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Teachers' Competencies and Utilization of E-Learning in Technology and Livelihood Education Among Public Schools in Congressional District I

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Abstract

The transition to e-learning in Technology and Livelihood Education (TLE) presents a unique challenge due to the subject's inherently hands-on nature. This shift requires teachers to evolve from traditional demonstrators into digital facilitators proficient in digital literacy, pedagogical adaptation, and virtual management. E-Learning simply means learning using electronic devices and the internet. Think of it as school or training delivered digitally, like a teacher assigning a project using a website, a student watching an educational video on a tablet, or an entire college course being conducted online. It allows students to access lessons, resources, and communicate with teachers and peers using computers or smartphones, often giving them the flexibility to learn at their own pace and place. This study aimed to identify the specific challenges TLE teachers face to help school administrators and curriculum designers optimize resource allocation and support systems, ultimately improving student career readiness within the SDO Batangas Province. Using a quantitative descriptive research design, the study analyzed the relationship between teacher competence and e-learning utilization. The research focused on public secondary schools in Congressional District I, SDO Batangas Province, for the School Year 2025–2026. Out of a total population of 256 TLE teachers, 155 respondents were selected through a simple random sampling technique. Data were gathered to assess three competency domains: technological skills, pedagogical instruction, and adaptability/innovation.

The findings indicated that TLE teachers possess a moderate level of competence across all three domains. Regarding utilization, teachers showed a moderate level of engagement with digital platforms and content creation; however, tools for assessment and feedback remained only slightly utilized. Statistical analysis revealed a significant and very strong positive relationship between the teachers' competence levels and their extent of e-learning utilization, with high statistical significance across all areas. While teachers were competent, they faced persistent barriers to full integration. The most significant hurdles included the need for advanced skills in digital assessment and the systemic issue of unstable internet connectivity. The composite mean suggested these challenges are a shared experience among the teaching force. To address these gaps, the study concluded with the development of a proposed innovative activity designed to bridge competency deficits and overcome infrastructure hurdles, ensuring more resilient and effective TLE instruction.

Keywords: *Teachers Competencies, Utilization, e-Learning, Innovative Activity, TLE instruction*

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1. Introduction

Background and Rationale

The global educational landscape is undergoing a radical transformation driven by the rapid evolution of digital technology. In the context of Technology and Livelihood Education (TLE), this shift is particularly complex. Unlike traditional academic subjects, TLE is intrinsically hands-on and vocational, making the transition to remote or hybrid instruction a significant challenge. For e-learning to be successful in this field, teachers must transcend their roles as manual demonstrators to become digital facilitators and instructional designers.

Internationally, organizations like UNESCO and the World Economic Forum have flagged a readiness gap, noting that while digital access has increased, teacher confidence and specialized ICT training have not kept pace. In the Philippines, this issue is exacerbated by a stark digital divide. National data reveal critical infrastructure deficits, including thousands of last-mile schools without electricity and a severe shortage of hardware, as evidenced by a teacher-to-computer ratio of 1:30. These systemic barriers often restrict technology use to administrative tasks rather than to deep, integrated instruction.

In Congressional District I, a unique paradox exists; while the area experiences rapid urbanization and commercial growth, the public secondary school's lag. TLE teachers in this district are tasked with preparing students for a high-tech workforce while contending with aging hardware and inconsistent internet connectivity. Furthermore, the diverse socio-economic profiles of students in an urbanizing district force teachers to design flexible content that caters to both tech-rich and tech-poor households. Assessing the competencies of TLE teachers in this specific locale is essential to bridge the gap between industrial demand and educational delivery.

The primary motivation for this study stems from the urgent need to align TLE instruction with the demands of the 21st-century workforce. TLE is the primary vehicle for equipping junior high school students with practical, employable skills; however, if the delivery of these skills is hampered by low technological competence or inadequate resources, the subject's core purpose is undermined.

Despite the district's economic progress, the digital lag in classrooms creates a disconnect between student potential and actual career readiness. The goal is to move beyond temporary emergency remote teaching and toward a sustainable, standardized, and competent e-learning ecosystem that ensures no student in Congressional District I is left behind in an increasingly digital economy.

Review of Related Literature

The present study aligns with the literature by rooting teacher competence in the PPST and the TPACK framework, which views technology as a blend of content, pedagogy, and tools (Devera et al., 2021; Rosales, 2021). Similar to the findings of Dela Cruz et al. (2025) and Abella and Domingo (2025), this research recognizes that Filipino teachers generally possess high

digital literacy, yet their success is heavily dependent on self-efficacy and institutional support. Furthermore, consistent with the localized studies by Pornela (2023) and Adarlo (2023), this investigation acknowledges a persistent utilization gap in which high technical skills do not always translate into frequent classroom use due to barriers such as limited resources and technical malfunctions.

Unlike the broader international perspectives of the OECD (2023) or the psychometric scale validation of Tzafilkou et al. (2023), this study is uniquely situated within the specific socio-geographic context of Congressional District I. While Dimaano (2023) explored niche tools like TikTok and Sergeeva (2024) focused on pre-service teachers, this research addresses a distinct gap by examining the actual utilization of e-learning platforms among active TLE practitioners. By focusing on the technical-vocational sector, which Adarlo (2023) suggests has unique strand-specific challenges, this study provides a more specialized analysis of how digital competencies are operationalized in high-stakes, skill-based subjects compared with general education settings.

Focusing on teachers' use of e-learning in TLE instruction, the present study aligns with the literature by conceptualizing e-learning as a strategic tool for human capital development and workforce readiness, as argued by Bayudan-Dacuycuy and Serafica (2023). Consistent with the findings of Ilustre (2025), Cueto (2021), and Alcaide and Blancia (2024), this research finds that TLE teachers generally value and possess the skills to use digital tools for assessment and instruction. Furthermore, the study shares a common focus on the systemic barriers identified by Goles et al. (2024) and Mayantao and Tantiado (2024), specifically the persistent challenges of unstable internet, lack of equipment, and the need for sustained, hands-on professional development to move beyond basic digital literacy (Ranga, 2025; Smetana & Bell, 2021).

While the literature offers broad national and international perspectives, such as the OECD's policy analysis or Kato et al.'s (2022) focus on the Internet of Things (IoT), the study is distinct in its localized focus on Congressional District I. Unlike Ma and Yang (2020), who focus on high-end AR/VR simulations, or Al-Balushi and Al-Harrasi (2021), who emphasize entrepreneurial software, the research examines the broader practical utilization of general e-learning platforms in a public-school setting. Additionally, whereas Cattaneo et al. (2025) conducted a multi-country survey of 21 different technologies, the study provides a deep dive into the specific pedagogical alignment of these tools within the unique technical strands of the Philippine TLE curriculum, filling the gap for context-sensitive data in non-urban or specific district divisions as suggested by Biray et al. (2024).

Regarding the challenges faced by TLE teachers in using e-learning, the present study aligns with the literature in identifying inadequate infrastructure and connectivity as the most pervasive barriers to e-learning, a challenge emphasized by Espinosa and Cardenas (2025) and Alvarez (2020). Consistent with the findings of Mamayabay (2024) and Pura (2022), the research recognizes the dual-resource burden unique to TLE, in which limited budgets must be allocated between traditional workshop tools and modern digital equipment. Furthermore, the study aligns with Pate and Blanton (2022) and Barcelona et al. (2023) in highlighting the time-

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intensive nature of technology integration and the lack of targeted, TLE-specific professional development, which often forces teachers to revert to traditional, low-tech instructional methods.

While the literature covers broad national digital divides and international vocational contexts, such as Riyanda et al.'s (2025) work in Jordan and Anwar et al.'s (2024) study in Southeast Asia, the study is specifically contextualized within the unique socio-economic landscape of Congressional District I. Unlike Domingo and Mina (2024), who focused on the specific safety and industry-grade requirements of the TVL track in Senior High, this study examines the broader TLE curriculum in public schools. Additionally, while Magno and Mendoza (2025) highlight the specific stress caused by the new MATATAG curriculum, the research centers on persistent, fundamental competencies and utilization gaps that exist regardless of curricular shifts, providing a localized baseline for teachers in your district.

Lastly, focusing on a plan of innovative activities, the present study aligns with the consensus that effective training must shift from isolated workshops to a Continuous Professional Development (CPD) model, as advocated by Smetana and Bell (2021) and Babor and Dela Cruz (2025). Like the works of Abapo (2024) and Sabac (2025), this research emphasizes the TPACK framework as the essential foundation for TLE instruction, particularly the need to translate psychomotor skills into digital formats such as video demonstrations and simulations. Furthermore, this study echoes the findings of Dela Torre and Ramos (2024) and Lim et al. (2025) regarding the necessity of collaborative learning structures, such as School Learning Action Cells (SLAC), to provide the peer support and hands-on practice required to build teacher self-efficacy (Bandura, 2021).

Hence, while the broader literature explores diverse frameworks such as ADDIE for instructional design (Spatioti et al., 2022) and the Kirkpatrick model for corporate and youth evaluation (Quinton et al., 2022; Cheung, 2023), this study focuses on the contextualized needs of TLE teachers in Congressional District I. Unlike the international health-sector training programs discussed by Cotta et al. (2024) or the CDC's virtual nursing home capacity building (Penna et al., 2022), the research addresses the specific technical strands of the Philippine TLE curriculum. Additionally, while Azad et al. (2022) focus on psychosocial well-being and stress management, this study prioritizes the technical-pedagogical bridge, specifically how to help teachers become resource creators who can align digital modules with TESDA competencies despite localized resource constraints (Goles et al., 2025).

The cited literature closely aligns with the present study, as it collectively establishes that teacher competence in Technology and Livelihood Education (TLE) is no longer defined by basic ICT literacy. Still, by the sophisticated integration of the TPACK framework and PPST standards, studies consistently mirror the present investigation's focus on the utilization gap, where systemic dual-resource barriers frequently undermine high digital self-efficacy. Furthermore, literature converge on the necessity of moving toward Continuous Professional Development (CPD) and collaborative structures such as School Learning Action Cells (SLAC), thereby validating the present study's premise that localized, hands-on support is the primary catalyst for transforming TLE teachers into effective digital resource creators.

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Statement of the Problem

This study aims to assess the influence of teachers' competencies on the utilization of e-learning in technology and livelihood education Among Public Schools in Congressional District I. Specifically, it sought answers to the following research questions:

1. What is the level of competencies in using e-learning in teaching assessed by teachers themselves relative to:
   1.1. technological skills;
   1.2. pedagogical instruction; and
   1.3. adaptability and innovation?

2. How may the extent of utilization of e-learning in teaching TLE be assessed by the respondents in terms of:
   2.1. digital platforms;
   2.2. content creation and delivery; and
   2.3. assessment and feedback?

3. Is there any significant relationship between the assessments on the level of teachers' competencies and on the extent of utilization of e-learning?

4. What are the challenges faced by TLE teachers in utilizing e-learning?

5. Based on the results of the study, what innovative activities may be proposed?

Hypothesis

The null hypothesis was tested in this study

There is no significant relationship between the assessment on teachers' level of competencies and on their extent of utilization of e-learning.

2. Materials and Methods

Research Design

The study utilized a quantitative descriptive research design to assess the influence of teachers' competencies on the utilization of e-learning in Technology and Livelihood Education (TLE) among public secondary schools in Congressional District I.

The quantitative technique aligns with Bhandari's (2020) assertion that gathering and analyzing numerical data is the basis of quantitative research. It may be used to identify trends and averages, make predictions, assess causal links, and extend findings to larger groups. The descriptive design is considered appropriate as it aims to systematically describe the technology-

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based tools used by teachers in teaching TLE and examines the level of teachers' competencies in using e-learning in teaching without manipulating any variables.

Participants

The subjects of the study were 155 TLE teachers out of 265 population during the school year 2025 – 2026 from the public junior high school in Congressional District I. Raosoft calculation procedure was utilized in the selection of TLE teachers. Raosoft is a database management system primarily used to calculate the sample size of a research study, a proven system that possesses high data integrity and security. Simple random sampling was used to select the respondents.

Instruments

A validated Likert-type questionnaire was the primary instrument for collecting quantitative data regarding the digital platforms, content creation and delivery, assessment and feedback, technological skills, pedagogical instruction, and adaptability and innovation (teachers' competencies), as well as the challenges faced by TLE teachers in integrating e-learning into their teaching practices.

Procedure

The data-gathering procedures for this survey research involved several key steps to ensure the accuracy and reliability of the results. First, a sample population was identified, and a sampling method was determined to select participants. This involved obtaining a list of potential participants and purposely selecting individuals to participate in the survey.

Then, a survey questionnaire was developed that included clear and concise questions that were relevant to the research objectives. The survey was pre-tested to ensure clarity and ease of completion. After any necessary revisions were made, the final survey instrument was distributed to the selected participants.

