

Integrating Instructional Design and Technology Acceptance in Self-Learning Modular Education: A Review of ICT-Based Approaches for TLE-ICT under the MATATAG Curriculum

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ABSTRACT

The fast pace of digital transformation in education requires the emergence of pedagogical models that will combine effective instruction, easy-to-use technology, and acceptance by students as top priorities in TLE-ICT in the Philippines. The following paper seeks to review best practices (2019-2025) in the field of instructional design, usability, and technology acceptance to develop a unified model of self-directed modular learning. A narrative-integrative review was conducted with an inclusion criterion based on the research on the ADDIE model, the Technology Acceptance Model (TAM), and the System Usability Scale (SUS), published in Scopus, ERIC, Science Direct, and Google Scholar.

The findings indicated that lessons using ADDIE-based modular learning systems are more focused and learner-centered. They also demonstrated the fact that SUS is an effective means of measuring effectiveness, satisfaction, and usability. The TAM can be used to understand why students desire the use and continued use of SLTs, depending on their usefulness and ease of use. A combination of the three frameworks creates a triadic model in which instructional design, usability, and adoption are connected to each other in a cycle of continuous improvement. The review indicates that the ADDIE-TAM-SUS model serves as a robust and pragmatic framework for educators, curriculum developers, and policymakers aiming to promote accessible, cost-effective, and highly engaging digital environments, as exemplified by the principles outlined in the MATATAG Curriculum.

Keywords: Self-learning modular education; Technology acceptance; System usability; ADDIE model; TLE-ICT; MATATAG Curriculum; Educational technology

INTRODUCTION

The twenty-first century is witnessing the digital transformation of education and the massive penetration of Information and Communication Technologies (ICT). In the case of the Philippines, underpinning the MATATAG Curriculum framework released by the Department of Education in 2024, this program shifts basic education towards competency-based, inclusive, and technology-driven learning. Embedded in this reform is the critical role of Technology and Livelihood Education–Information and Communication Technology (TLE-ICT) as a tool to develop students' digital literacy, problem-solving, and workplace readiness skills (Department of Education [DepEd], 2024). These policy changes underscore the importance of interest in learning experiences that are self-paced, self-directed, and modular with effective instructional design and user-friendly digital platforms.

Self-learning modules (SLMs) have become central to flexible learning modalities, particularly after the pandemic-induced transition to remote and blended instruction. Recent studies affirm that SLMs improve student autonomy, conceptual understanding, and engagement when grounded in strong pedagogical and technological design principles (Bernardo, 2021; Reyes & Dela Cruz, 2020; Apellido, 2025). Santos and De

Guzman (2023) found similar results, showing that technology-enhanced self-learning modules greatly increased motivation and task persistence among senior high school students in the Philippines. This shows that there is still a need for design frameworks that combine pedagogy and usability.

However, its potential success depends not only on the quality of its content but also on the usability and acceptance of technology channels, which ultimately determine whether learners use this meaningfully (Jiang et al., 2025; García et al., 2024). Alon-Barkat and Busuioc (2022) contend that trust, autonomy, and accountability in AI-driven decision support systems significantly influence students' confidence in digital learning environments, beyond just the user interface. For long-lasting changes in learning, teachers need a model that combines instructional design, user experience, and learner perception.

The ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) is still a good way to plan lessons. Research findings indicate that ADDIE enhances the quality of digital learning materials by ensuring alignment among learner needs, objectives, and delivery media (Garcia, 2019; Luo et al., 2024). When used in modular learning, ADDIE can help developers figure out when to teach lessons, how to combine different types of media, and how to use feedback loops to make all kinds of improvements. However, even the best-designed module will fail if students believe it is excessively challenging or lacks relevance. In this sense, the Technology Acceptance Model (TAM) (Davis, 1989) and the System Usability Scale (SUS) (Brooke, 1986) appear as indispensable complements.

The TAM is based on two fundamental constructs, the Perceived Usefulness and the Perceived Ease of Use, that predict attitude as well as extended use of digital tools. In Malaysia, Hashim et al. (2022) concluded that teachers' preparedness and digital receptivity play a more significant role in influencing perceived ease of use toward new learning platforms, further highlighting TAM's predictive power within the educational context (SEA). Recent findings in online and hybrid learning settings also demonstrate that these constructs are still the best indicators of satisfaction and engagement (García et al., 2024; Jiang et al., 2025). Even in recent practices, there is a meta-synthesis by Chiu and Hew (2021) that indicates that perceived usefulness always has a significantly greater contribution to learning outcomes in blended and self-paced learning from the perspective of technology acceptance theory. In the meantime, the SUS provides a valid benchmark of efficiency, effectiveness, and satisfaction. Current research has also confirmed its reliability for evaluating educational interfaces, particularly between adolescent learners on mobile-responsive platforms (Deshmukh et al., 2024). The synergy between ADDIE, TAM, and SUS permits the design of teaching not only on what learners learn during study but also how they experience and adopt technology-based instruction.

