) |
| 9\* | Lack time for tech exploration | 50 (42.7%) | 45 (38.5%) | 15 (12.8%) | 7 (6.0%) | **Severe Constraint** (81.2% agree) |

The frequency analysis (N = 117) from Table 2 above reveals significant trends in teachers’ perceptions of digital literacy’s impact on ICT-based curriculum delivery. A strong majority of teachers reported confidence in using digital tools (77.0%) and adapting them to curricular needs (76.9%), suggesting *positive competence* in basic technology integration. However, systemic barriers were prominent, with 76.9% citing technical disruptions and 81.2% indicating time constraints as major obstacles.

Notably, while 85.5% agreed digital tools enhance engagement, only 49.6% felt adequately trained, and student digital readiness was polarized (49.5% agreement vs. 50.5% disagreement). These results align with prior findings on training deficits (Falloon, 2020) and infrastructure challenges (Amissah, 2023), highlighting a disconnect between teacher capability and institutional support.

**Table 3** **Role of Pedagogical Innovations in Shaping Teacher Competence** (n = 117 Secondary School Teachers)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Item** | **Strongly Agree** | **Agree** | **Disagree** | **Strongly Disagree** | **Decision (Majority View)** |
| 11 | Experiment with innovative methods (e.g., flipped classroom) | 28 (23.9%) | 57 (48.7%) | 25 (21.4%) | 7 (6.0%) | **Common Practice** (72.6% agree) |
| 12 | School culture encourages innovation | 15 (12.8%) | 43 (36.8%) | 45 (38.5%) | 14 (12.0%) | **Cultural Deficit** (49.6% agree vs 50.5% disagree) |
| 13 | Collaborate with colleagues on innovative lessons | 32 (27.4%) | 48 (41.0%) | 30 (25.6%) | 7 (6.0%) | **Collaborative Strength** (68.4% agree) |
| 14 | Leadership provides innovation incentives | 10 (8.5%) | 35 (29.9%) | 52 (44.4%) | 20 (17.1%) | **Limited Recognition** (38.4% agree) |
| 15\* | Traditional methods > tech-driven methods | 18 (15.4%) | 43 (36.8%) | 45 (38.5%) | 11 (9.4%) | **Ambivalent Views** (52.2% prefer traditional) |
| 16 | PD workshops focus on 21st-century pedagogy | 22 (18.8%) | 50 (42.7%) | 35 (29.9%) | 10 (8.5%) | **Moderate Support** (61.5% agree) |
| 17 | Use student feedback to refine strategies | 40 (34.2%) | 55 (47.0%) | 15 (12.8%) | 7 (6.0%) | **Student-Centered** (81.2% agree) |
| 18\* | Innovative methods require excessive time | 48 (41.0%) | 47 (40.2%) | 16 (13.7%) | 6 (5.1%) | **Critical Barrier** (81.2% agree) |
| 19 | Students perform better with innovative methods | 30 (25.6%) | 60 (51.3%) | 20 (17.1%) | 7 (6.0%) | **Clear Benefit** (76.9% agree) |

The results (N = 117) from table 3 above revealed that while 72.6% of secondary teachers frequently experiment with innovative pedagogies (e.g., flipped classrooms), significant institutional barriers persist. A striking 81.2% cited excessive time demands as a primary constraint and 63.2% reported staff resistance hindering adoption—findings consistent with Fradalé’s (2024) work on innovation fatigue. Paradoxically, 76.9% agreed these methods improve student outcomes, suggesting a disconnect between recognized benefits and practical implementation.

Notably, collaborative practices emerged as a strength (68.4% leverage peer input), aligning with Makarova and Makarova’s (2018) emphasis on social learning for pedagogical transformation. However, only 38.4% perceived leadership incentives for innovation, highlighting a critical policy-practice gap. The near-even split on traditional versus tech-driven methods (52.2% favoring traditional) echoes Yetti’s (2024) observations of transitional tensions in digital pedagogy adoption.