The researcher asked permission and approval from the principals of the select public junior high schools in Congressional District I for the distribution of the questionnaire to the respondents. The questionnaires were personally distributed by the researcher to the respondents. Participants were given a set amount of time to complete the survey, and reminders were sent out to ensure a high response rate.

A follow-up was made to ensure that all the respondents could answer the entire questionnaire. After that, the raw data was retrieved, and the answers were analyzed and evaluated.

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Data Analysis

The data gathered in this descriptive quantitative research were analyzed using appropriate statistical tools to interpret the responses in alignment with the study's objectives. The data were compiled, organized, and tabulated to ensure clarity and facilitate understanding. These included ranking, weighted mean, Pearson's r product-moment correlation, including unstructured interview.

3. Results

Table 1 presents the level of competencies among TLE teachers in using e-learning, specifically in terms of their technological skills.

Table 1. Teachers' Level of Competencies in Using e-Learning in Teaching in terms of Technological Skills

As part of the level of teacher's competencies using e-learning in teaching, I …..	WM	Interpretation	Rank
1. can operate classroom hardware, such as connecting my laptop to a projector.	3.14	Moderately Competent	1
2. can organize my digital files and instructional materials using cloud storage services.	3.08	Moderately Competent	2
3. can evaluate the credibility of digital information sources for curriculum integration.	3.05	Moderately Competent	4.5
4. can independently troubleshoot common software that arises while teaching a lesson.	2.98	Moderately Competent	6.5
5. can edit multimedia elements to customize my learning resources.	3.06	Moderately Competent	3
6. use spreadsheet software to compute student data for analysis.	3.05	Moderately Competent	4.5
7. can manage educational software on my teaching device.	2.98	Moderately Competent	6.5
8. apply basic digital security measures to protect student privacy and data.	2.97	Moderately Competent	8
9. can navigate all features and settings within our school's Learning Management System (LMS).	2.87	Moderately Competent	10
10. can utilize digital accessibility features and settings to create inclusive content for all learners.	2.92	Moderately Competent	9
COMPOSITE MEAN	**3.01**	**Moderately Competent**	

***Legend**: 3:50 – 4.00 Highly Competent (HC) 2.50 – 3.49 Moderately Competent (MC) 1.50 – 2.49 Slightly Competent (SC)*
1.00 – 1.49 Least Competent (LC)

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The analysis of the three highest weighted means showed that teachers were most proficient in basic hardware and resource management. The highest-ranked indicator is the ability to "operate classroom hardware, such as connecting my laptop to a projector" with a WM of 3.14, Moderately Competent. This suggests that teachers had achieved their highest level of comfort with the physical tools of trade, such as connecting laptops to projectors and document cameras. Because these devices were essential for daily face-to-face instruction, the high means were likely a result of constant, repetitive use, which had turned these technical tasks into routine habits. This aligned with the TPACK framework, where Koehler and Mishra (2021) emphasized that effective integration was rooted in the Technological Knowledge of the tools themselves, suggesting that familiarity with hardware served as the baseline foundation for more complex pedagogical integration.

This is followed by the ability to "organize my digital files and instructional materials using cloud storage services" with a WM of 3.08 Moderately Competent. This reflects the modern administrative shift in education, where physical filing cabinets have been replaced by digital services. The relatively high score indicates that teachers have adapted well to the necessity of digital organization to access materials across various devices. This transition supports the findings of Mayer and Turner (2020), who argued that such organizational skills are primary measures of digital literacy, directly impacting a teacher's ability to manage a digital learning environment effectively.

The third highest indicator is the ability to "edit multimedia elements to customize my learning resources" at a WM of 3.06, Moderately Competent. By customizing multimedia elements for their specific lessons, they demonstrated a proactive effort to cater to a digital-native student body. This practice resonates with the Philippine Professional Standards for Teachers (PPST), which, as Devera et al. (2021) noted, mandates the proper selection of teaching and learning resources, indicating that these teachers are successfully operationalizing national policy by using ICT to create more meaningful and engaging learning experiences.

Conversely, the three lowest weighted means highlighted areas requiring further technical depth and specialized knowledge. The lowest-ranked indicator is the ability to "navigate all features and settings within our school's Learning Management System (LMS)" with a WM of 2.87 Moderately Competent. This finding supports the assertion by Mamayabay, R. C. (2024) that one-off training sessions were insufficient for systemic mastery. To move from being simple users to confident innovators within complex platforms like an LMS, teachers require the sustained professional learning communities and ongoing mentorship that the authors advocate for.

Ranking just above is the ability to "utilize digital accessibility features and settings to create inclusive content for all learners" with a WM of 2.92, Moderately Competent. The lower score suggested that while teachers were comfortable creating general content, they struggled with the technical settings required to support learners with disabilities. This underscored the argument by Bin Abdulrahman et al. (2025) that true TPACK competence is not just about using software, but about understanding how to facilitate learning in a way that is instructionally sound and relevant to their students' needs, which necessitates specific training in inclusive digital design that the current faculty appears to lack.

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The eighth-ranked indicator is the ability to "apply basic digital security measures to protect student privacy and data" with a WM of 2.97, Moderately Competent. While teachers may practice basic digital hygiene, the lower score indicated they may lack the deeper technical knowledge required to fully protect student privacy or navigate complex data laws. This lack of confidence in systemic security can be linked to the concept of teacher self-efficacy discussed by Rebucas and Dizon (2024); without a firm belief in their ability to handle the technical challenges of cybersecurity, teachers may avoid advanced security settings, potentially leaving student data exposed.

Overall, the Composite Mean is 3.01, which falls within the Moderately Competent range. This indicates that while TLE teachers in Congressional District I possessed the necessary foundational skills to facilitate e-learning, their competency remained at an intermediate level. The interpretation suggests that they were comfortable with basic ICT tasks but required targeted professional development to bridge the gap in more specialized areas like LMS optimization, digital inclusivity, and cybersecurity to transition from being moderate users to highly proficient digital educators.

Table 2 refers to the level of teacher competencies in using e-learning in teaching in terms of pedagogical instructions.

Table 2. Teachers' Level of Competencies in Using e-Learning in Teaching in terms of Pedagogical Instruction

As part of the level of teachers' competencies using e-learning in teaching, I …..	WM	Interpretation	Rank
1. can integrate technology into my lessons to introduce complex concepts.	2.97	Moderately Competent	1
2. can utilize technology to facilitate collaborative learning activities among students.	2.90	Moderately Competent	6
3. can employ digital tools to effectively differentiate instruction.	2.92	Moderately Competent	4.5
4. can utilize technology-based simulations to provide authentic, practical learning experiences for my students.	2.94	Moderately Competent	3
5. can use it to effectively manage classroom activities, ensuring students remain focused.	2.92	Moderately Competent	4.5
6. can design and utilize Project-Based Learning (PBL) that requires my students to use technology for research and content creation.	2.86	Moderately Competent	8
7. can use technology to promote students' higher-order thinking skills.	2.95	Moderately Competent	2
8. select technological tools to ensure they are appropriate for the intended learning objectives.	2.88	Moderately Competent	7
9. can guide my students in the ethical, legal, and responsible use of technology and digital	2.84	Moderately Competent	9

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resources.			
10. can use digital communication tools to effectively engage parents and guardians in their children's learning process.	2.83	Moderately Competent	10
COMPOSITE MEAN	**2.90**	**Moderately Competent**	

***Legend**: 3:50 – 4.00 Highly Competent (HC) 2.50 – 3.49 Moderately Competent (MC) 1.50 – 2.49 Slightly Competent (SC)*
1.0 – 1.49 Least Competent (LC)

As reflected in the table, the highest-ranked competency in pedagogical instruction is the ability to "integrate technology into my lessons to introduce complex concepts" with a WM of 2.97, Moderately Competent. This indicates that teachers were most comfortable using digital tools as a primary support for explaining difficult subject matter, likely because this directly enhanced their traditional teaching role by making abstract ideas more concrete and visually understandable. This aligns with the concept of the teacher as a content creator and curator, where Chen et al. (2020) emphasize that digital competence is defined by a teacher's ability to design content specifically tailored to meet their students' needs and align with curriculum objectives.

Ranking second is the ability to "use technology to promote students' higher-order thinking skills" with a WM of 2.95, Moderately Competent. This suggests that teachers recognized the pedagogical value of technology beyond simple content delivery and were making efforts to foster analytical and critical thinking, though they might still be in the developmental stages of fully mastering these strategies. This movement away from a teacher-led, sage on the stage model toward a facilitator role was supported by Larson and Lockee (2020), who measured a teacher's competence by their ability to select and use e-learning to empower students to become active participants in their learning through research and collaborative projects.

Followed closely is the ability to "utilize technology-based simulations to provide authentic, practical learning experiences for my students" with a WM of 2.94 (Moderately Competent). This score reflects a positive shift toward experiential learning, where teachers used simulations to bridge the gap between theoretical classroom knowledge and real-world applications. This practice was conceptually situated within the Philippines' broader agenda of digital transformation; as Treceñe (2021) noted, e-learning systems are conceptualized as an advantageous technology that enhances the learning environment by leveraging digital resources to create more authentic and efficient educational experiences.

In contrast, the three lowest weighted means point toward difficulties in digital communication, ethics, and advanced instructional design. The lowest-ranked indicator is the ability to "use digital communication tools to effectively engage parents and guardians in their children's learning process," with a WM of 2.83, Moderately Competent. This result suggests that while teachers understood the value of student-centered projects, they found the structural demands of facilitating tech-heavy, long-term projects to be challenging. This difficulty is

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consistent with the perspective of Kato et al. (2022), who argued that the successful utilization of digital infrastructure is essential for creating more seamless and efficient educational experiences, yet remains a challenge in the current developmental context.

The ninth rank is held by the ability to "guide my students in the ethical, legal, and responsible use of technology and digital resources" at a WM of 2.84, Moderately Competent. The lower mean here indicates a potential gap in digital citizenship education; teachers felt less confident in teaching complex concepts like intellectual property and ethical online behavior. This highlights a limitation in current practice relative to the findings of Means et al. (2020), who emphasized that a truly competent teacher must leverage digital tools to provide personalized, formative feedback and maintain a digital environment that is ethically sound and responsive to student needs.

The eighth-ranked indicator involves the ability to "design and utilize Project-Based Learning (PBL) that requires my students to use technology for research and content creation," with a WM of 2.86, Moderately Competent. This was interpreted as moderately competent and pointed to a significant area for development. This low score reflects a potential disconnect in the use of e-learning for differentiated instruction and broader community engagement. As Chan et al. (2021) expounded, the utilization of e-learning to support differentiated instruction is central to modern pedagogy; when teachers lack the tools or confidence to communicate effectively with guardians via digital platforms, they miss critical opportunities to tailor learning pathways that ensure every student can benefit from technology-enhanced instruction.

The Composite Mean for Pedagogical Instruction is 2.90, which is interpreted as Moderately Competent. This overall result indicates that TLE teachers have a functional grasp of how to use technology to support instruction, particularly in simplifying complex vocational topics. However, the analysis highlights a need for targeted training in "soft" pedagogical skills, such as digital ethics and parental engagement, as well as "hard" instructional design like Project-Based Learning. Strengthening these areas would help move teachers toward a more holistic and student-centered digital pedagogy.

Table 3 presents the level of teachers' competencies in using e-learning in teaching in terms of adaptability and innovation.

Table 3. Teachers' Level of Competencies in Using e-Learning in Teaching in terms of Adaptability and Innovation

As part of the level of teacher's competencies using e-learning in teaching I …..	WM	Interpretation	Rank
1. can modify traditional teaching tasks to take full advantage of innovative technological capabilities.	2.92	Moderately Competent	1.5
2. can actively seek out educational software that I believe could improve student learning outcomes.	2.83	Moderately Competent	6

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3. can transfer my technical skills from one digital platform to a similar, but new, learning platform.	2.81	Moderately Competent	9
4. can creatively combine multiple technological tools to create a unique and effective instructional sequence.	2.81	Moderately Competent	9
5. can revise my lesson plans to incorporate newly available technology.	2.92	Moderately Competent	1.5
6. use technology to solve unexpected classroom problems.	2.83	Moderately Competent	6
7. can customize the features of digital tools to make them better fit the specific needs of my students or subject matter.	2.83	Moderately Competent	6
8. can lead professional development sessions with colleagues regarding the utilization of new teaching technologies.	2.84	Moderately Competent	4
9. can support students to use new digital tools for completing their assignments and projects.	2.88	Moderately Competent	3
10. can use continuous feedback from technology-based assessments to immediately adjust my instructional strategies.	2.81	Moderately Competent	9
COMPOSITE MEAN	**2.85**	**Moderately Competent**	

***Legend**: 3:50 – 4.00 Highly Competent (HC) 2.50 – 3.49 Moderately Competent (MC) 1.50 – 2.49 Slightly Competent (SC)*
1.00 – 1.49 Least Competent (LC)

The highest-ranked competencies in terms of adaptability and innovation are the modification of traditional teaching tasks to take full advantage of innovative technological capabilities and the revision of lesson plans to incorporate newly available technology, both of which earned a weighted mean of 2.92. These were interpreted as moderately competent. The parity in these scores suggests that teachers were willing to adjust their established routines to accommodate modern tech. This willingness was likely driven by the practical realization that traditional methods often require augmentation to remain relevant in a digital classroom, representing a foundational shift toward adopting new pedagogical tools. This aligned with the perspective of Bayudan-Dacuycuy and Serafica (2023), who positioned e-learning as a critical national investment in human capital, where the effective integration of digital tools is essential for teachers to prepare students for a continually disrupted and digitized economy.