Internationally, academics recommend thematic unity between instructional design, usability testing, and technology acceptance in educational innovation (Luo et al., 2024; Zeng et al., 2024). In TLE-ICT education, this integration is manifested in the form of modular websites using multimedia learning, gamification, adaptive feedback, and offline accessibility – all resulting in a high motivation and high achievement (Li et al., 2023; Diaz, 2024). In the midst of these advancements, literature frequently discusses each dimension—pedagogy, usability, and adoption— independently, and a conceptual void can be discerned from the lens of how these dimensions interplay within Philippine secondary education.

Therefore, this study synthesizes empirical and conceptual studies between 2019-2025 to examine the link among instructional design, technology acceptance, and usability in a self-learning modular setting. This study focuses on integrating the ADDIE, TAM, and SUS models as frameworks for developing a holistic framework that outlines the creation of an ICT-based modular website for TLE-ICT utilizing the MATATAG Curriculum. This study analyzes emerging trends, theoretical intersections, and research gaps to propose a conceptual model aimed at guiding future initiatives in digital pedagogy, curriculum implementation, and teacher development in the Philippine education system and beyond.

METHOD OF REVIEW

This paper took the form of a narrative-integrative review to evaluate how the combination of ADD, Technology Acceptance Model (TAM), and System Usability Scale (SUS) frameworks can be used to design

and evaluate ICT-based learning systems, specifically in Technology and Livelihood Education- Information and Communication Technology (TLE-ICT) in the Philippine secondary curriculum. The convergent integrative process allowed taking the best of both empirical and conceptual literature, which allowed making a more comprehensive synthesis of theoretical and practical knowledge (Whitemore & Knafl, 2005).

Search Strategy

A thorough search was performed between January and September 2025 in the main electronic databases, such as Scopus, ERIC (Education Resource Information Center), Google Scholar, and ScienceDirect. The search words and Boolean operation were as follows: (“ADDIE model” OR “instructional design”) AND (“technology acceptance” OR “TAM”) AND (“System Usability Scale” OR “usability evaluation”) AND (“modular learning” OR “self-learning module” OR “ICT education”) AND (“secondary education” OR “TLE-ICT” OR “Philippines”). The search was restricted to peer-reviewed journal articles, conference proceedings, and institutional reports published from 2019 to 2025, in English and available in full-text. Bibliographies of the included studies were also hand-searched to find relevant papers.

Inclusion and Exclusion Criteria

Studies were included if the focus was on the design, implementation, or evaluation of an ICT-based learning system modular in nature, relevant to the educational context. In particular, a study was included in the review if it employed or referred to ADDIE as an instructional design model, TAM as a theoretical framework, and/or SUS as an analytical framework. Additionally, investigations had to compare as essential outcomes educational results, usability, or learners’ opinions. On the other hand, papers that were mainly technical—a software engineering or an algorithm development-based one without a direct relevance to educational applications, for example—were outside our scope. Research that was not about secondary or vocational education and did not have the necessary clarity or methodological rigor was also excluded from the final synthesis.

Data Extraction and Analysis

Each study was reviewed for research objectives, methods, participant characteristics, frameworks applied, and key findings. The data were organized into two synthesis tables:

Table 1: Review of Related Studies and Their Connection to the Self-Learning Modular Website

Table 2: Comparative Synthesis of Research-Based Learning Approaches and the Proposed Self-Learning Modular Framework for TLE-ICT.

Themes were developed through an inductive process and categorized with reference to the areas of instructional design, usability, and learner acceptability. The results were subsequently scrutinized to search for common themes, strengths and limitations of methods, and areas of deficiency in the literature. Lastly, perspectives were synthesized in a conceptual model (Figure 1) which combines the ADDIE, TAM, and SUS models towards future scholarly inquiry and development of modular learning systems grounded on the MATATAG Curriculum.

RESULTS AND THEMATIC DISCUSSION

The literature we have surveyed has reached a consensus on the idea that self-learning modular education, if scaffolded by a structured design of instruction and user-centered applications, can bring about significantly better learner engagement and performance in technology-driven subject areas. Two key findings were synthesized: (1) pedagogical aspects of modular ICT-based learning, and (2) instructional design/usability/technology acceptance framework integration as predictors of effectiveness and adoption. Each theme is a summary of the findings presented in Tables 1 and 2, both underpinned by empirical (conceptual) inferences since 2019, to is highly significant.

Theme 1: Pedagogical Foundations of Modular and Self-Learning ICT Education

Table 1 Review of Related Studies and Their Connection to the Self-Learning Modular Website

Author(s) & Year	Key Focus	Findings	Challenges Identified	Connection to the Study
Bernardo (2021)	Self-Learning Modules (SLMs)	Encourage independent learning and critical thinking; multimedia aids comprehension.	Student motivation issues: lack of teacher feedback.	The modular website uses multimedia and structured guidance to sustain self-study motivation.
Reyes & Dela Cruz (2020)	E-Learning in TVL Education	Enhances access and supports multiple learning styles; virtual simulations complement practice.	Limited internet connectivity (digital divide).	Downloadable, mobile-friendly resources address connectivity issues.
Wilson & Martin (2021)	Constructivist Learning in Digital Education	Promotes active learning and skill development through interaction.	Lack of structured guidance in self-learning platforms.	The site integrates problem-based learning, guided tasks, and discussion forums.
Kapp (2019)	Gamification in Online Learning	Increases motivation and persistence via feedback and rewards.	Poor gamification design can cause disengagement.	Incorporates balanced points, badges, and leaderboards to sustain engagement.
Smith & Brown (2021)	Personalized Learning in ICT-Based Education	Adaptive pathways and analytics support learner diversity.	Implementation constraints (training, resources).	Employs adaptive lessons and teacher monitoring features.
Mayer (2020) & others	Cognitive Load and Multimedia Learning	Dual-coding, spaced repetition, and retrieval practice enhance retention.	Cognitive overload and insufficient reinforcement.	Applies multimedia, spaced review, and retrieval-based quizzes for mastery.