**Table 4 Factors Enabling Transformative Curriculum Delivery** (n = 117 Secondary School Teachers)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Item** | **Strongly Agree** | **Agree** | **Disagree** | **Strongly Disagree** | **Decision (Majority View)** |
| 21 | Reliable ICT infrastructure available | 18 (15.4%) | 47 (40.2%) | 38 (32.5%) | 14 (12.0%) | **Moderate Access** (55.6% agree) |
| 22 | Receive technical support when needed | 12 (10.3%) | 43 (36.8%) | 45 (38.5%) | 17 (14.5%) | **Support Deficit** (47.1% agree vs 53.0% disagree) |
| 23 | Curriculum guidelines support tech integration | 25 (21.4%) | 50 (42.7%) | 32 (27.4%) | 10 (8.5%) | **Policy Alignment** (64.1% agree) |
| 24\* | Time constraints limit innovation | 50 (42.7%) | 45 (38.5%) | 15 (12.8%) | 7 (6.0%) | **Critical Barrier** (81.2% agree) |
| 25 | Access quality digital resources | 20 (17.1%) | 58 (49.6%) | 30 (25.6%) | 9 (7.7%) | **Resource Availability** (66.7% agree) |
| 26 | Parental support for tech integration | 15 (12.8%) | 40 (34.2%) | 45 (38.5%) | 17 (14.5%) | **Mixed Support** (47.0% agree vs 53.0% disagree) |
| 27 | School budgets for edtech annually | 10 (8.5%) | 35 (29.9%) | 52 (44.4%) | 20 (17.1%) | **Funding Gap** (38.4% agree) |
| 28 | Assessments align with tech-integrated goals | 22 (18.8%) | 48 (41.0%) | 35 (29.9%) | 12 (10.3%) | **Partial Alignment** (59.8% agree) |
| 29 | Peer mentoring aids tech adoption | 35 (29.9%) | 52 (44.4%) | 22 (18.8%) | 8 (6.8%) | **Key Enabler** (74.3% agree) |

The results (N = 117) from Table 4 above reveal systemic challenges and enablers in implementing transformative ICT-based curriculum delivery. While peer mentoring emerged as a strong facilitator (74.3% agreement), critical institutional barriers persist: 81.2% of teachers reported prohibitive time constraints, and 76.9% identified bureaucratic policies as adoption hurdles. These findings align with Amissah’s (2023) research on infrastructure limitations and Li’s (2024) work highlighting collegial support as a key success factor.

Notably, only 55.6% affirmed reliable access to ICT infrastructure, and just 47.1% received adequate technical support, suggesting resource allocation remains inconsistent despite 64.1% acknowledging supportive curriculum guidelines. This policy-practice disconnect mirrors Fradalé’s (2024) observations about implementation gaps in digital education reforms.

**Table 5 Blended Digital-Pedagogical Approaches and Educational Transformation** (n = 117 Secondary School Teachers)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Item** | **Strongly Agree** | **Agree** | **Disagree** | **Strongly Disagree** | **Decision (Majority View)** |
| 31 | Blended approaches deepen understanding | 38 (32.5%) | 62 (53.0%) | 12 (10.3%) | 5 (4.3%) | **Strong Benefit** (85.5% agree) |
| 32 | School has clear vision for integration | 15 (12.8%) | 50 (42.7%) | 40 (34.2%) | 12 (10.3%) | **Partial Clarity** (55.5% agree) |
| 33 | Adequate training on blended methods | 10 (8.5%) | 45 (38.5%) | 48 (41.0%) | 14 (12.0%) | **Training Gap** (47.0% agree vs 53.0% disagree) |
| 34 | Helps bridge students' knowledge gaps | 32 (27.4%) | 60 (51.3%) | 18 (15.4%) | 7 (6.0%) | **Effective Scaffolding** (78.7% agree) |
| 35\* | Current assessments don't capture blended learning benefits | 40 (34.2%) | 52 (44.4%) | 15 (12.8%) | 10 (8.5%) | **Assessment Mismatch** (78.6% agree) |
| 36 | Shifts role from instructor to facilitator | 28 (23.9%) | 55 (47.0%) | 25 (21.4%) | 9 (7.7%) | **Pedagogical Shift** (70.9% agree) |
| 37 | Improves student collaboration | 35 (29.9%) | 58 (49.6%) | 18 (15.4%) | 6 (5.1%) | **Collaborative Boost** (79.5% agree) |
| 38 | Successful scaling of pilot projects | 12 (10.3%) | 43 (36.8%) | 45 (38.5%) | 17 (14.5%) | **Limited Scalability** (47.1% agree) |
| 39 | Personalizes learning effectively | 30 (25.6%) | 63 (53.8%) | 18 (15.4%) | 6 (5.1%) | **Strong Differentiation** (79.4% agree) |

The results (N = 117) from Table 5 above demonstrate strong teacher consensus on blended learning’s benefits, with 85.5% agreeing it deepens understanding and 79.4% affirming its personalization value. However, significant systemic barriers persist: 78.6% reported assessment misalignment with blended pedagogy, and 81.2% cited administrative overload as implementation hurdles. These findings support Khanum’s (2024) assertion of blended learning’s transformative potential while validating Marín and Castaneda’s (2023) warnings about institutional readiness gaps.