Following these is the ability to support students to use new digital tools for completing their assignments and projects, which holds a weighted mean of 2.88 and was interpreted as moderately competent. This score indicates that while teachers were capable of guiding students through new interfaces, they found it easier to act as facilitators of existing tool usage rather than acting as primary innovators. The mean reflects a growing comfort level in managing student-

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facing technology. This matches the findings of Kim and Ryu (2022), who emphasized that e-learning tools act as instruments for students to create and share their work, noting that teachers who successfully facilitate digital storytelling or portfolio creation directly enhance their students' creativity and presentation skills.

The lowest mean in the table is also 2.81 for the ability to use continuous feedback from technology-based assessments to immediately adjust instructional strategies, interpreted as moderately competent. This indicates a gap in the use of data-driven pedagogy. Even with access to digital assessment tools, teachers struggled to translate that raw data into real-time instructional changes. This underscores the necessity of what Dunn and Kennedy (2021) observed as the transformative potential of digital tools: they should automate feedback and track development to shift the teacher's role from a simple grader to a facilitator, a transition that is currently hindered by the lack of proficiency in using assessment analytics.

Also ranking ninth with a weighted mean of 2.81 is the ability to creatively combine multiple technological tools to create a unique and effective instructional sequence, which is interpreted as moderately competent. This score highlights a limitation in integrative innovation; while teachers could use individual tools, the complex task of orchestrating multiple digital components into a cohesive instructional flow was perceived as challenging. This is a critical area for growth, as Carstens et al. (2024) explained that immersive technologies like virtual and augmented reality require high levels of pedagogical planning to provide safe, complex virtual labs - an integration that demands the very orchestration skills these teachers are currently struggling to master.

In the eight ranks, the ability to transfer technical skills from one digital platform to a similar but new learning platform ranks ninth with a weighted mean of 2.81, interpreted as moderately competent. This result suggests that while teachers were adept at using specific tools, they struggled with broader digital agility. The lower mean indicates that when faced with a new system, teachers find it difficult to generalize their existing knowledge. This highlights the importance of the collaborative platforms mentioned by Agaton & Cueto (2021), who argued that such tools simulate modern workplace environments; without the ability to transfer skills across these platforms, teachers struggled to fully replicate the collaborative and communicative nature of modern professional settings for their students.

The overall composite mean for adaptability and innovation is 2.85, which is interpreted as moderately competent. This average demonstrates that teachers were not resistant to innovation, but they are currently working within a comfort zone that favors incremental updates over radical digital transformation. While they could perform basic modifications to their teaching, they were still transitioning toward the level of high competence required to independently seek out new software, perform complex tool integration, and use data-driven feedback to adjust their teaching in real-time. This composite score underscores a need for professional development that moves beyond basic usage and focuses on empowering teachers to become creators and innovators.

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Following Table 4, it shows the extent to which teachers moderately utilize e-learning in terms of digital platforms.

Table 4. Teachers' Extent of Utilization of e-Learning in Teaching in terms of Digital Platforms

As part of the utilization of e-learning in teaching TLE, I…….	WM	Interpretation	Rank
1. Supervise internet-connected smart devices in demonstrating real-time data collection in TLE.	2.62	Moderately Utilized	2
2. Utilize digital platforms in creating streamlined for TLE students.	2.56	Moderately Utilized	5
3. Use virtual reality (VR) in teaching students' practical skills.	2.43	Slightly Utilized	10
4. Impart technology-based tools in conceptualizing practical TLE processes like cooking.	2.55	Moderately Utilized	7
5. Convey the use of software in helping students create digital portfolios.	2.55	Moderately Utilized	7
6. Utilize digital tools in automating the grading of TLE assessments.	2.68	Moderately Utilized	1
7. Use digital platforms in providing real-time feedback on student tasks.	2.55	Moderately Utilized	7
8. actively create digital portfolios within a platform to track students' skill development over time in TLE.	2.57	Moderately Utilized	4
9. Use e-commerce platforms in fostering entrepreneurial mindsets in TLE lessons.	2.55	Moderately Utilized	7
10. Apply adaptive learning platforms in scaffolding the teaching of hands-on TLE skills when instruction is delivered remotely.	2.54	Moderately Utilized	9
COMPOSITE MEAN	**2.56**	Moderately **Utilized**	

***Legend**: 3:50 – 4.00 Highly Utilized (HU) 2.50 – 3.49 Moderately Utilized (MU) 1.50 – 2.49 Slightly Utilized (SU)*
1.0 – 1.49 Least Utilized (LU)

The analysis of the three highest weighted means indicates that teachers primarily utilize digital platforms for assessment and data-driven instruction. The highest-ranked indicator is the ability to "utilize digital tools in automating the grading of TLE assessments" with a WM of 2.68 Moderately Utilized. This indicates that teachers were prioritizing efficiency in their administrative tasks, likely because automated grading significantly reduces the time spent on repetitive, manual evaluation. This finding aligns with Dunn and Kennedy (2021), who observed

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that digital tools can automate the grading of multiple-choice quizzes and provide real-time feedback, effectively shifting the teacher's role from a simple grader to a facilitator of learning.

This is followed by the practice of "supervise internet-connected smart services in demonstrating real-time data collection in TLE, "which earned a WM of 2.62, Moderately Utilized. This suggests that teachers were integrating modern, interconnected technology into the laboratory setting to give students hands-on experience with real-time data. This practice mirrors the conceptualization by Kato et al. (2022) regarding the Internet of Things (IoT), where the utilization of smart devices and ubiquitous connectivity is essential for streamlining digital educational experiences and preparing students for data-driven fields like smart cities and healthcare.

The third highest indicator is the use of digital platforms to provide real-time feedback on student tasks, with a WM of 2.59, Moderately Utilized. This score reflects a transition toward more dynamic instructional support, where teachers leveraged platforms to offer immediate guidance. This is supported by Means et al. (2020), who stated that a competent teacher is one who leverages digital tools to provide real-time, formative feedback that is both timely and personalized, allowing for continuous monitoring and adjustment of instruction.

On the other hand, the three lowest weighted means identify gaps in the use of immersive and adaptive technologies. The lowest-ranked indicator is the attempt to "use virtual reality (VR) in teaching students' practical skills," with a WM of 2.43 (Slightly Utilized). This indicates that virtual reality remains the least accessed technology, likely due to the high cost of hardware and complex content integration. This infrastructural bottleneck is a significant barrier identified by Espinosa and Cardenas (2025), who noted that the severe digital divide between urban and rural schools prevented the implementation of advanced instructional practices like virtual reality simulations, which would otherwise provide safe, cost-effective environments for practicing high-risk skills (Ma & Yang, 2020).

This is followed by the indicator "apply adaptive learning platforms in scaffolding the teaching of hands-on TLE skills when instruction is delivered remotely," with a WM of 2.54, Moderately Utilized. The consistently lower scores here reflect the challenge of infrastructure and the prohibitive cost of modern digital tools. While Al-Balushi and Al-Harrasi (2021) highlighted that these technologies are essential for fostering entrepreneurial mindsets, Mamayabay (2024) argued that poor connectivity and outdated equipment constrain teachers to simple presentations, preventing them from moving toward the transformative, immersive practices that are truly necessary to prepare students for the digital economy.

The third lowest, which shared a rank with several other items but sits at the lower end of the Moderately Utilized spectrum, includes several indicators such as imparting technology-based tools in conceptualizing practical TLE processes, use of software in helping students create digital platforms, and using e-commerce platforms in fostering entrepreneurial mindsets with a WM of 2.55. The lower score suggested that while teachers were familiar with basic digital tools, they faced significant hurdles when attempting to adapt highly physical or manual TLE subjects for a remote environment. As Mamayabay (2024) explained, this is compounded by the

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resource-intensive nature of the TLE curriculum; when schools face financial strain and infrastructure deficits, teachers lack the sophisticated cloud-based platforms needed to effectively scaffold practical skills like carpentry or Agri-Fishery Arts remotely.

The Composite Mean for Digital Platforms is 2.56, interpreted as Moderately Utilized. While this indicates a positive trend toward digital integration, it is the lowest composite mean compared to basic technological and pedagogical skills. The interpretation suggests that while TLE teachers were integrating digital platforms into their workflows - particularly for assessment and portfolios - there was a notable struggle to implement more advanced or specialized platforms like VR or adaptive learning systems. This indicates a need for increased institutional support and access to more diverse digital resources to fully realize the potential of e-learning in a practical, hands-on subject like TLE.

Table 5 illustrates the teachers' extent of utilization of e-learning in teaching Technology and Livelihood Education (TLE), specifically focusing on Content Creation and Delivery.

Table 5. Teachers' Extent of Utilization of e-Learning in Teaching in terms of Content Creation and Delivery

As part of the utilization of e-learning in teaching TLE, I…….	WM	Interpretation	Rank
1. Use presentation software in creating customized visual aids for TLE lesson delivery.	2.74	Moderately Utilized	1
2. Create instructional videos and tutorials to demonstrate TLE skills.	2.60	Moderately Utilized	4
3. Utilize Learning Management Systems (LMS) in organizing TLE content.	2.59	Moderately Utilized	5.5
4. Design interactive quizzes for delivering TLE concepts.	2.68	Moderately Utilized	2
5. Use digital tools for creating infographics to simplify complex TLE technical information.	2.63	Moderately Utilized	3
6. Integrate subject-specific simulation software tools in delivering practical TLE lessons.	2.52	Moderately Utilized	8
7. Use online collaboration tools for students in presenting the TLE project content.	2.54	Moderately Utilized	7
8. Use Word desktop publishing tools in generating printable TLE handouts.	2.59	Moderately Utilized	5.5
9. Utilize cloud storage services in sharing TLE learning resources with my students.	2.48	Slightly Utilized	9
10. Use computer-aided design (CAD) for creating technical drawings for TLE topics.	2.38	Slightly Utilized	10
COMPOSITE MEAN	**2.57**	Moderately **Utilized**	

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***Legend**: 3:50 – 4.00 Highly Utilized (HU) 2.50 – 3.49 Moderately Utilized (MU) 1.50 – 2.49 Slightly Utilized (SU)*
1.0 – 1.49 Least Utilized (LU)

The analysis of the three highest weighted means reveals that teachers were most comfortable using traditional and interactive digital presentation tools. The highest-ranked indicator is the "use of presentation software in creating customized visual aids for TLE lesson delivery" with a WM of 2.74, Moderately Utilized. This indicates that teachers prioritized visual instructional design, likely because presentation tools were user-friendly and offered a direct way to organize technical information for students. This practice aligns with Chen et al. (2020), who emphasized that digital competence involves a teacher's ability to create their own digital content specifically designed to meet student needs and align with curriculum objectives.

This is followed by the practice of "designing interactive quizzes for delivering TLE concepts," which garnered a WM of 2.68, Moderately Utilized. This suggests that teachers were leveraging technology to move beyond static content toward active student participation. This shift is supported by Means et al. (2020), who argued that a competent teacher uses digital tools to provide real-time, formative feedback, turning standard assessment into an interactive learning opportunity that allows teachers to monitor progress continuously.

The third highest indicator involves the "use of digital tools for creating infographics to simplify complex TLE technical information," scoring a WM of 2.63, Moderately Utilized. This score reflects an effort to make dense vocational content more accessible through visual synthesis. This resonates with the findings of Larson and Lockee (2020), who measured competence by the ability to select and use e-learning to empower students, noting that simplifying technical information is a crucial facilitation role that helps students become active participants in their learning.

Conversely, the three lowest weighted means highlight significant gaps in technical software applications and resource sharing. The lowest-ranked indicator is the "use of computer-aided design (CAD) for creating technical drawings for TLE topics" with a WM of 2.38, Slightly Utilized. This low score likely stems from the high learning curve associated with specialized CAD tools and the technical support gap. Al-Harrasi and Al-Balushi (2021) observed that the absence of knowledgeable IT support often derails the use of complex, specialized technology in the classroom, leading teachers to avoid such tools for fear of technical failure during a lesson.

This is followed by the "utilization of cloud storage services in sharing TLE learning resources with students," which received a WM of 2.48, Slightly Utilized. This low score revealed a gap in collaborative digital infrastructure. This limitation was highlighted by Espinosa and Cardenas (2025), who noted that the digital divide makes cloud-based sharing services impractical, forcing teachers to rely on localized or offline resources despite the clear benefits of cloud collaboration.

