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# From Digital Skills to Digital Literacy: Designing an Interactive Learning Model for Senior High School

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**ABSTRACT**

Digital transformation changes how student access, process, and produce information in modern educational settings. While high school students are often proficient in basic digital skills, this operational competency does not automatically translate into digital literacy, the ability to critically evaluate, analyze, and use information responsibly in the post-truth era. This study aims to design an Interactive Digital Literacy Learning Model (IDLLM) as a conceptual framework to bridge the gap between mechanical digital skills and critical digital literacy for high school students. Utilizing a design-oriented conceptual research approach based on the Dynamic Cognitive Learning Theory (DCLT), this study systematically identified relevant literature on digital literacy, selected theoretical and pedagogical studies focusing on interactive learning, analyzed them to extract core cognitive mechanisms, and synthesized these findings to formulate a structured instructional model. The resulting model consists of four cyclical phases: (1) Digital Information Engagement, (2) Critical Digital Evaluation, (3) Collaborative Knowledge Integration, and (4) Cognitive-Digital Reflection. The IDLLM shifts the educational focus from mere technology use to critical and reflective technology engagement, positioning teachers as cognitive mentors and technology (including generative AI) as a thinking partner rather than an absolute source of truth. The conceptualized model provides a systematic guideline for educators to foster higher-order cognitive skills and epistemic resilience in digital environments. Future research directions include expert validation and empirical testing to measure the model's effectiveness in diverse classroom settings.

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## A. INTRODUCTION

Digital transformation impacts how learners acquire, process, apply, and generate information (Falloon, 2020; Maharani et al., 2026). Digital devices, search engines, social media platforms, learning management systems, and generative artificial intelligence are now deeply embedded in the educational landscape, becoming nearly inseparable from students' daily lives (Selwyn, 2022). This shift presents substantial opportunities for education, granting learners access to a massive amount of learning resources. Consequently, the paradigm has shifted from an era of information scarcity to one of information abundance (Bawden & Robinson, 2020; Siemens et al., 2019). However, merely having access to technology and knowing how to operate it does not inherently mean that students have developed robust digital literacy (Buckingham, 2015; Kurniawan & Sarah, 2025). The ability to navigate devices, utilize applications, conduct internet searches, or create digital content represents foundational digital competencies. Yet, true digital literacy demands a much broader skill set, specifically the capacity to comprehend, analyze, evaluate, and employ information in a critical and responsible manner (Hobbs, 2017).

Kurniawan (2025) emphasizes that digital literacy cannot be reduced merely to the technical proficiency required to operate digital tools or access online information. Instead, it encompasses the ability to critically and responsibly understand, analyze, evaluate, and produce information, involving cognitive, social, and ethical dimensions when interacting within digital spaces (Bawden & Robinson, 2020; Pangrazio et al., 2020). Therefore, a clear conceptual distinction exists between digital skills, the operational ability to use technology and digital literacy the competence that enables individuals to engage with technology and digital information critically, reflectively, ethically, meaningfully, and responsibly (van Dijk & van Deursen, 2014).

Differentiating between the two is especially important for Senior High School students. While high school students represent a demographic highly immersed in digital technology, this proximity does not consistently equate to the ability to critically evaluate the information they encounter (Wineburg & McGrew, 2019). Studies examining digital literacy in educational contexts reveal that terms such as digital literacy, digital skills, digital competence, and 21st-century digital skills are frequently used interchangeably, despite possessing distinct conceptual scopes (Spante et al., 2018). A publication by Novenra & Sapta (2025) highlights a fragmentation in the journal some research views digital literacy primarily as the practical skills used in everyday technology application, while other studies situate it squarely within the context of formal learning. This fragmentation underscores the need to build a more integrated understanding of how foundational digital skills can be cultivated into comprehensive digital literacy throughout the learning process.

Moreover, today's learners must navigate an information environment characterized by rapid change, unverified content, algorithmic curation, filter bubbles, echo chambers, disinformation, and the outputs of generative artificial intelligence (Guess et al., 2020; Pennycook & Rand, 2021). In such an environment, the mere ability to locate information is no longer sufficient. Students must be equipped to question the information they find, cross-reference sources, verify credibility, identify potential biases, synthesize diverse perspectives, and make informed decisions grounded in verifiable evidence (Caulfield, 2017; Wineburg & McGrew, 2019).