Modular and self-paced learning featured in all the reviewed studies improved learner autonomy, concept acquisition competence, and digital fluency (Bernardo, 2021; Reyes & Dela Cruz, 2020), Apellido (2025). These effects were particularly strong when instruction was designed to include multimedia learning principles, such as dual coding, spaced repetition, and interactive feedback (Mayer 2020). Researchers indicated that SRLME were optimal when learning can be done at the learner's own pace, support multiple representations of the content, and provide instant feedback (Li et al., 2023).

The collection of studies also showed that students' motivation is maintained only if the modules feature both gamification and tasks seriously aimed at real-life aspects (Kapp, 2015; Diaz, 2024). For example, gamification: reward elements (such as Points, off gamers, and leaderboards) were linked to increased persistence and enjoyment when the mechanics were pedagogically-informative as opposed solely competitive (Zeng et al., 2024). This is a testimony to the fact that instructional engagement must be designed in and not draped on.

In the Philippine setting, modular learning was a practical response to the restricted use of the internet during and post-pandemic. According to research, downloadable modules that are mobile responsive narrow the digital divide because they allow for offline interaction (Wilson & Martin, 2021; Reyes & Dela Cruz, 2020). All these accessibility features are in line with the support of the MATATAG Curriculum's promotion of equity and inclusion (DepEd, 2024). In line with these principles, fostering self-regulated learning in digital settings has been identified as having a positive effect on student performance (Alzahrani 2021), which corroborates the pedagogic relevance of autonomy in modular design of learning.

Collectively, the evidence confirms that pedagogically rich modular systems improve both engagement and outcomes. However, these systems require explicit **design frameworks**—such as the ADDIE model—to

maintain coherence, ensure evaluation, and allow iterative improvement (Garcia, 2019; Luo et al., 2024). Learning management systems run the risk of becoming content repositories rather than learning engines if they lack this structure.

Theme 2: Integration of ADDIE, TAM, and SUS in ICT-Based Modular Systems

Table 2 Comparative Synthesis of Research-Based Learning Approaches and the Proposed Self-Learning Modular Framework for TLE-ICT

Feature	Existing Research-Based Learning Approaches	Proposed Self-Learning Modular Website (TLE-ICT)
Platform	Generic e-learning platforms (LMS, Google Sites)	Google Sites-based modular portal
Curriculum Coverage	TVL/ICT general content	Grade 7 TLE-ICT Quarter 1 (MATATAG Curriculum)
Instructional Approach	SLMs, constructivist, and personalized learning	ADDIE-model self-learning design
Learning Resources	Multimedia content, worksheets, assessments	Lesson plans, quizzes, PowerPoints, videos
Interactivity	Quizzes, discussions, simulations	Activities that are interactive, like discussion forums
Gamification	Points, badges, tracking	Points, badges, and leaderboards to keep people interested
Progress Tracking	AI analytics, teacher feedback	Tests before and after, and surveys on a Likert scale
Accessibility	Mobile and limited offline support	Works on mobile devices and lets you download modules
Teacher Controls	Adaptive analytics, feedback	Monitoring teachers and moderating content
Constructivist Elements	Project-based learning, real-world application	Helping people work together to solve problems
Student Engagement	Gamification, peer interaction	Gamification and community features in multimedia

In order to undertake comprehensive assessments of digital learning environments, the second key theme represents the growing tendency of combining usability (SUS), technological acceptability (TAM), and systematic instructional design (ADDIE). Despite their usefulness, frameworks intersect throughout crucial stages of system development and deployment (refer to Table 2).

ADDIE Model as Structural Backbone

The ADDIE model serves as a framework for developing digital and modular lessons, providing a systematic approach that facilitates ongoing iteration to ensure instructional coherence and flexibility. Research indicates that the application of the ADDIE model in blended and online learning environments enhances instructional alignment, thereby facilitating continuous quality assessment (Luo et al., 2024). The process begins with the analysis phase, during which learners' needs, technical constraints, and curriculum objectives are explicitly delineated to establish a robust pedagogical foundation (Garcia, 2019). The lessons and multimedia interactions are structured during the design process based on the principles of cognitive load according to the principles of understanding and engagement (Mayer, 2020). Digital prototypes will go through a refinement stage to bring in expert and end-user feedback, and also emphasis will be made on accessibility and usability in different platforms (Wilson and Martin, 2021). In a learning management system, modules are utilized with a mobile and desktop-friendly web interface, which provides the flexibility of delivering learning (Reyes and Dela Cruz, 2020). The assessment stage encompasses a set of measures, including technical training and self-study knowledge, score of usability as measured by the System Usability Scale (SUS), adoption intentions measured

according to the Technology Acceptance Model (TAM), and all aimed at increasing the system performance and sustainability (Deshmukh et al., 2024). The theory and skills are systematically integrated in the ADDIE model, which is essential in technical-vocational education, such as the TLE-ICT.