The third lowest indicator is the "integration of subject-specific simulation software tools in delivering practical TLE lessons," with a WM of 2.52, Moderately Utilized. The relatively lower score suggests that while teachers were comfortable with general software, they faced

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significant hurdles when integrating highly specialized technical simulations. This difficulty was exacerbated by the lack of adequate hardware and software resources, as Mamayabay (2024) explained that the financial strain of balancing traditional vocational equipment with expensive digital simulation software creates a prohibitive barrier for many schools.

The overall Composite Mean for the utilization of e-learning in Content Creation and Delivery is 2.57, which carries a verbal interpretation of Moderately Utilized. This result indicates that while teachers had moved beyond basic digitization, their efforts were concentrated on "delivery-side" tools like slideshows and quizzes rather than "creation-side" technical tools like CAD or simulation software. The analysis suggests a mid-level integration of e-learning where the primary focus is on enhancing the presentation of content rather than modernizing the technical methods through which TLE skills are taught and shared.

Table 6 presents the data regarding the teachers' extent of utilization of e-learning in teaching Technology and Livelihood Education (TLE), specifically in the domain of Assessment and Feedback.

Table 6. Teachers' Extent of Utilization of e-Learning in Teaching in terms of Assessment and Feedback

As part of the utilization of e-learning in teaching TLE, I…….	WM	Interpretation	Rank
1. Use online quizzing platforms to administer formative and summative tests in TLE.	2.49	Slightly Utilized	3
2. Utilize features in a Learning Management System (LMS) in tracking student progress for TLE tasks.	2.43	Slightly Utilized	7
3. Use digital tools/apps in grading performance-based TLE outputs.	2.54	Moderately Utilized	2
4. Provide immediate, automated feedback to students on their TLE comprehension through the use of technology-based assessment tools.	2.44	Slightly Utilized	6
5. Use digital portfolio tools for students to showcase their final TLE projects for assessment.	2.46	Slightly Utilized	5
6. Use audio recording tools in giving rich, personalized feedback on TLE work.	2.48	Slightly Utilized	4
7. Use spreadsheet software in managing student grades in TLE.	2.59	Moderately Utilized	1
8. Use online peer-assessment tools that allow students to review each other's TLE output.	2.37	Slightly Utilized	10

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9. Communicate assessment results and individual feedback to students and parents/guardians via digital channels.	2.41	Slightly Utilized	8
10. Use live streaming tools to remotely assess student performance on practical TLE tasks.	2.39	Slightly Utilized	9
COMPOSITE	**2.46**	**Slightly Utilized**	

Legend: *3:50 – 4.00 Highly Utilized (HU) 2.50 – 3.49 Moderately Utilized (MU) 1.50 – 2.49 Slightly Utilized (SU)*
1.0 – 1.49 Least Utilized (LU)

The analysis of the three highest weighted means shows that teachers were most inclined toward using familiar digital tools for logistical assessment tasks. The highest-ranked indicator is the "use of spreadsheet software in managing student grades in TLE" with a WM of 2.59, Moderately Utilized. This indicates that teachers prioritize foundational digital tools for administrative record-keeping, likely because spreadsheets provide a familiar and efficient interface for processing large volumes of student data. This reliance on established tools was consistent with the findings of Rebucas and Dizon (2024), who noted that teachers often gravitate toward applications they perceived as manageable to fulfill their basic administrative requirements, even as they expressed a need for training in more complex digital systems.

This is followed by the "use of digital tools/apps in grading performance-based TLE outputs," which obtained a WM of 2.54, Moderately Utilized. This suggests that teachers were moving toward digitizing the evaluation of practical skills, perhaps by using rubrics in digital formats to ensure more consistent assessments. This reflects the push toward modernizing pedagogical strategies mentioned by Sarmiento and Reyes (2024), who argued that strengthening a teacher's ability to apply innovative assessment strategies is critical for enhancing student outcomes in vocational subjects.

The third highest indicator is the "use of online quizzing platforms to administer formative and summative tests in TLE," with a WM of 2.49, Slightly Utilized. This indicates that while teachers had adopted basic grading software, the shift toward fully online testing platforms was still developing. This transition was addressed by Spatioti et al. (2022), who highlighted that the analysis and evaluation phases of the ADDIE framework remain vital for quickly adapting programs to digital delivery, suggesting that teachers were increasingly viewing online quizzing as a necessary component of this cyclical design process.

In contrast, the three lowest weighted means highlight a significant lack of interactive and remote feedback mechanisms. The lowest-ranked indicator is the "use of online peer-assessment tools that allow students to review each other's TLE output" with a WM of 2.37, Slightly Utilized. This indicates that collaborative assessment was the least prioritized method in the current TLE digital landscape. This lack of engagement might stem from the barriers identified by Abella and Domingo (2025), who noted that managing student interaction and engagement in a technology-

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rich environment could be a significant distraction, often leading teachers to favor more controlled, teacher-led assessment methods over peer-based digital interactions.

This is followed by the "use of live streaming tools to remotely assess student performance on practical TLE tasks" with a WM of 2.39, Slightly Utilized. This lower score highlights the difficulty of applying digital assessment to highly manual, hands-on tasks. This challenge was rooted in the logistical constraints identified by Dela Torre and Ramos (2024), who pointed out that inadequate planning and preparation often prevent teachers from effectively executing complex remote assessments, especially when these require specialized equipment that may not be available in a home setting.

The third lowest indicator is the effort to "communicate assessment results and individual feedback to students and parents/guardians via digital channels," with a WM of 2.41, Slightly Utilized. This low score reflects the broader institutional hurdles regarding home-school communication. As argued by Lim et al. (2025), the potential benefits of such digital feedback are often not fully realized due to a lack of systemic support from school leadership and institutions, leaving teachers to struggle with these communication tasks without clear guidance or the necessary digital infrastructure.

The Composite Mean for Assessment and Feedback is 2.46, which is interpreted as Slightly Utilized. This is a critical finding, as it represents the lowest composite mean across all tables provided. The analysis indicates that assessment remained the most traditional aspect of the TLE e-learning experience. While teachers were using spreadsheets to record grades, the actual process of providing feedback, conducting peer reviews, and performing remote practical assessments via digital tools was not yet a standard practice. This suggests a significant need for professional development focused specifically on digital feedback strategies and technology-mediated practical assessment.

Tables 7–9 present the relationship between teachers' level of competence and their use of e-learning.

Table 7. Relationship between Teachers' Level of Competence and Their Extent of Utilization of E-Learning in terms of Technological Skills

	r-value	*Degree*	*p-value*	*Interpretation*	*Decision on Ho*
Technological Skills					
Digital Platforms	.690	Very Strong	<.001	Significant	Reject
Content Creation and Delivery	.710	Very Strong	<.001	Significant	Reject
Assessment and Feedback	.639	Very Strong	<.001	Significant	Reject

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The relationship between teachers' technological competence and e-learning utilization is defined by three interconnected domains: digital platforms, content creation, and assessment. Proficiency in digital platforms ($r = .690$) serves as a foundational gateway skill, establishing the necessary infrastructure for virtual instruction. As teachers mastered these environments, their integration of digital tools into daily pedagogy increased significantly, proving that platform competence was the baseline for any successful digital transition.

Content creation and delivery emerged as the most influential driver of e-learning utilization, with the highest correlation ($r = .710$). This suggests that the ability to design original digital resources, rather than merely using existing platforms, fosters a sense of ownership that directly predicts classroom integration. Consequently, content mastery acts as the primary bridge between theoretical technical knowledge and actualized classroom practice.

Although assessment and feedback showed the lowest correlation ($r = .639$), it remained a very strong and significant predictor of technology use. This lower value indicates a steeper learning curve for digital grading and automated feedback systems compared to content delivery. However, the data confirms that as teachers overcame these technical barriers, they were substantially more likely to abandon traditional paper-based methods in favor of digital loops.

These three domains form a synergistic toolkit where platform management, content delivery, and assessment are mutually reinforcing. The high r-values and statistical significance ($p < .001$) across all categories demonstrate that a teacher's digital fluency grows as a comprehensive set of abilities. This proves a direct link for policymaking: the lack of e-learning in schools is often tied more closely to teacher skill levels than to a mere lack of interest or equipment. Hence, the decision is to reject the null hypothesis.

The significance of this relationship provides a data-driven mandate for professional development focused on building teacher competence, particularly in content creation. By prioritizing these specific skills, institutions can ensure that training efforts yield a predictable and substantial increase in how technology is applied. This approach offers a clear path for educational improvement by transforming technical potential into practical, modern pedagogy.

These findings aligned with Goles et al. (2025) and Ranga (2025), who argued that while teacher proficiency is the engine of e-learning, systemic infrastructure governs its actual movement. While the data confirms technical mastery as an essential gateway, the literature provides a reality check regarding external barriers like unstable connectivity and insufficient support. Ultimately, the high potential for digital transformation represented by these skills may be stifled if institutional gaps and limited accessibility are not addressed to complement teacher motivation.

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Table 8. Relationship between Teachers' Level of Competence and Their Extent of Utilization of E-Learning in terms of Pedagogical Instruction

	r-value	*Degree*	*p-value*	*Interpretation*
Pedagogical Instruction				
Digital Platforms	.728	Very Strong	<.001	Significant
Content Creation and Delivery	.750	Very Strong	<.001	Significant
Assessment and Feedback	.687	Very Strong	<.001	Significant

Teacher competence in digital platforms shows a very strong positive relationship (r = .728) with e-learning use, marking it as the essential foundation of digital pedagogy. Mastery of these virtual environments is a prerequisite; without the ability to manage the platform, subsequent teaching and assessment phases cannot be effectively executed.

Content creation and delivery represent the strongest predictor of utilization (r = .750), suggesting that the ability to design original digital resources shifts teachers from passive users to active educators. This creative mastery provides a sense of ownership over the digital classroom, acting as the primary bridge between technical knowledge and practical curriculum integration.

Digital assessment and feedback (r = .687) also maintain a very strong correlation, though slightly lower than other domains, likely due to a steeper technical learning curve. However, the data confirms that as proficiency in digital grading grows, teachers substantially moved away from traditional paper-based methods toward more efficient, automated feedback systems.

These three domains constitute a synergistic toolkit where skills in one area reinforce the others. The consistent statistical significance ($p < .001$) across all categories proves that e-learning utilization is mathematically tied to teacher competence rather than just equipment availability or personal interest. Hence, the decision is to reject the null hypothesis.

The statistical data provided a clear mandate for educational policy to prioritize professional development targeting these specific technical skills. By focusing on teacher competence, particularly in content creation, institutions can ensure a predictable and significant increase in how technology is applied to improve modern pedagogical instruction.

These findings aligned with Casilao (2024) and Domingo and Mina (2024), illustrating that while teacher proficiency is the engine of digital education, it remained constrained by external logistical barriers. Even when competence was high, minimal technical support and the high-cost nature of vocational tools (TVL) often forced a return to traditional methods. Ultimately, professional development must be paired with infrastructure improvements to translate this high statistical potential into functional classroom practice.

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Table 9. Relationship between Teachers' Level of Competence and Their Extent of Utilization of E-Learning in terms of Adaptability and Innovation

	r-value	*Degree*	*p-value*	*Interpretation*
Adaptability and Innovation				
Digital Platforms	.730	Very Strong	<.001	Significant
Content Creation and Delivery	.757	Very Strong	<.001	Significant
Assessment and Feedback	.738	Very Strong	<.001	Significant

Regarding digital platforms, the data shows a very strong positive correlation (r = .730), suggesting that as TLE teachers gain mastery over navigating various virtual learning environments, their ability to pivot from traditional to digital instruction becomes more seamless. This significant relationship implies that technical competence acts as a foundational gateway; when teachers felt adept at managing the technicalities of a platform, they were far more likely to innovate within that space, utilizing its features to create a more flexible and responsive learning environment for their students.

For content creation and delivery, the study recorded the highest correlation coefficient r = .757), indicating a very strong and significant link between a teacher's creative competence and their actual instructional output. This suggests that the more a TLE teacher understands the nuances of digital media, the more they shift from being mere consumers of pre-packaged content to becoming active resource creators. This high level of utilization reflects the TPACK framework in action, where the teacher's specialized subject knowledge is successfully translated into a digital format that maintains the hands-on integrity of the TLE curriculum.

Finally, the relationship involving assessment and feedback yielded a very strong positive correlation (r = .738), highlighting that competence in digital evaluation is a major predictor of its use in the classroom. This interpretation suggests that when teachers master innovative assessment tools, they significantly increase their utilization of these tools to monitor student progress more effectively. This shift allows for more timely and personalized intervention, proving that digital competence in assessment is not just a technical skill but a pedagogical innovation that transforms how TLE teachers validate the practical skills of their learners.