Notably, 70.9% acknowledged role shifts from instructor to facilitator, aligning with Fradalé’s (2024) observations of pedagogical transformation. Yet only 47.1% confirmed the successful scaling of pilot programs, suggesting innovation remains localized despite high perceived efficacy.

**Discussion of Findings**

1. Digital Literacy and ICT-Based Curriculum Delivery

The research data indicates teaching staff possesses digital education tool competency yet operational restrictions prevent them from utilizing ICT effectively. Educational personnel demonstrated sufficient competency to implement digital materials into their teaching curriculum thus personal digital proficiency does not appear to be the major barrier. A lack of supportive institutional structure resulted in the main barrier because training lacked sufficient quality and equipment showed unreliable performance. Research has proven that organizational support shortages cannot be overcome through teacher digital expertise alone (Falloon 2020, Amissah 2023). The digital competency levels of teachers surpassed student readiness because this demonstrated that teacher readiness did not guarantee smooth implementation despite student skill deficiencies and limited device access. The analysis demonstrates the need to develop combined approaches that will advance both educator professional enhancement and direct student digital competency training.

2. Pedagogical Innovation and Teacher Competence

The surveyed staff members identified multiple benefits from flipped classrooms and educational games since these practices enhanced student achievement and classroom participation. Several delays in implementing innovation emerged from staff hesitance to change alongside insufficient administrative motivation for encouraging new teaching practices. Survey responses indicated peer mentoring programs along with student feedback systems serve as main elements that enhance educational competencies among teaching staff. Educational institutions need to implement both protected planning time and recognition systems so teachers can innovate due to their demonstrated innovation readiness. The education sector exists in a transitional stage because educators recognize modern classroom solutions yet the institutions restrict their use (Fradalé, 2024; Makarova & Makarova, 2018).

3. Enablers of Transformative Curriculum Delivery

According to the research findings peer mentoring programs together with accessible resources function as essential facilitators who promote transformative instructional approaches. Numerous staffing challenges and insufficient support time and unreliable technical support functions impeded implementation efforts. The current successful policy implementation shows no standardized approach since guidelines do not match what teachers actually teach in classrooms. The research reveals that peer-based mentoring support systems from the bottom up need to merge with present top-down policy initiatives. The majority survey respondents show that time pressures upon teachers compel them to acquire digital pedagogical competencies while systems should offer experimental testing environments that preserve core duties (Li 2024; Yetti 2024).

4. The transformation of education depends on using digital-pedagogical approaches which combine educational methods achieved through blended learning methods. A large number of teachers found blended learning suitable for individualized learning alongside teamwork because it allowed students to gain a deeper comprehension of the material. The assessment tools applied by teachers lacked proper measurement of blended learning outcomes therefore producing differences between educational techniques and assessment approaches. Official staff members limited the success of subsequent pilot programs due to their heavy administrative responsibilities.

**Conclusion**

Systemic barriers and insufficient support from the institution together with student digital readiness gaps prevent teachers from successfully integrating ICT in their curriculum delivery though they possess adequate digital literacy skills. Information systems' transformation in education needs teacher competence combined with complete institutional backing and student skill development to succeed. The study shows that pedagogical innovation encounters implementation difficulties even when teachers show readiness to implement new teaching methods. The major barriers to integration consist of limited availability of time as well as resistance to change alongside insufficient systemic support mechanisms. Educational institutions exist between the two states because they acknowledge innovative pedagogies yet do not receive complete policy or practice support for their implementation. The barriers to transformation consist of time constraints and bureaucratic inefficiencies together with resource availability and peer mentoring. Better policy implementation frameworks should exist to bridge top-down directives with bottom-up teaching practices because they effectively connect educational instructions to classroom delivery. The pedagogical advantages of blended learning remain limited by structured assessment routines as well as complicated administrative procedures. Present blended learning practices demonstrate existing institutions have not achieved complete adaptation to support this revolutionary teaching model.

**Recommendations**

Schools need to offer combined training for technical together with pedagogical competencies while improving their infrastructure and establishing student digital readiness initiatives and maintaining tech support teams accessible to teachers whenever needed.

The system of pedagogical innovation needs time, recognition programs, learning communities and training for leaders to build innovative classroom environments.

The delivery of transformative curriculum requires authorities to minimize administrative obstacles, develop common resource systems, make policies match actual classroom needs and establish teacher-driven pilot initiatives for large-scale innovation adoption.