System Usability Scale (SUS) as Quality Assurance

The System Usability Scale is a tested tool that can be employed to assess the level of efficiency, effectiveness, and satisfaction of end-users (Brooke, 1986; Deshmukh et al., 2024). Evidence-based studies on the topic of Education and Information Technologies reveal that the System Usability Scale (SUS) can be consistently used in various educational settings, and it correlates well with the satisfaction and engagement of learners. Application of SUS to modular websites enables the developers to test the level of ease of navigation for the learners, completion of the tasks, and reception of feedback, which are all critical aspects to determine the level of engagement and persistence of the learning process by the learners.

Figure 1 shows this conceptual model of SUS, which is a shell on the outside representing the quality control shell, which relates to instructional and behavioral components. The measures make the design innovations more likely to lead to direct improvements in the usability, thereby bridging the gap between the pedagogical intent and real experience.

Technology Acceptance Model (TAM) as Behavioral Lens

The Technology Acceptance Model (Davis, 1989) explains how students perceive and interact with digital systems by utilizing the concepts of perceived usefulness (PU) and perceived ease of use (PEOU). Recent studies in educational technology verify that both constructs are positive predictors of satisfaction and intention to use (García et al., 2024; Jiang et al., 2025). Among TLE-ICT secondary learners, PU refers to smooth skill learning from a modular site, while PEOU directly links with the degree of interface clarity and workload reduction. Embedding TAM into evaluation would acknowledge success as contingent not only on ease-of-use but also perceived relevance and usefulness. As seen in Figure 1, TAM is positioned as the intermediary (middle layer) between design quality (ADDIE or non-ADDIE) and user experience. The model explains how usability perceptions influence motivation and engagement, bridging the mechanistic with the affective learning outcomes.

Theme 3: Interaction of Design, Usability, and Acceptance

Figure 1 ADDIE, TAM, and SUS frameworks intersect as shown in Figure 1. The intersection of the elements shows a dynamic and interdependent process in supporting effective modular learning facilitated by ICT. The three attributes of the model are organized instructional design and pedagogical alignment with the ADDIE model, a standard method of gauging the usability and user satisfaction with the System Usability Scale (SUS) scale, and technology acceptance through forecasting behavioral intention by the Technology Acceptance Model (TAM). These models would form a three-pronged model of a triadic framework of effective modular learning success, whereby good design, usability, and acceptance by learners are established. Empirical evidence shows that increased usability (SUS) would improve the perception of usefulness and ease of use (TAM) by the user, which, in turn, will lead to an improved engagement of the learner and improved performance, in terms of achievement (Luo et al., 2024; Zeng et al., 2024). However, conversely, good teaching content can even react to presented ICT yet fail to meet the objectives of the educational process when usability remains low (Asati, 2026) since bad user interface design always has a negative impact on perceived usefulness and utility of use (Deshmukh et al., 2024). Also, such game components as points, badges, and instant feedback can be mediators in this relationship and may sustain motivation and interest when used in the Design phase in the Evaluation phase of the ADDIE model (Li et al., 2023; Diaz, 2024). This combined approach to the curriculum assists policy-wise the competency-based continuation of the MATATAG Curriculum, in which evidence-based and learner-driven innovations are put into the limelight (DepEd, 2024). ADDIE-based TLE-ICT sites are context-dependent ecosystems of feedback, which can be combined with SUS measurements and TAM systems to enable pharmacy instructors to improve pedagogy and support individual students during the learning process.

Theoretical and Practical Implications

The synthesis of the evidence revealed several important implications for pedagogical design, usability evaluation, and educational policy. Instructors should regard ADDIE not as a linear checklist but as a process of continuous development that integrates iterative learner feedback and usability results to improve modular content design. This cyclical model enables the development of adaptive learning materials that evolve based on learners' needs and technological advancements. The utilization of the SUS score provides a cost-effective and efficient method for evaluating the quality of digital learning tools. Integrating usability evaluations into standard program assessments will enhance baseline levels for ICT initiatives, particularly in public schools where resources are limited. Third, the integration of the constructs of the Technology Acceptance Model offers educators a theoretical framework to understand the factors influencing learner persistence or disengagement. An understanding of perceived usefulness and ease of use can facilitate the design of targeted interventions aimed at enhancing learner motivation and retention. From a policy and institutional perspective, the Department of Education and teacher training institutions can employ the tri-model framework (ADDIE-SUS-TAM) as a foundation for professional development programs that enhance design literacy, facilitate data-informed evaluation, and implement a learner-centered approach in practice. Quasi-experimental or mixed methods studies are necessary to empirically validate the integrated model that examines the causal relationships among instructional design quality, usability measurements, and learning outcomes. This validation would enhance the empirical foundation of technology-mediated education, utilizing the MATATAG Curriculum and beyond.