The statistical analysis of the relationship between teachers' competencies and their utilization of e-learning reveals a consistent and powerful synergy across all dimensions of adaptability and innovation, characterized by very strong positive correlation coefficients. Hence, there is a significant relationship between the teachers' level of competence in adaptability and innovation and their extent of utilization of e-learning. This robust relationship indicates that as TLE teachers enhance their digital proficiency, there is a corresponding and substantial increase in their actual application of technology for digital platforms, content creation, and assessment.

Ultimately, these findings suggest that for TLE educators in Congressional District I, digital competence is not merely a static technical requirement but a dynamic driver of

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instructional transformation, where increased self-efficacy in navigating e-learning tools directly results in more frequent and sophisticated classroom integration.

These findings resonate with Dela Torre and Ramos (2024) and Lim et al. (2025), noting that while teacher competence drives innovation, its impact is often stifled by a lack of institutional alignment and inadequate planning. Although technical proficiency is a prerequisite for change, the literature highlights that systemic barriers, such as financial constraints and heavy workloads, frequently prevent these skills from being fully realized.

Table 10. Challenges Encountered by TLE Teachers in Integrating e-Learning into their Teaching Practices

As part of the challenges of e- learning in teaching TLE, I….	WM	Interpretation	Rank
1) Struggle with unstable internet access, making reliable technology use difficult.	3.12	Agree	2
2) Often lack access to essential in the TLE classroom, preventing me from consistently utilizing technology-based lessons.	3.04	Agree	8
3) Frequently use my personal time for lesson planning related to digital tools.	3.08	Agree	4.5
4) Experience a digital equity gap because I lack the resources needed to effectively use the same tools I am expected to integrate in class.	3.05	Agree	7
5) Find it challenging to align technology use with the practical and hands-on objectives of the TLE curriculum.	3.03	Agree	9.5
6) Need to further develop my skills in creating digital assessments.	3.14	Agree	1
7) Experience a lack of on-demand technical support, which forces me to resolve complex hardware.	3.08	Agree	4.5
8) Need to develop new digital classroom management strategies to keep students focused while using technology in practical TLE activities.	3.09	Agree	3
9) Have limited access to professional development programs specifically designed to help integrate digital tools into TLE instruction	3.06	Agree	6
10) Receive insufficient policy for digitalization in TLE, including unclear competency standards and limited funding for specialized equipment.	3.03	Agree	9.5
COMPOSITE	**3.07**	**Agree**	

***Legend**: 3:50 – 4.00Strongly Agree (SA) 2.50 – 3.49 Agree (A) 1.50 – 2.49 Disagree (D)1.00 – 1.49 Strongly Disagree (SD)*

The analysis of the three highest weighted means highlights that skill gaps and

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infrastructure remain the most significant hurdles. The highest-ranked challenge is the "need to further develop my skills in creating digital assessments" with a WM of 3.14 (Agree). This indicates a specific pedagogical gap; while teachers might be comfortable delivering a lecture via a screen, they struggled to translate traditional grading and testing into a digital format that was both secure and effective. The interpretation here is that professional development should shift away from general how-to tech sessions and instead focus on specialized tools for evaluating student performance in a virtual environment.

This finding directly aligns with the research of Barcelona et al. (2023), who noted that professional development for TLE teachers often focuses on generic technology tools rather than integrated pedagogy. Furthermore, Riyanda et al. (2025) highlighted international concerns regarding the validity of remote demonstrations and video submissions, which cannot always reliably substitute for supervised, hands-on workshop performance.

This is closely followed by the "struggle with unstable internet access, making reliable technology use difficult" with a WM of 3.12 (Agree). This is an environmental and structural issue that lies largely outside the teachers' direct control. The result suggests a high level of frustration, as even the most well-planned digital lesson can be derailed by a poor connection. In practice, this means e-learning in TLE remained a high-risk activity where teachers must always have a non-digital backup plan ready to go. This environmental barrier was corroborated by Quinton et al. (2022), whose action research documented that a lack of reliable connectivity consistently undermines the core aims of TLE by forcing teachers to omit hands-on components. Similarly, Anwar et al. (2024) identified the digital divide as a primary structural barrier that complicates integration efforts across Southeast Asia.

The third highest-ranked indicator is the "need to develop new digital classroom management strategies to keep students focused while using technology in practical TLE activities" with a WM of 3.09 (Agree). This highlights the unique nature of the TLE curriculum, which relies heavily on hands-on work. The result implies that the introduction of devices often acts as a double-edged sword: while they provide resources, they also provide distractions. Teachers were finding it difficult to maintain the discipline required for TLE when students were tempted by the various distractions of a digital device. This finding is supported by the observations of Barcelona et al. (2023) regarding the tradeoffs between covering mandated competency lists and the time-intensive task of re-designing lessons for digital formats. As teachers navigated these distractions, they faced the practical constraints of maintaining shop floor discipline in a digital space.

The lowest-ranked indicators, sharing a rank, are the "challenge to align technology use with the practical and hands-on objectives of the TLE curriculum." This result is particularly interesting because it suggests that TLE teachers were becoming resourceful at finding digital parallels for physical tasks. While it remained a challenge to make a simulation feel as real as a hands-on project, it was perceived as less of a barrier than the immediate need for better internet or assessment skills. This is a central theme in the research of Domingo and Mina (2024), who observed that safety regulations and the need for industry-grade machinery make simulating realistic shop environments uniquely difficult online. Despite these hurdles, the lower ranking in

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the current study suggests a move toward the pragmatic solutions suggested by Joshi and Khatiwada (2024), such as blended models and teacher collaboration.

Also in the lowest rank are insufficient policy for digitalization in TLE, including unclear competency standards and aligning technology use with the practical and hands-on objective of TLE curriculum both with a WM of 3.03 (Agree). The interpretation of this result suggests that while clearer competency standards and more money would help, they were not the most urgent points of pain for the average teacher. Educators seem more concerned with the daily, practical realities of their classrooms than they were with the macro-level policies that govern their department. This reflects the synthesis provided by Mustafa et al. (2024), which found that while policy frameworks often exist for general ICT, they frequently fail to address specific vocational needs like industry software licenses or workshop safety in online contexts.

The next lowest indicator is the "lack of access to essential [resources] in the TLE classroom," with a WM of 3.04 (Agree). While this still hinders the consistency of technology-based lessons, the lower ranking suggests that teachers are finding ways to make do with what they have, or that they have at least some baseline equipment available to them. This finding was reflected in the work of Casilao (2024), who documented uneven access to devices and minimal technical support in local divisions. While teachers are resourceful, the literature suggests that this lack of hardware often leads to an under-utilization of digital platforms, with many educators defaulting to paper-based materials when equipment is unavailable.

The Composite Mean for Challenges Encountered is 3.07, interpreted as Agree. This indicates that teachers universally recognize and experience these barriers at a high level. The analysis suggests that e-learning integration in TLE was currently hampered by a "double-bind" of challenges: external technical issues (unstable internet) and internal pedagogical needs (digital assessment skills). The interpretation points toward a clear requirement for targeted professional development that moves beyond general ICT training and focuses specifically on digital assessment and classroom management strategies tailored for the hands-on nature of TLE.

4. Discussion

The research focused on assessing the influence of teachers' competencies on the utilization of e-learning in Technology and Livelihood Education among public schools in Congressional District I. After careful and thorough analysis of the gathered data, the study yielded these salient findings:

1. Teachers' Level of Competencies in Using e-Learning in Teaching

1.1. Technological Skills. The results indicate a generally consistent level of proficiency across various skills, with all items falling under the moderately competent interpretation. The top three strengths are led by operating classroom hardware (3.14), followed by organizing digital files via cloud storage (3.08), and editing multimedia elements (3.06). These rankings suggest that teachers are most comfortable with the physical and organizational aspects of educational technology.

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Conversely, the three lowest-ranked competencies, though still moderately competent, reveal areas where teachers may require more support. These include applying basic digital security measures (2.97), utilizing digital accessibility features for inclusive content (2.92), and finally, navigating all features of the school's Learning Management System (LMS), which ranked last with a weighted mean of 2.87. This downward trend toward the bottom of the list suggests that while teachers can handle hardware and files, they struggle more with the complex software ecosystems and specialized settings required for data privacy and inclusive design.

1.2. Pedagogical Instruction. The data reveal that while teachers maintain a moderately competent level across all indicators, their primary strengths lie in direct classroom application. The three highest-ranked competencies are integrating technology to introduce complex concepts (2.97), promoting higher-order thinking skills (2.95), and utilizing simulations for authentic learning (2.94). These results suggest that teachers are most confident when using digital tools to enhance the core instructional experience and student cognition.

Conversely, the three lowest-ranked areas highlight challenges in extending technology use beyond basic instruction. These include designing technology-driven Project-Based Learning (2.86), guiding students in the ethical and legal use of digital resources (2.84), and using communication tools to engage parents and guardians (2.83). The relatively lower scores in these areas, particularly in parental engagement and ethical guidance, indicate a need for professional development focused on the broader social and administrative responsibilities of a digital educator.

1.3. Adaptability and Innovation. The findings indicate a consistent moderately competent rating, though these scores are slightly lower overall than previous categories. The top three highlights are tied between modifying traditional teaching tasks to leverage technology and revising lesson plans to incorporate new tools (both 2.92), followed closely by supporting students in using digital tools for their assignments (2.88). These results suggest that teachers are most comfortable with the adaptive planning and supportive phases of innovation.

On the other hand, the three lowest-ranked competencies all share the same weighted mean (2.81), indicating a plateau in more advanced innovative practices. These include transferring technical skills across different learning platforms, creatively combining multiple tools for unique instructional sequences, and using feedback from technology-based assessments to immediately adjust strategies. The lower ranking of these items suggests that while teachers can plan for technology, they find it more challenging to integrate multiple platforms seamlessly or use real-time data for instructional agility.

2. Teachers' Extent of Utilization of e-Learning in Teaching TLE

2.1. Digital Platforms. The data, which details the utilization of digital platforms specifically within the Technology and Livelihood Education (TLE) context, reveal a shift in scores toward a generally lower utilized interpretation compared to previous competency tables. The top three highlights are led by the automation of grading for TLE assessments (2.68), followed by the supervision of smart devices for real-time data collection (2.62), and the

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provision of real-time feedback on student tasks (2.59). These rankings indicate that when teachers do utilize these platforms, they prioritize efficiency in administrative tasks like grading and immediate instructional feedback.

In contrast, the bottom three rankings highlight significant gaps in the adoption of more specialized or complex digital tools. Tied for the eighth and ninth positions is the application of adaptive learning platforms to scaffold hands-on skills during remote instruction (2.54), alongside a three-way tie for seventh place which includes the use of e-commerce platforms to foster entrepreneurial mindsets (2.55). The absolute lowest-ranked item is the use of Virtual Reality (VR) for teaching practical skills, which received a weighted mean of 2.43 and is the only indicator falling under the slightly utilized category. This suggests that while basic digital tools are integrated into TLE, high-cost or high-complexity technologies like VR and adaptive platforms remain largely untapped in the practical classroom setting.

2.2. Content Creation and Delivery. Regarding the extent of utilization in terms of content creation and delivery, the results reflect a preference for traditional digital formats over specialized technical tools. The three highest-ranked indicators are the use of presentation software for customized visual aids (2.74), designing interactive quizzes (2.68), and using digital tools to create infographics (2.63). These utilized ratings suggest that teachers are most active in creating visual and evaluative content that mirrors standard classroom practices.

In contrast, the three lowest-ranked areas indicate significant barriers to more advanced or technical content delivery. These include the integration of subject-specific simulation software (2.52), utilizing cloud storage services to share resources (2.48), and finally, the use of Computer-Aided Design (CAD) for technical drawings (2.38). Notably, the last two indicators fall into the slightly utilized category, which is particularly revealing for TLE instruction. This suggests that while teachers are comfortable with general creative tools, they are less likely to utilize highly specialized software, like CAD, that is often foundational to technical and vocational expertise.

2.3. Assessment and Feedback. The data reflect a notable trend toward administrative efficiency over collaborative evaluation. The three highest-ranked indicators are led by the use of spreadsheet software for managing grades (2.59), followed by using digital tools for grading performance-based outputs (2.54), and administering formative and summative tests via online quizzing platforms (2.49). These rankings demonstrate that teachers are most active in digitizing traditional grading and testing workflows.

Conversely, the three lowest-ranked competencies highlight significant gaps in interactive and remote assessment strategies, with all three falling under the slightly utilized category. These include communicating assessment results to parents and students via digital channels (2.41), using live streaming tools for remote performance assessment (2.39), and finally, the use of online peer-assessment tools (2.37). This indicates that while teachers use technology to record and calculate grades, they are less inclined to utilize digital platforms for real-time remote observation or for fostering student-led peer evaluation processes.