These conditions also necessitate a shift in how technology-enhanced learning is conceptualized. Technology should not be viewed solely as a delivery mechanism for transmitting content more rapidly; rather, it must be integrated into the learning environment to stimulate higher-order cognitive activities (Gazali & Sumarsono, 2025; Howland et al., 2014). In essence, the primary challenge of digital education is no longer just teaching students how to use technology, but designing learning experiences that guide students to think through, with, and about technology.

Several studies suggest that interactive learning environments hold significant potential for developing students' digital literacy. For instance, research involving high school students in Indonesia demonstrated that interactive learning interventions can improve digital literacy capabilities, as evidenced by pre- and post-learning assessments (Ervianti et al., 2023). Another study focusing on tenth-grade students found that the use of interactive learning media based on Google Sites led to greater improvements in digital literacy compared to conventional teaching methods (Astini, 2020; Miramadhani et al., 2024). These findings indicate that interactivity can serve as a valuable pedagogical approach for cultivating digital literacy (Hendratni et al., 2026).

While current interactive learning shows potential, existing research remains heavily focused on the specific media or platforms utilized such as e-modules, Google Sites, multimedia presentations, or distinct learning applications (Sugiarto et al., 2023). While

recent studies document the proliferation of various interactive media formats designed to enhance digital literacy, the emphasis is frequently placed on the development of the media product itself or the measurement of its immediate effectiveness. While such approaches are valuable, they do not fully address a more fundamental question: how must cognitive processes and student learning activities be designed so that technology use extends beyond basic digital skills and evolves into true digital literacy? This question serves as the point of departure for the present study.

This study employs Dynamic Cognitive Learning Theory (DCLT), formulated by (Kurniawan & Saksana, 2026a), as its primary conceptual foundation for designing the learning model. DCLT was developed in response to the shifting educational landscape of the digital era, aiming to synergize the internal cognitive flexibility emphasized by Cognitivism with the external technological networks highlighted by Connectivism (Kurniawan & Saksana, 2026a; Siemens et al., 2019). DCLT is constructed upon three main pillars: Adaptive Cognition, Critical Digital Literacy and Navigation, and Learning Ecosystem Synergy. The learning mechanism within DCLT unfolds through four cyclical stages: Information Input, Cognitive Evaluation, Knowledge Integration, and Reflection.

The Adaptive Cognition pillar of DCLT positions mental flexibility as a crucial capability for learners. Students are not just expected to receive new information; they must possess the readiness to question their initial assumptions, unlearn misconceptions, and relearn based on stronger evidence (Kurniawan, 2025b). Meanwhile, the Critical Digital Literacy and Navigation pillar focuses on students' ability to navigate algorithmic traps using strategies such as lateral reading, cross-checking, and information triangulation (Wineburg & McGrew, 2019).

Furthermore, DCLT advocates for a transformation in the roles of both technology and educators within the learning process. Technology, including generative AI, is not positioned as an unquestionable source of truth, but rather as a “thinking partner” whose outputs must be continuously evaluated by the learner (Rusman et al., 2024). Concurrently, teachers transition from being mere transmitters of information to cognitive mentors who design engaging learning experiences, pose metacognitive challenges, and support students in developing robust evaluative and reflective skills (Ertmer & Ottenbreit-Leftwich, 2010).

This theoretical framework aligns strongly with the need to cultivate digital literacy. If digital skills represent the foundational ability to use devices and technologies, the learning process must provide structured opportunities for students to apply these skills in activities that require evaluation, synthesis, collaboration, creation, and reflection (Fraillon et al., 2020). Consequently, digital skills are treated not as the ultimate goal, but as the starting point on the path toward more complex digital literacy competencies.

This research also builds upon the premise that digital literacy must be situated within the context of reflective learning (Meyers et al., 2013). Within DCLT, this metacognitive process is facilitated through a “Cognitive Audit Trail,” which involves documenting the evolution of a student's thinking based on the evidence they encounter (Kurniawan & Saksana, 2026b, 2026a; Wing, 2006). This approach allows the thinking process itself to become a key component of assessment, moving beyond the mere evaluation of a final product.

Grounded in these theoretical perspectives, this study seeks to address the pedagogical gap between the operational use of technology and its critical, reflective application. This gap is fundamentally pedagogical because, while the theoretical necessity of digital literacy is well-documented, educators often lack structured instructional sequences to cultivate it in daily classroom practices. Addressing this gap is

vital because while previous research indicates that interactive learning interventions can enhance digital literacy (Ervianti et al., 2023), there remains a pressing need for instructional designs that explicitly articulate the mechanisms by which digital skills transform into digital literacy.