Synthesis

Findings indicate that the effectiveness of self-learning modular websites fosters synergy among systematic design (ADDIE), measurable usability (SUS), and sustainable acceptance (TAM). When these systems operate together, they create learning environments that are pedagogically effective, technologically viable, and behaviorally stimulating. The integrated model offered accordingly, serves as a guide for educators, curriculum developers, and policymakers in institutionalizing technology-enhanced learning within the MATATAG framework.

CONCEPTUAL FRAMEWORK

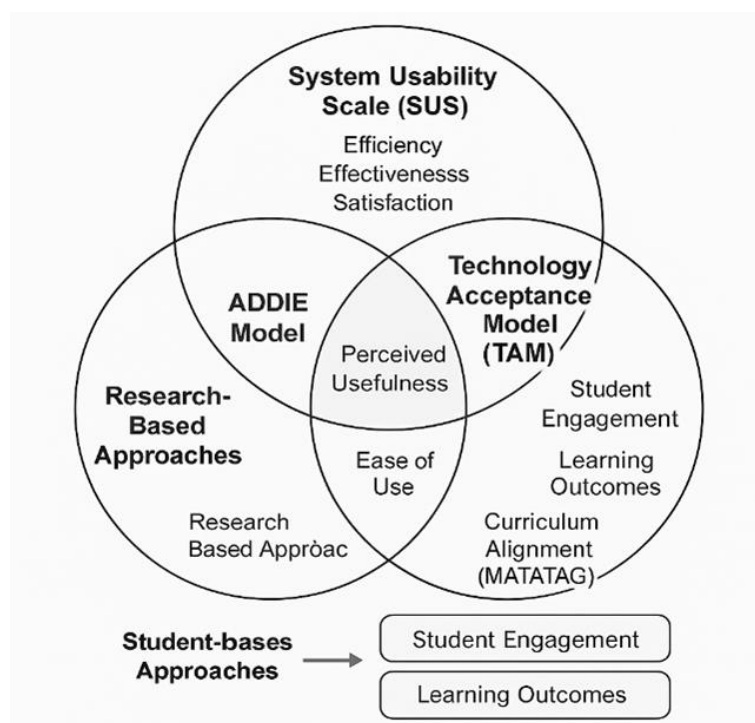


Figure 1 Integrated Framework of Instructional Design, Technology Acceptance, and Usability Models in ICT-Based Self-Learning under the MATATAG Curriculum

Figure 1 depicts the overarching concept model that was synthesized from studies included in Tables 1 and 2. By Means of a Framework, Figure 1 (below) illustrates the confluence of three distinct perspectives: U Instructional Design (ADDIE), Technology Acceptance (TAM), and System Usability (SUS). Collectively, these frameworks offer a holistic framework for the development, assessment, and sustaining of ICT-supported autonomous modular systems, which are consistent with the pedagogical and policy objectives of the MATATAG Curriculum (DepEd, 2024).

Core Layer: Instructional Design through the ADDIE Model

At the core of the integrated framework lies the ADDIE model, which establishes the pedagogical foundation for the self-learning modular website and ensures that instructional design follows a systematic, iterative process. The model comprises five phases: Analysis, Design, Development, Implementation, and Evaluation. These phases operate not as a fixed sequence but as a continuous improvement cycle that enhances adaptability and responsiveness to learner feedback (Luo et al., 2024). The analysis phase focuses on identifying learner characteristics, technological access, and gaps in digital literacy to inform design priorities. In the design phase, requirements are transformed into measurable learning objectives, multimedia formats, and organized learning activities, guided by cognitive load theory and multimedia learning principles (Mayer, 2020). The development phase involves converting prototypes into interactive, mobile-responsive modules that feature accessible and user-friendly interfaces. The modular website is implemented to gather data on learner interactions and engagement within real-world contexts. Evaluation combines formative and summative feedback mechanisms, utilizing usability metrics and adoption data to improve future design iterations. Research demonstrates that the ADDIE model significantly improves modular instruction by providing a structured yet flexible framework applicable to diverse educational settings, including technical and vocational learning environments such as TLE-ICT (Garcia, 2019; Wilson & Martin, 2021). Ndlovu and Mostert (2022) demonstrated the model's adaptability in evaluating mobile-assisted learning modules in African secondary schools, highlighting its ability to accommodate infrastructural diversity while maintaining instructional coherence. The structural core ensures that modular content is pedagogically effective, technologically consistent, and adaptable to particular learning needs.

Middle Layer: Technology Acceptance (TAM) as a Predictor of Adoption

The second circle that is located around the ADDIE core is a technology acceptance model (TAM) (Davis, 1989), which explains the intention of learners with regard to the use of the modular website. According to the Technology Acceptance Model (TAM), the usefulness (PU) and ease of use (PEOU) have a significant influence on technology attitudes and intentions to use it. The latest research proves that the elements of perceived usefulness (PU) and perceived ease of use (PEOU) have a huge impact on the engagement and retention of users in the context of secondary education (Garcia et al., 2024; Jiang et al., 2025). Perceived usefulness (PU) in TLE-ICT environment refers to the degree to which learners think that the modular site increases their digital and practical skills, and perceived ease of use (PEoU) is the confidence that the individual has in using the site easily and conveniently.