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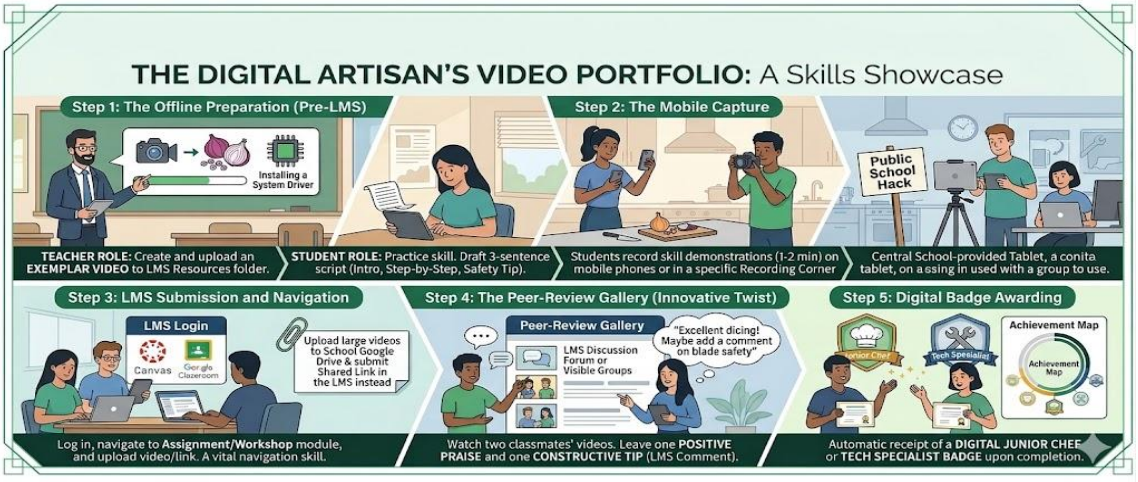
3. Relationship Between Teachers' Level of Competence and their Extent of Utilization of E-Learning. The statistical results demonstrate a consistently high correlation between the three dimensions of teacher competence and the implementation of e-learning tools. Across all categories: technological skills, pedagogical instruction, and adaptability and innovation, all of which are classified as having a very strong degree of relationship. Notably, the highest correlation is found within the adaptability and innovation domain, specifically regarding content creation and delivery followed by pedagogical instruction.

4. Challenges Faced by Teachers in Integrating e-Learning into their Teaching Practices. The major challenges encountered by TLE teachers in integrating e-learning are characterized by a combination of technical skill gaps and systemic infrastructural hurdles. The most prominent challenge is the need to further develop skills in creating digital assessments (3.14), which indicates that while teachers may be using digital tools for delivery, they struggle with the transition to digital evaluation. This is closely followed by the struggle with unstable internet access (3.12), a foundational barrier that makes reliable technology use difficult and often discourages consistent integration in a practical classroom setting. Furthermore, teachers expressed a significant need for new digital classroom management strategies (3.09) to keep students focused during hands-on activities, suggesting that traditional management techniques are insufficient when devices are introduced.

Beyond these top-tier concerns, the data reveals a heavy reliance on the teachers' personal resources and time. This is compounded by limited access to professional development specifically tailored for TLE (3.06) and a persistent digital equity gap (3.05). Even the lowest-ranked challenges, such as aligning technology with hands-on objectives and insufficient funding/policy (both 3.03), still maintain an interpretation of agree, highlighting a broad spectrum of obstacles that hinder the effective digitalization of the TLE curriculum.

5. Proposed Innovation Activities. The proposed output intended to serve as a strategic roadmap designed to bridge the gap between teacher competence and the systemic challenges.

Innovative Activity 1: The Digital Artisan's Video Portfolio



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Introduction

Navigating all the features and settings within a school's LMS can be a daunting experience, often leading to it being an underutilized tool. This challenge is precisely why The Digital Artisan's Video Portfolio was designed.

This activity is not just about recording a video; it's a guided, step-by-step quest through the LMS environment. Instead of asking students (and teachers) to memorize a navigation map, they are tasked with performing essential functions: finding resources, locating specific assignments, navigating text-entry boxes, using peer-review forums, and tracking their achievement progression. The LMS becomes an active partner in the learning journey, rather than just a complex container. By the end of this activity, navigating the LMS isn't just a skill; it's second nature, learned through the process of building a professional digital portfolio.

Target Variable (Lowest Mean in Table 1): Navigate all features and settings within the school's LMS.

Activity Objective

Students will record a short (1-2 minute) skill demonstration of a specific TLE competency and upload it to the LMS for peer and teacher evaluation.

Step-by-Step Procedure

Step 1: The Offline Preparation (Pre-LMS)

- **Teacher Role:** Upload a 1-minute Exemplar Video (e.g., Proper Way to Dice an Onion or Installing a System Driver).
- **Student Role:** Practice the skill at home or in the school lab. Draft a 3-sentence script: (1) Introduction of the skill, (2) Step-by-step narration, and (3) Safety tip.

Step 2: The Mobile Capture

- Students use their mobile phones to record their demonstration.
- **Public School Hack:** For students without high-end phones, the teacher can set up a Recording Corner in the TLE laboratory using a single school tablet or smartphone.

Step 3: LMS Submission and Navigation (may be done as an assignment when internet access is not available at school)

- Students log into LMS (Google Classroom or Canvas).
- They navigate to the Assignment or Workshop module.
- They upload their video. If the video file is too large for the LMS server, teach them to upload it to their School Google Drive first and submit the Shared Link in the LMS text box instead.

Step 4: The Peer-Review Gallery (Innovative Twist)

- The teacher sets the LMS setting to Visible Groups or uses a Forum thread.

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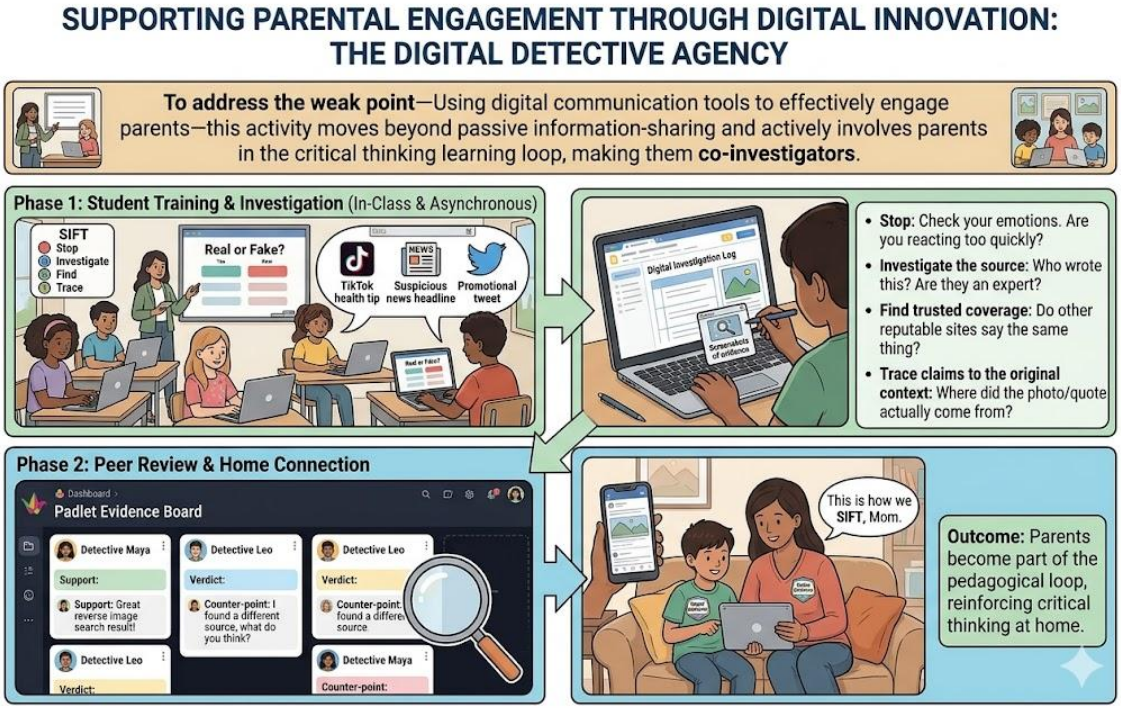
- Each student must watch two classmates' videos and leave one Positive Praise and one Constructive Tip using the LMS Comment feature.

Step 5: Digital Badge Awarding

- The teacher uses the Badges or Completion Tracking setting in the LMS.
- Once the video is uploaded and peer reviews are done, the student automatically receives a digital Junior Chef or Tech Specialist badge

Innovative Activity 2: The Digital Detective Agency



Introduction

To address the identified weak point, this activity implements a home connection strategy. Instead of traditional, static parent-teacher communication, it uses students' digital work as the conversation starter.

By requiring students to share their specific analytical findings and then collaboratively SIFT a new story with their parents (Step 5), the activity fosters active, skill-based digital engagement between home and school. This directly involves parents in the pedagogical loop and turns the digital tool into a bridge for active critical thinking rather than just a passive information channel.

Target Variable (Lowest Mean in Table 2): Use digital communication tools to effectively engage parents.

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Activity Objective: Students will apply **SIFT** (Stop, Investigate, Find, Trace) techniques to determine the reliability of digital information.

Step-by-Step Procedure

Step 1: The Briefing (Synchronous/Asynchronous)

- **Action:** Provide students with three digital artifacts (a viral TikTok health tip, a suspicious news headline, and a promotional tweet).
- **Tool:** Use **Nearpod** or **Mentimeter** to gather initial Real or Fake? votes from the class.

Step 2: Training the Detectives (Pedagogical Instruction)

- **Action:** Teach the **SIFT** method through a short, interactive video.
  - **S**top: Check your emotions. Are you reacting too quickly?
  - **I**nvestigate the source: Who wrote this? Are they an expert?
  - **F**ind trusted coverage: Do other reputable sites say the same thing?
  - **T**race claims to the original context: Where did the photo/quote actually come from?

Step 3: The Investigation (Active Learning)

- **Action:** Students choose one artifact and use a **Digital Investigation Log** (a shared Google Slide or Canva template) to document their findings.
- **Instruction:** They must take screenshots of evidence (a reverse image search result or a Wikipedia entry about the author).

Step 4: The Verdict (Collaboration)

- **Action:** Students post their verdict on a **Padlet** Evidence Board. They must comment on at least one peer's findings, either supporting the evidence or offering a counter-point.

Step 5: Parent-Detective Debrief (Home Connection)

- **Action:** For homework, students must show their Investigation Log to their parents and find one news story in the parent's social media feed to SIFT together.
- **Outcome:** Parents become part of the pedagogical loop, reinforcing critical thinking at home.

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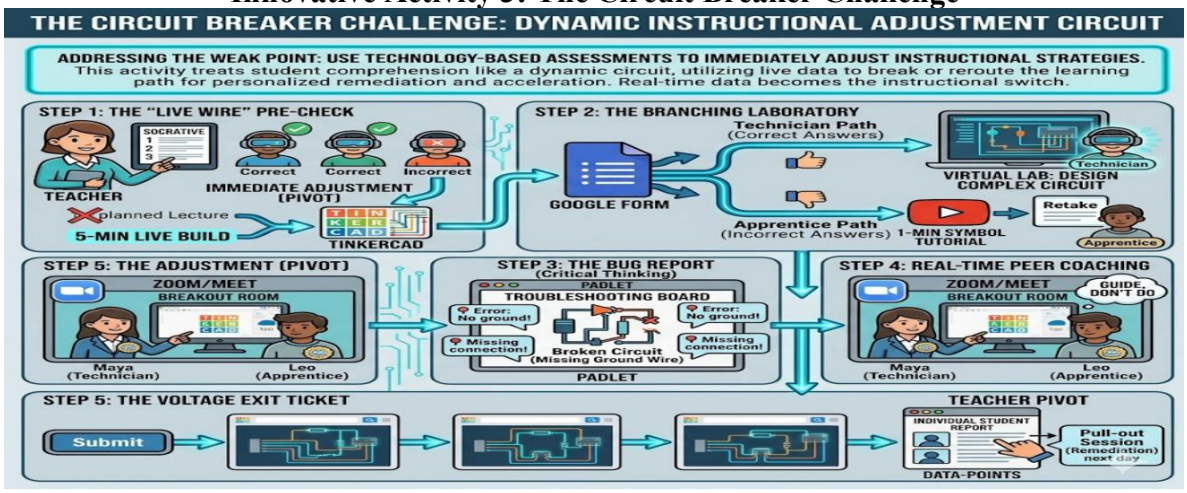
Innovative Activity 3: The Circuit Breaker Challenge



Introduction

To address the key instructional challenge of making real-time adjustments based on student understanding, the Circuit Breaker Challenge is introduced. Traditional assessments often provide feedback too late, creating a learning gap that compounds as the lesson progresses. This activity moves beyond simple grading at the end and treats the student learning path as a dynamic circuit.

By implementing technology-based fuse boxes (assessments) in real-time, the activity empowers the teacher to act as an active breaker, immediately rerouting, branching, or fixing the instructional path for each student. The feedback is not an add-on; it is the curriculum.