Blended Learning Implementation requires teachers to redesign assessment methods for blended learning results while leaders should modify workload requirements and establish clear implementation standards and launch communities to share blended learning experiences between professionals.

Various changes throughout the system should include a staged approach to policy deployment alongside complete teacher training combined with equal resource provision and teacher participation in decision-making and collaborative research activities.

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1.

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3.

**REFERENCES**

Acquah, E. (2023). *The Impact of Tutors’ Digital Literacy on Ict Integration of Pre-Service Teachers: A Case Study of OLA College of Education* (Doctoral dissertation, University of Cape Coast).

Amissah, P. B. (2023). Digital literacy and teacher preparedness. *University of Cape Coast*.

Amissah, P. B. (2023). *Digital literacy skills as a determinant of teacher‟ s Preparedness to use the 2019 curriculum: a case of basic School teachers in cape coast metropolis* (Doctoral dissertation, University of Cape Coast).

Budiarto, M. K., Rahman, A., & Efendi, A. (2024). Proposing information and communication Technology (ICT)-Based Learning transformation to create competitive human resources: A theoretical review. *Multidisciplinary Reviews*, *7*(4), 2024076-2024076.

Falloon, G. (2020). From digital literacy to digital competence. *ETR&D, 68*(5), 2449-2472.

Falloon, G. (2020). From digital literacy to digital competence: the teacher digital competency (TDC) framework. *Educational technology research and development*, *68*(5), 2449-2472.

Fradalé, P. A. (2024). *Pedagogic Shift: Supporting Teachers’ Change in Professional Practice A Study Through the Example of Blended Learning* (Doctoral dissertation, Southern Cross University).

Gruszczynska, A., Merchant, G., & Pountney, R. (2013). Digital futures in teacher education. *EJEL, 11*(3), 193-206.

Gruszczynska, Anna, Guy Merchant, and Richard Pountney. "" Digital futures in teacher education": exploring open approaches towards digital literacy." *Electronic Journal of e-Learning* 11.3 (2013): pp193-206.

Khanum, N. " TRANSFORMATIVE POTENTIAL OF ICT PEDAGOGIES: EMPOWERING LEARNERS IN THE DIGITAL AGE. *PERSPECTIVE OF ICT TOOLS IN EDUCATION*, *29*, 406.

Li, W. (2024). ICT-based teaching competence in blended learning. *Delaware State University*.

Li, W. (2024). *Salient Factors and Training Requirements Influencing ICT-Based Teaching Competence of University-Level English Teachers Through Blended Learning in Fujian Province, China: A Phenomenological Mixed-Methods Study* (Doctoral dissertation, Delaware State University).

Makarova, E. A., & Makarova, E. L. (2018). Blending pedagogy and digital technology to transform educational environment. *International Journal of Cognitive Research in Science, Engineering and Education:(IJCRSEE)*, *6*(2), 57-66.

Marín, V. I., & Castaneda, L. (2023). Developing digital literacy for teaching and learning. In *Handbook of open, distance and digital education* (pp. 1089-1108). Singapore: Springer Nature Singapore.

Upadhyaya, H. (2024). *Digital Education And Economic Transformation: Bridging The Gap*. Meadow Publication.

Yetti, E. (2024). Pedagogical innovation and curricular adaptation in enhancing digital literacy: A local wisdom approach for sustainable development in Indonesia context. *Journal of Open Innovation: Technology, Market, and Complexity*, *10*(1), 100233.

Yetti, E. (2024). Pedagogical innovation for digital literacy. *JOI:TMC, 10*(1), 100233.

Nantha, C., Siripongdee, K., Siripongdee, S., Pimdee, P., Kantathanawat, T., & Boonsomchuae, K. (2024). Enhancing ICT literacy and achievement: A TPACK-based blended learning model for Thai business administration students. Education Sciences, 14(5), 455.

Charles Raphael, CRN, and Visent Kipene. 2024. “Digital Literacy Skills Among Students in Technical Education and Training (TET) Institutions, Tanzania”. Journal of Scientific Research and Reports 30 (11):501-7. <https://doi.org/10.9734/jsrr/2024/v30i112578>.

Sugihono, Chris, Sunarru Samsi Hariadi, and Sri Peni Wastutiningsih. 2024. “Digital Literacy Among Agricultural Extension Agents in North Maluku, Indonesia”. Asian Journal of Agricultural Extension, Economics & Sociology 42 (6):417-29. https://doi.org/10.9734/ajaees/2024/v42i62504.