The inclusion of TAM can guarantee that the instructional designs produced by ADDIE are designed well and also psychologically acceptable to users. TAM-based surveys can be applied by educators to understand student perception, pinpoint usability bottlenecks, and tailor modules for increased motivation and long-term use. A recent extension of TAM constructs, such as self-efficacy and perceived enjoyment, which are used to account for prolonged mediated use of technologies in digital learning environments. Islam and Azad (2023) revealed that learner self-efficacy is a significant mediator of behavioral intention in e-learning systems, because learners' confidence in their own use of technology will have power over the perceived usefulness and ease-of-use.

Outer Layer: Usability Evaluation via the System Usability Scale (SUS)

Enveloping the entire model is a battered shell in the form of a System Usability Scale (SUS), which serves as a quality control machine, translating design principles and user perceptions into measurable usability outcomes (Brooke, 1986; Deshmukh et al., 2023). Translated into three key dimensions of efficiency,

effectiveness, and satisfaction, they add to the overall learning experience. Rahman and Prasetyo (2022) also reported cross-cultural reliability of the SUS model in such a case to valuing learning satisfaction in a Southeast Asian setting, after testing the relevance of this construct vis-a-vis navigation problem and interface problem encountered on Indonesian E-learning. Kraveva and Sabani (2023) presented corroborative findings indicating that elevated SUS ratings are negatively related to the intuitive structure of interfaces and enhance learning retention among high school students, hence affirming the essential dependency between usability and cognitive engagement. Padilla and Soriano (2024) noted that in the realm of higher education in the Philippines, pedagogical usability positively influences perceived satisfaction and engagement, establishing the System Usability Scale (SUS) as a multi-dimensional metric that extends beyond mere interface usability.

SUS scores provide explicit feedback to developers: a highly efficient system facilitates seamless navigation and eliminates redundancy; an effective system enables the effortless achievement of learning objectives; and when consoles receive high satisfaction ratings, user perceptions of the product tend to be favorable. This additional layer maintains a separation between the learning system and user feedback, which ensures accessibility for students who have access to a variety of technical resources. Within the framework of the changes that were put into place by MATATAG, this accessibility is very necessary in order to achieve equity in the educational system.

Dynamic Interaction and Feedback Loops

The dynamic feedback loops that span all three tiers of the integrated model are what distinguish it from other models. As demonstrated by the enhanced confidence measured by the System Usability Scale (SUS), the ADDIE approach guarantees that decisions regarding instructional design will result in an improvement in usability. In accordance with the Technology Acceptance Model (TAM) (Zeng et al.), this helps users or learners develop perceptions of the utility and simplicity of use of the technology, which in turn promotes acceptance and engagement through adoption. Results that are unfavorable with regard to the usability of a tool might motivate its redesign, and the assessment step of the ADDIE process ensures that such products are continuously improved.

As a result of this triadic interaction, a dynamic process is established that oscillates between design, validation, and adoption. This is a unique component that differentiates our practice-based approach from earlier linear models in instructional development (M+1) (Luo et al., 2025). This positioned usability and learner perception as core components of instructional design, rather than auxiliary features that were previously considered to be supplemental.

Alignment with the MATATAG Curriculum

The MATATAG Curriculum stresses the ideas of relevance, equity, and quality through learner-centered and technology-enhanced teaching (DepEd, 2024). The proposed integrated system effectively aligns with these objectives by promoting self-paced, competence-oriented learning through the use of ICT tools. The ADDIE model is a model that ensures that the goals of learning and performance standards are consistent with one another at all levels of learning. This ensures that the objectives of the curriculum are aligned with online integration. This framework incorporates the Technology Acceptance Model (TAM) to enable the students to feel more empowered and motivated, which are two key aspects of lifelong learning in a digital classroom. The System Usability Scale (SUS) correlates with the concept of accessibility, inclusiveness, and user satisfaction, particularly in resource-constrained public schools. The integration of these frameworks brings a continuous design-evaluation-adoption process to facilitate the MATATAG Curriculum achieve its objectives of facilitating quality, equity, and technology-enhanced learning. The combined tri-model process serves as a collaborative model of curriculum implementers, educators, and educational technology to establish research-intensive digital learning ecosystems that will support the aims and purposes of MATATAG and the overall aims and purposes of digital transformation in Philippine education.

IMPLICATIONS AND FUTURE DIRECTIONS

This combination of the instructional design, the technology acceptability, and the usability paradigms brings a lot of understanding to the educators, curriculum developers, curriculum planners, and policy makers in order

to enhance the quality of modular and technology-mediated instruction in Philippine secondary education. This merging advances the comprehensive approach, which connects academic proficiency, student perception, and technological effectiveness, which resonate strongly with the principles of the MATATAG Curriculum. Vega and Santos (2023) demanded the need to implement digital pedagogy frameworks integrating the concepts of technological acceptability and usability to help increase student engagement and to promote policy-based innovations in technical education, specifically in the context of the Southeast Asian region.