Target Variable: Use technology-based assessments to immediately adjust instructional strategies.

This activity focuses on Electronics and Troubleshooting (a core TLE-CSS component). It uses assessment data to break or fix the learning path for each student.

Step-by-Step Procedure

Step 1: The Live Wire Pre-Check (Assessment)

- **Action:** Start with a 3-question Socrative quiz on identifying symbols (Resistor, Capacitor, Ground).
- **Immediate Adjustment**: If the Live Results show students are confusing Series vs. Parallel circuits, the teacher replaces the planned lecture with a 5-minute Live Build using a digital simulator like Tinkercad.

Step 2: The Branching Laboratory (Pedagogical Individualization)

- **Action:** Students access a Google Form with Section Branching.
- **The Technician Path (Correct answers):** Students move to a virtual lab to design a complex circuit.

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- **The Apprentice Path (Incorrect answers):** The Form automatically redirects them to a 1-minute YouTube tutorial on the specific symbol they missed, followed by a Retake question.

Step 3: The Bug Report (Critical Thinking)

- **Action:** Use Padlet as a Troubleshooting Board. The teacher posts a photo of a Broken Circuit (a missing ground wire).
- **Task:** Students must pin a comment identifying the error.

Step 4: Real-Time Peer Coaching

- **Action:** Based on the Socrative data from Step 1, the teacher uses the Breakout Room feature in Zoom/Meet to pair a Technician with an Apprentice.
- **Instruction:** The Technician must guide the Apprentice through one simulation task without doing it for them.

Step 5: The Voltage Exit Ticket

- **Action:** Students submit a final screenshot of their working Tinkercad circuit.
- **Teacher Pivot:** Use the Individual Student Report to decide who needs a Pull-out session (remediation) the next day.

Innovative Activity 4: The VR Safety Auditor

Introduction

This activity utilizes a hybrid immersive method. The challenge is often that traditional VR, while engaging, can create a passive viewing experience without translating into direct practical competence.

By combining the low-cost accessibility of mobile VR (viewer + phone) with the active, practical task of a safety walkthrough, students are forced to translate sensory information ("I see a hazard") into a tangible, practical documentation and remediation process. The skill taught is

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not just identification, but the practical process of observation, categorization, and proposed correction which all central competencies of a safety auditor.

Target Variable: Use VR in teaching students' practical skills.

Activity Objective: Students will use VR to perform a safety walkthrough of a virtual workshop, identifying at least five Occupational Safety and Health Administration (OSHA) violations that could lead to workplace accidents.

Step-by-Step Procedure

Step 1: The Virtual Entry (Preparation)

- **Action:** Provide a QR code that links to a 360-degree YouTube video of a Messy Workshop (search for *360 Industrial Safety Training*).
- **Instruction:** Students slide their smartphones into a Google Cardboard or VR viewer.

Step 2: The Immersive Scan (Observation)

- **Action:** Students must physically rotate their bodies 360 degrees to scan the virtual room.
- **Task:** They are looking for specific TLE hazards: exposed wires, blocked fire exits, liquid spills near electronics, or lack of Personal Protective Equipment (PPE).

Step 3: The Freeze-Frame Audit (Digital Assessment)

- **Action:** When a student spots a hazard, they pause the VR video and take a 360-degree screenshot or note the timestamp.
- **Documentation:** On a shared Google Keep note, they categorize the hazard (Physical, Chemical, or Electrical).

Step 4: The Virtual Rectification (Synthesis)

- **Action:** Students switch from the VR viewer to a Digital Collaborative Board (Padlet).
- **Task:** They must post their screenshot and fix the problem digitally by adding a sticker of the correct tool or safety sign that *should* be there.

Step 5: Peer Review Walkthrough

- **Action:** Using the VR headsets again, students view a Corrected 360 Environment provided by the teacher.
- **Reflection:** They compare their initial audit with the gold standard and record a short audio reflection on Flip about why they missed certain hazards.

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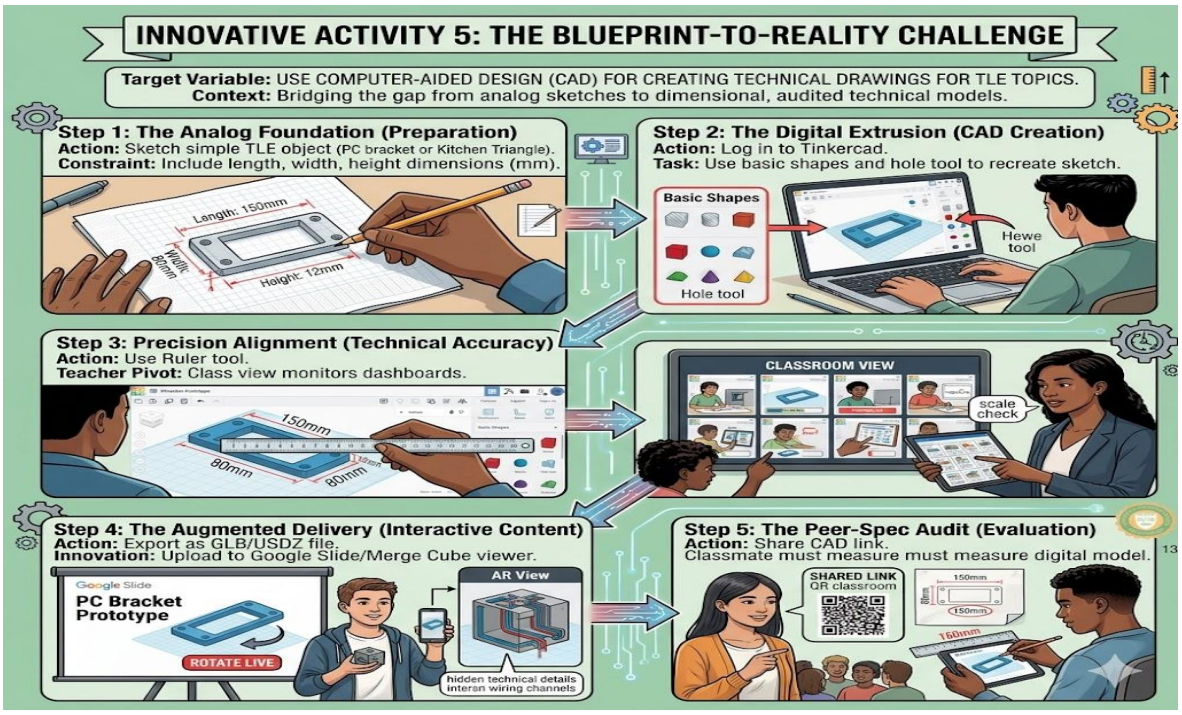
Innovative Activity 5: The Blueprint-to-Reality Challenge



Introduction

To address the target weak point of utilizing computer-aided design (CAD) for creating technical drawings in TLE topics, this activity proposes an active, hands-on methodology. Traditional instruction can struggle to connect static, hand-drawn blueprints to the precise, practical digital technical drawings that are now standard in industries like engineering and design. The core of this challenge is not just teaching CAD as a software skill, but leveraging CAD as a tool for creating, verifying, and presenting functional technical specifications, skills crucial for TLE fields.

By forcing students to directly convert their manual sketches into dimension-driven, digital objects and then presenting those models for dimension audits, they learn that a technical drawing is not just a picture, but a precise set of data. This approach closes the gap between the analog idea and the technical reality.

Target Variable: Use computer-aided design (CAD) for creating technical drawings for TLE topics.

Activity Objective: Students will transform a 2D napkin sketch into a scaled, 3D-printable digital prototype using CAD, then deliver it as an interactive presentation.

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Step-by-Step Procedure

Step 1: The Analog Foundation (Preparation)

- **Action:** Students draw a manual sketch of a simple TLE object (a custom bracket for a PC or a standardized kitchen work triangle).
- **Constraint:** The sketch must include at least three specific dimensions (length, width, height) in millimeters (mm).

Step 2: The Digital Extrusion (CAD Creation)

- **Action:** Students log into Tinkercad.
- **Task:** Using Basic Shapes, they recreate their sketch.
- **Pedagogical Skill:** They must use the Hole tool to create negative space (screw holes or doorways) and the Group tool to fuse parts.

Step 3: Precision Alignment (Technical Accuracy)

- **Action:** Use the Ruler Tool within the CAD software to ensure the digital model matches the mm measurements from Step 1.
- **Teacher Pivot:** The teacher uses the classroom view in Tinkercad to monitor all student dashboards live, identifying who is struggling with scale and providing instant digital feedback.

Step 4: The Augmented Delivery (Interactive Content)

- **Action:** Students export their CAD file as a GLB/USDZ file.
- **Innovation:** They upload this to a Google Slide or a Merge Cube viewer.
- **Task:** Instead of a static picture, the student must deliver their content by rotating the 3D model live during their presentation to show the hidden technical details (like internal wiring channels).

Step 5: The Peer-Spec Audit (Evaluation)

- **Action:** Students share their CAD link with a classmate.
- **Peer Task:** The classmate must measure the digital model using the CAD tools to see if it meets the original project specifications.

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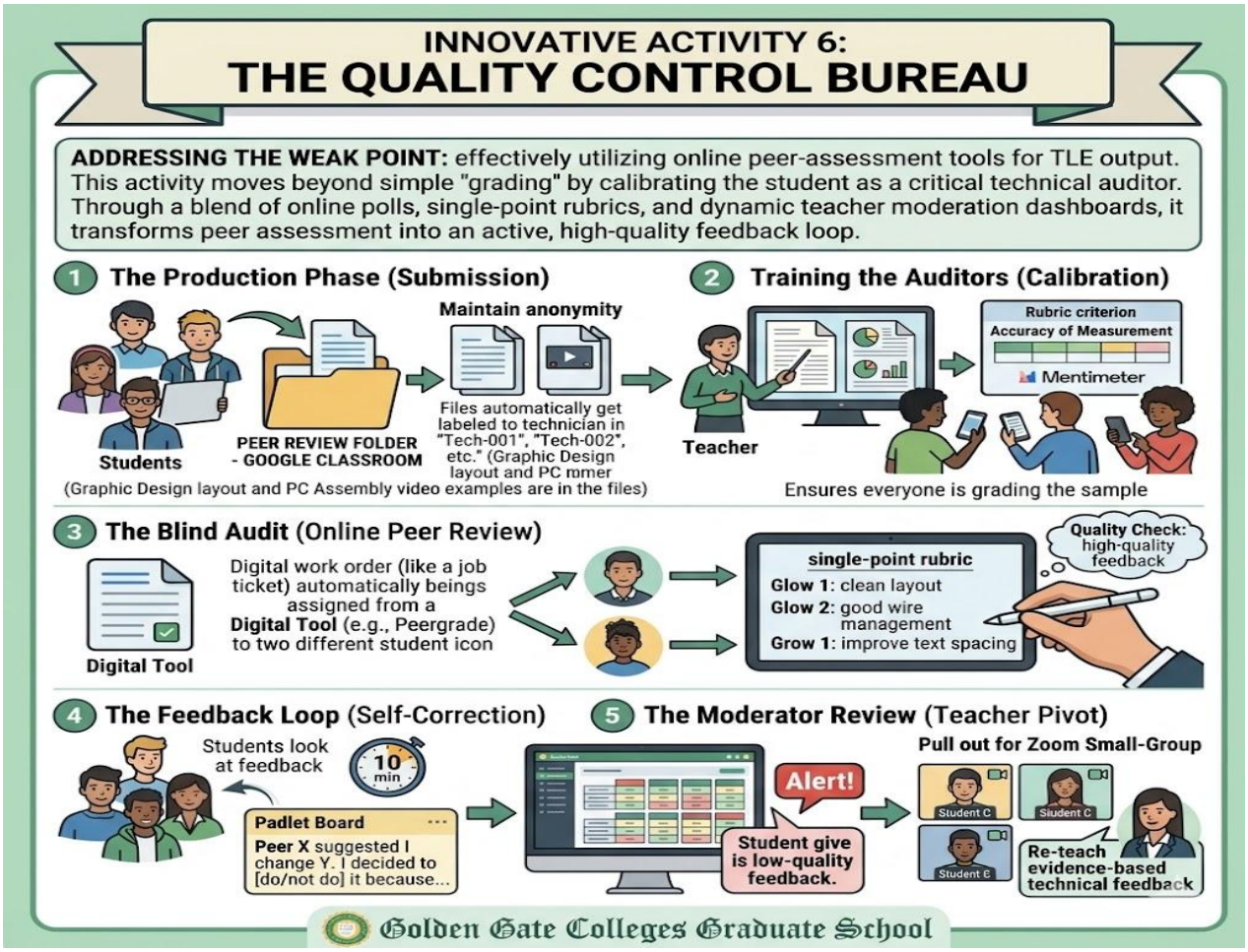
Innovative Activity 6: The Quality Control Bureau



Introduction

This activity proposes a highly structured, industry-calibrated workflow. The primary challenge often encountered with peer assessment is ensuring high-quality, constructive feedback that is technically accurate, especially for complex TLE projects like Graphic Design or PC Assembly.

This activity overcomes that challenge by incorporating two crucial pedagogical levers within the digital tools: calibration and moderation. By first training the auditors as a whole class using online polls, we establish a shared definition of quality before students review their peers. Secondly, the use of a digital moderator dashboard allows the teacher to act as a pivot point, instantly identifying students who require remediation in providing evidence-based, high-quality feedback. This shifts peer-assessment from a simple grading task to an active, moderated, and self-correcting feedback loop.

Target Variable: Use online peer-assessment tools for TLE output.

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Activity Objective: Students will apply an industry-standard rubric to evaluate a peer's TLE project (a Graphic Design Layout or a PC Assembly Video), providing two Glows (strengths) and one Grow (area for improvement).

Step-by-Step Procedure

Step 1: The Production Phase (Submission)

- **Action:** Students upload their final TLE output to a designated peer review folder in Google Classroom or a dedicated tool like Peergrade.
- **Constraint:** Files must be named with a technician ID (*Tech-001*) to maintain anonymity.

Step 2: Training the Auditors (Calibration)

- **Action:** Before reviewing peers, the teacher displays one Anchor Paper (a sample work).
- **Instruction:** The whole class uses a Mentimeter poll to grade the sample based on a single rubric criterion (Accuracy of Measurement).
- **Goal:** This ensures everyone interprets the rubric the same way.

Step 3: The Blind Audit (Online Peer Review)

- **Action:** The digital tool automatically assigns each student two work orders (peer submissions).
- **Task:** Using a digital single-point rubric, students must leave a comment on specific parts of the work.
    - *Example (ICT):* At 0:45 in your video, the RAM installation isn't clearly visible; try a closer angle next time.

Step 4: The Feedback Loop (Self-Correction)

- **Action:** Students receive their peer feedback. They are given 10 minutes to accept or reject the suggestions.
- **Documentation:** On a Padlet board, they post: *"Peer X suggested I change Y. I decided to [do/not do] it because..."*

Step 5: The Moderator Review (Teacher Pivot)

- **Action:** The teacher scans the digital dashboard to see which students gave low-quality feedback.
- **Immediate Adjustment:** The teacher pulls those students into a small-group zoom breakout room to re-teach how to give *evidence-based* technical feedback.

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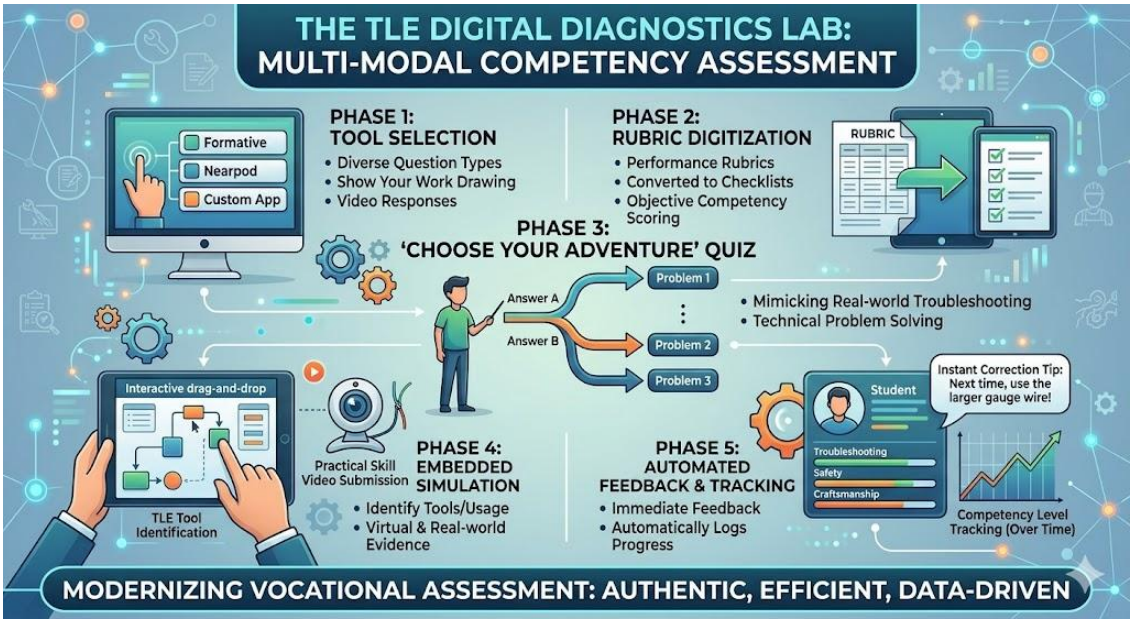
Innovative Activity 7: The TLE Digital Diagnostics Lab: Multi-Modal Competency Assessment



Introduction

This activity focuses on transitioning from paper-based tests to authentic, automated digital assessments that can evaluate both theoretical knowledge and practical TLE skills.

Target Variable: Digital Assessment Competency

Activity Objective: To design and implement a multi-modal digital assessment that provides immediate feedback and automatically tracks student competency levels.

Step-by-Step Procedures:

1. Choose a tool that supports diverse question types (e.g., Formative or Nearpod) that allows for "show your work" drawing or video responses.
2. Convert traditional TLE performance rubrics into digital "Checklist" formats within the platform.
3. Create a "Choose Your Own Adventure" quiz where students' answers determine the next technical problem they must solve, mimicking real-world troubleshooting.
4. Embed short screen-recordings or interactive "drag-and-drop" diagrams of TLE tools to test identification and usage before students handle physical equipment.
5. Program the platform to provide specific "Correction Tips" for incorrect answers, allowing students to learn immediately from their mistakes
6.

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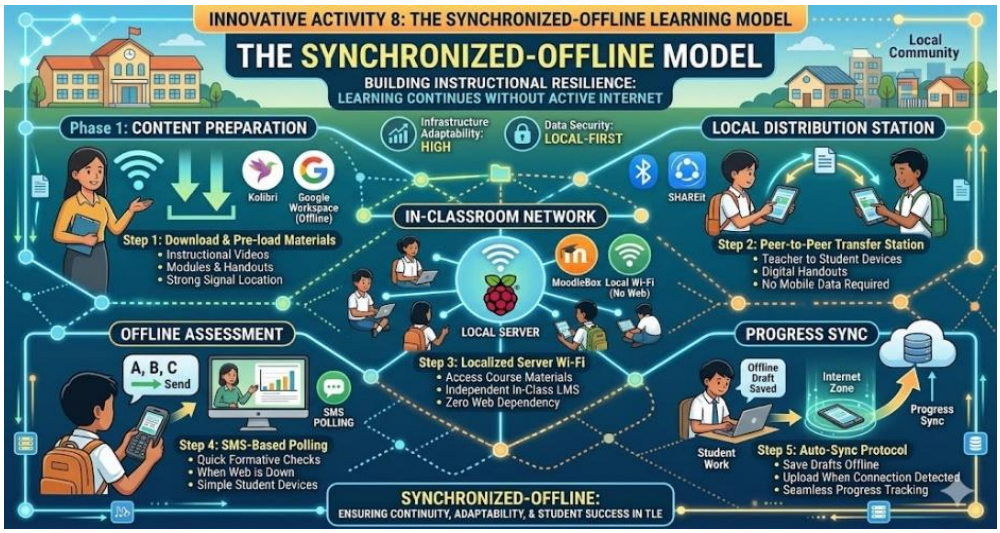
Innovative Activity 8: The Synchronized-Offline Model



Introduction

To overcome connectivity issues, teachers must shift toward a synchronized-offline model, ensuring learning continues regardless of the signal strength.

Target Variable: Instructional Resilience and Infrastructure Adaptability

Activity Objective: To create and distribute local-first digital learning packages that function without an active internet connection.

Step-by-Step Procedures:

1. Use tools like Kolibri or Google Workspace (Offline Mode) to download instructional videos and modules while at a location with strong signal.
2. Set up a peer-to-peer transfer station using apps like SHAREit or Bluetooth to distribute digital handouts directly from the teacher's device to student devices.
3. Use a localized server (like a Raspberry Pi loaded with MoodleBox) to create a local Wi-Fi network in the classroom that doesn't require actual internet to access course materials.
4. For quick formative assessments when the web is down, use SMS-based polling services to collect student responses.
5. Allow students to save drafts of their digital work and set an auto-sync protocol that uploads their progress the moment a connection is detected.

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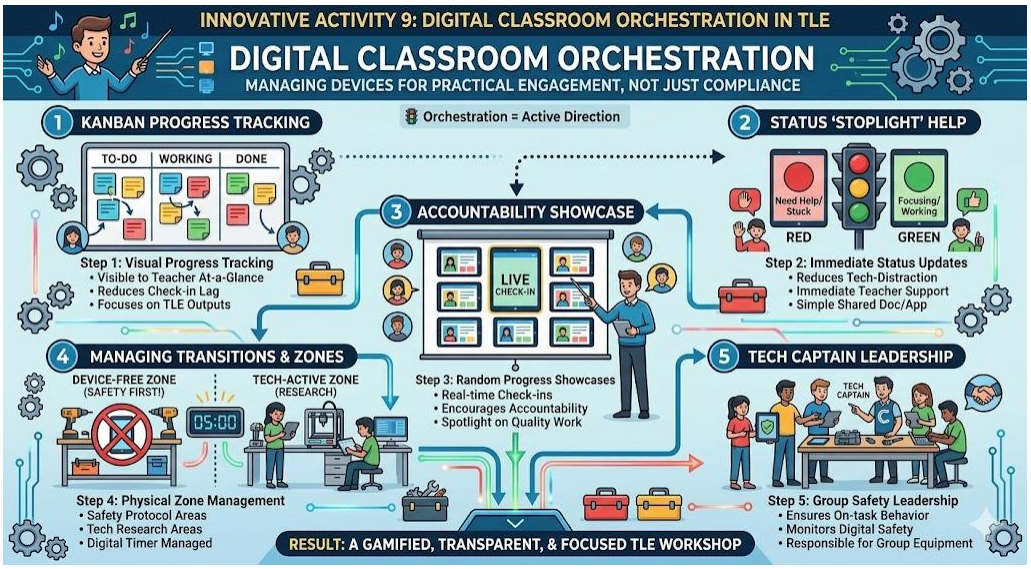
Innovative Activity 9: Digital Classroom Orchestration



Introduction

Managing a classroom where students are using devices for practical TLE tasks requires a shift from monitoring for compliance to orchestrating for engagement.

Target Variable: Digital Classroom Orchestration

Activity Objective: To implement a gamified, transparent classroom management system that keeps students focused on practical TLE outputs.

Step-by-Step Procedures:

1. Use a digital Kanban board (like Trello or Padlet) where students move their project cards from To-Do to Done. This makes student progress visible to the teacher at a glance.
2. Use a simple shared document or status app where students toggle their status to Red (Stuck/Need Help) or Green (Working/Focusing), reducing tech-distraction by providing immediate support.
3. Randomly select student screens to be projected to the front of the class for Real-time Progress Check-ins, encouraging accountability.
4. Establish physical areas in the TLE workshop where devices are strictly prohibited (for safety) and Tech-Active Zones for research, using digital timers to manage transitions.
5. Assign a Tech Captain for each group responsible for ensuring all members are on-task and following digital safety protocols during the practical activity.

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5. Conclusion

Based on the findings of the study, the following conclusions were drawn:

1. Teachers' level of competencies in using e-learning in teaching technological skills, pedagogical instruction, and adaptability and innovation was moderately competent.
2. Teachers' extent of utilization of e-learning in teaching TLE in terms of digital platforms and content creation and delivery were utilized. Assessment and feedback were slightly utilized.
3. There was a significant relationship between teachers' level of competence and their extent of utilization of e-learning.
4. Teachers agreed that the challenges in integrating e-learning into their teaching practices were the need to further develop skills in creating digital assessments, struggling with unstable internet access, making reliable technology use difficult, and the need to develop new digital classroom management strategies to keep students focused while using technology in practical TLE activities.
5. The proposed output consists of activities to bridge the gap between teacher competence and the systemic challenges.

6. Recommendation

Based on the conclusions drawn, the following recommendations were given:

1. The school may provide specialized workshops on advanced LMS features, digital security, and inclusive design to move teachers from moderate to high competency.
2. The school may invest in subject-specific software and ready-to-use digital templates to help teachers more frequently utilize e-learning tools in TLE classes.
3. The school administrators may include digital tool utilization in faculty performance evaluations and incentive programs to ensure that improved skills are actually applied in the classroom.
4. The school administrators may upgrade school internet and establish a technical helpdesk to reduce the personal time and effort teachers spend troubleshooting technology.
5. The school administrators may upgrade school internet and establish a technical helpdesk to reduce the personal time and effort teachers spend troubleshooting technology.
6. The future researchers may do similar or parallel studies.

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