Implications for Teachers and Instructional Designers

For teachers and educational designers, the framework emphasizes the importance of deliberate design and iterative testing. It is through the ADDIE model that materials developed for self-directed learning can extend content delivery to an active-competence-based learning experience. Educators are encouraged to use **learner data** from pre-assessments, usability tests, and feedback forms to continuously refine modules and adapt instructional strategies (Luo et al., 2024). The involvement of SUS metrics provides teachers with a simple way to evaluate usability that is not dependent on high levels of technical knowledge. Regular usability testing can inform improvements in design, navigation, and interactivity, particularly for learners with low digital literacy. Similarly, educators utilize the TAM factors of perceived usefulness and perceived ease of use to predict learner motivation and engagement, addressing potential issues that could hinder adoption before negatively impacting learning outcomes (García et al., 2024; Jiang et al., 2025).

Implications for Curriculum Developers and Policymakers

At the curriculum level, an integrated approach is proposed to support DepEd's program for a competency-based, ICT-enhanced learning with the MATATAG Curriculum (20224). The approach establishes a basis for guaranteeing the quality of digital materials prior to their dissemination. By combining the principles of usability and acceptability with policy prescriptions, educational institutions will be able to ensure that learning platforms are accommodating, convenient, and educationally sound. The combination of SUS and TAM data can help policymakers make decisions regarding spending in infrastructure and teacher education in order to make sure that digital technologies comply with technical requirements and user-satisfaction standards. It is an evidence-based planning approach that enhances national English Language Teaching initiatives in terms of accountability and sustainability.

Directions for Future Research

Future researchers are urged to empirically confirm the hypothesized predictive capabilities of the integrated ADDIE–TAM–SUS model through quasi-experimental or mixed-method designs, incorporating various grade levels and discipline-specific contexts. It can also be the subject of longitudinal studies to learn how usability and acceptance change as users acquire experience with digital tools (Baxter & Eyles, 1997), while design-based research might refine this model in authentic classroom contexts (Whittemore & Knafl, 2005).

Moreover, broadening the model to consider affective as well as socio-cultural factors - examples include the role of learner resilience, digital ethics, and collaborative learning - could enhance its relevance in a wide range of other educational settings. By integrating design science and learning analytics, researchers can develop knowledge-based evidence that supports the creation of adaptive and personalized modular systems that are in accordance with MATATAG's equity and innovation objectives.

CONCLUSION

In this paper, recent advancements in instructional design, technology acceptance, and usability evaluation have been integrated to present a unified model for ICT-based self-learning modular education in TLE-ICT as implemented under the MATATAG Curriculum. The synthesis of ADDIE, TAM, and SUS frames this paper's convergent view that combines pedagogical principles, user satisfaction, and learners' perception - three key dimensions in a sustainable digital learning pedagogy development.

Literature on the topic of modular learning published between 2019 and 2025 indicates that content quality is not the only indicator of modular learning efficacy. The presence of highly developed, easy-to-use, and applicable materials limits learning. The ADDIE model facilitates the establishment of a pedagogical alignment with the help of successive design and assessment. At the same time Technology Acceptance Model (TAM) explains the attitude of learners toward technologies, which serve as predictors of behavioral integration with the usability of technologies. Combining these structures results in a feedback loop that enhances the quality of instruction, independence amongst students, and ensures that the curriculum aligns with skills in the 21st century.

The consistency of models in the Philippine education environment is a reflection of the MATATAG Curriculum priorities of the Department of Education, which is focused on access, inclusivity, and digital transition. The framework offers a rich source to teachers and policy makers to develop self-learning systems that can serve diverse learners as well as guarantee the best quality of pedagogical delivery. The framework has the potential to lead to various initiatives on different topics that involve blended and on-demand learning activities.

The theoretical framework of educational technology research and its application is improved as the ADDIE, TAM, and SUS models are combined. The research study indicates that converting learning into a modular form goes beyond digitizing it; it has to be designed properly, tested by the users, and approved by the learners. All these ought to inform the post-digital HWB teaching. Zhang and Chen (2025) found that the combination of usability, motivation, and engagement to AI-driven learning systems ensures the flexibility of digital pedagogies, which are crucial in the development of learner-centered modular learning systems.

REFERENCES

1. Alon-Barkat, S., & Busuioc, M. (2022). Artificial intelligence decision-support in education: Trust, autonomy, and accountability. *Computers & Education*, 180, 104447. <https://doi.org/10.1016/j.compedu.2022.104447>
2. Alzahrani, M. G. (2021). The effect of self-regulated learning on learners' academic achievement in online environments. *Education and Information Technologies*, 26(3), 3337–3355. <https://doi.org/10.1007/s10639-020-10415-6>
3. Apellido, J. M. (2025). Interactive self-learning materials and student performance in computer systems servicing: A quasi-experimental analysis. *Philippine Journal of Educational Technology*, 17(2), 45–60.*
4. Bernardo, A. B. I. (2021). Self-learning modules and learner autonomy in Philippine secondary education. *Asia-Pacific Education Researcher*, 30(5), 487–496.* <https://doi.org/10.1007/s40299-021-00581-7>
5. Brooke, J. (1986). System Usability Scale (SUS): A quick and dirty usability scale. Digital Equipment Co.
6. Chiu, T. K. F., & Hew, T. K. (2021). Factors influencing learning outcomes in blended learning: A systematic review of technology acceptance. *Interactive Learning Environments*, 29(6), 939–956. <https://doi.org/10.1080/10494820.2020.1777114>
7. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.* <https://doi.org/10.2307/249008>
8. Department of Education [DepEd]. (2024). The MATATAG Curriculum framework. DepEd Order No. 010, s. 2024. <https://www.deped.gov.ph>
9. Deshmukh, V., Patel, S., & Kumar, R. (2024). Validating the System Usability Scale for e-learning platforms in secondary education. *Education and Information Technologies*, 29(6), 8099–8116.* <https://doi.org/10.1007/s10639-024-12711-5>
10. Diaz, R. C. (2024). Gamified modular instruction and student motivation in online technical-vocational education. *Journal of Digital Pedagogies*, 5(1), 22–35.*
11. García, M. A. (2019). Applying the ADDIE model in developing digital instructional materials for technical subjects. *International Journal of Educational Development*, 65, 102–110.*

12. García, E., Ruiz, R. & Morales, F. (2024). Exploring TAM constructs in higher-education e-learning adoption post-pandemic. *Computers & Education Open*, 8, 100189.* <https://doi.org/10.1016/j.caeo.2024.100189>
13. Hashim, H., Yunus, M. M., & Embi, M. A. (2022). Exploring digital readiness and technology acceptance among ESL teachers in Malaysian secondary schools. *Asian EFL Journal*, 24(3), 214–235.*
14. Islam, A. N., & Azad, N. (2023). Investigating learners' behavioral intention in e-learning through extended TAM and self-efficacy. *Education and Information Technologies*, 28(5), 5373–5392.* <https://doi.org/10.1007/s10639-023-11680-3>
15. Jiang, S., Lee, J., & Chen, H. (2025). Technology acceptance and engagement in self-paced online learning among secondary students. *British Journal of Educational Technology*, 56(1), 65–83.* <https://doi.org/10.1111/bjet.13420>
16. Kapp, K. M. (2019). *The gamification of learning and instruction: Game-based methods and strategies for training and education*. Wiley.
17. Kraleva, R., & Sabani, M. (2023). Evaluating user interface design for digital learning materials among high school students. *British Journal of Educational Technology*, 54(2), 357–372.* <https://doi.org/10.1111/bjet.13200>
18. Li, Y., Tan, K., & Halim, N. (2023). Gamification for engagement in virtual learning: A meta-analytic review. *Frontiers in Education*, 8, 112–129.* <https://doi.org/10.3389/feduc.2023.112129>
19. Luo, Y., Zhou, M. Y Wu, P. (2024). Enhancing instructional quality through the ADDIE model in blended learning environments. *Educational Technology Research and Development*, 72(4), 1897–1915.* <https://doi.org/10.1007/s11423-024-01385-8>
20. Mayer, R. E. (2020). *Multimedia learning* (3rd ed.). Cambridge University Press.
21. Ndlovu, M., & Mostert, I. (2022). Evaluating mobile-assisted learning through the ADDIE framework: Lessons from African secondary schools. *Education and Information Technologies*, 27(3), 3211–3230.* <https://doi.org/10.1007/s10639-021-10813-5>
22. Padilla, D., & Soriano, J. (2024). Pedagogical usability of e-learning systems in Philippine universities: A mixed-methods analysis. *International Journal of Emerging Technologies in Learning*, 19(5), 65–79.* <https://doi.org/10.3991/ijet.v19i05.38724>
23. Rahman, F., & Prasetyo, A. (2022). Usability evaluation and learner satisfaction in Indonesian e-learning platforms: Applying the System Usability Scale (SUS) framework. *Asian Journal of Distance Education*, 17(2), 25–40.* <https://doi.org/10.5281/zenodo.7225512>
24. Reyes, L., & Dela Cruz, E. (2020). E-learning integration in technical-vocational education and its impact on learner engagement. *Asia Pacific Journal of Education*, 40(4), 612–627.* <https://doi.org/10.1080/02188791.2020.1849634>
25. Santos, M. R., Y De Guzmán, J. P. (2023). Technology-enhanced self-learning modules and student motivation in Philippine senior high school. *International Journal of Learning, Teaching and Educational Research*, 22(4), 145–162.* <https://doi.org/10.26803/ijlter.22.4.8>
26. Vega, N. C., & Santos, L. (2023). Digital pedagogy and learner engagement in Southeast Asian technical education. *Asia Pacific Education Review*, 24(3), 547–563.* <https://doi.org/10.1007/s12564-023-09821-3>
27. Whittemore, R., & Knafl, K. (2005). The integrative review: Updated methodology. *Journal of Advanced Nursing*, 52(5), 546–553.* <https://doi.org/10.1111/j.1365-2648.2005.03621.x>
28. Wilson, C., & Martin, P. (2021). Constructivist learning and digital education: A framework for modular ICT instruction. *Computers in Human Behavior Reports*, 3, 100074.* <https://doi.org/10.1016/j.chbr.2021.100074>
29. Zeng, L., He, Q., & Zhang, X. (2024). Designing technology-enhanced learning environments: Integrating usability, motivation, and engagement. *British Journal of Educational Technology*, 55(3), 739–758.* <https://doi.org/10.1111/bjet.13325>
30. Zhang, Y., & Chen, J. (2025). Integrating usability, engagement, and motivation in AI-driven learning environments. *Computers & Education*, 210, 105032.