Therefore, this study aims to design an interactive learning model that serves as a conceptual framework for developing digital literacy among high school students, utilizing the principles of Dynamic Cognitive Learning Theory. The contribution of this research is twofold. First, regarding DCLT, the IDLLM operationalizes its broad theoretical pillars into a practical, classroom-ready instructional syntax. Second, compared to existing digital literacy frameworks that often focus heavily on media production or technical proficiency, the IDLLM introduces a mandatory, structured cognitive-reflective cycle that explicitly positions technology (including AI) as a partner for critical thinking rather than just a medium for information retrieval.

## B. METHODS

This study employs a design-oriented conceptual research approach (McKenney & Reeves, 2013), focusing on the conceptual design of an interactive learning model aimed at developing digital literacy in high school students. This specific approach was selected because the primary objective of this phase of the research is not full product development, expert validation, field testing, or efficacy evaluation. Instead, the goal is to generate a comprehensive model design that is grounded in a clear theoretical foundation and robust pedagogical rationale (Purwati et al., 2024).

The design process was informed by three primary sources: theoretical reviews, synthesis of previous research findings, and the operationalization of Dynamic Cognitive Learning Theory principles within the context of high school education. DCLT served as the overarching framework to connect cognitive processes, critical digital literacy, technological interaction, and reflection within a cohesive learning cycle.

The first stage involved conceptual identification. This stage analyzed the distinctions between digital skills and digital literacy. Digital skills were conceptualized as the operational abilities required to use devices, applications, networks, and digital technologies. In contrast, digital literacy was understood as the broader capacity to comprehend, analyze, evaluate, produce, and utilize digital information critically and responsibly (Sena Kurniawan & Yuni Siti Sarah, 2023; van Dijk & van Deursen, 2014).

The second stage comprised the synthesis of the theoretical foundation. DCLT was employed to delineate the transition from basic technology use to deeper cognitive engagement. The four stages of DCLT Information Input, Cognitive Evaluation, Knowledge Integration, and Reflection, provided the structural basis for developing the phases of the proposed learning model.

The third stage focused on competency mapping. Each phase of the learning model was mapped to relevant digital activities and cognitive tasks. This mapping ensured that the interactivity embedded within the model extended beyond students merely interacting with devices, encompassing interactions with information, sources, peers, teachers, and the technology itself (Howland et al., 2014).

The fourth stage involved the actual design of the model. The model was formulated by detailing the instructional syntax, teacher activities, student activities, modes of interaction, learning artifacts, and reflective exercises. The resulting design was then subjected to conceptual analysis to ensure strong alignment among the learning objectives, the planned activities, and the specific digital literacy competencies targeted for development.

Through this four-stage design process, the methodology specifically addresses the need for practical application of emerging theories. By systematically mapping DCLT principles into specific student and teacher activities, this method directly contributes to DCLT by providing it with a concrete, classroom-ready instructional syntax (the IDLLM). Furthermore, by structurally embedding the 'Cognitive-Digital Reflection' phase as a mandatory design requirement, this methodological approach explicitly overcomes the limitations of existing digital literacy frameworks that tend to stop at media production or basic operational skills.

Because this study concludes at the design phase, it does not include an empirical evaluation of the model's effectiveness. Expert validation, feasibility studies, empirical testing, and efficacy evaluations are explicitly positioned as necessary agendas for future research (Amiel & Reeves, 2008). This approach aligns with the current status of DCLT as an emerging theory that requires further empirical validation and the development of more specific instructional models.

## C. RESULT AND DISCUSSION

### 1. Conceptualizing the Transition from Digital Skills to Digital Literacy

Conceptualizing the Transition from Digital Skills to Digital Literacy

The primary outcome of this research is a conceptual framework that positions digital skills as an essential prerequisite, rather than the ultimate endpoint, of digital learning. In the proposed model, the transition from skills to literacy is not viewed as an automatic occurrence (Buckingham, 2015). A student capable of using a search engine is not necessarily equipped to determine the credibility of the information they find. Similarly, a student adept at prompting generative AI may lack the skills to verify the accuracy of the AI's output (Holmes et al., 2019). Furthermore, a student who can produce digital content may not fully grasp the ethical, social, and epistemic implications of the content they create (Pangrazio et al., 2020).

Therefore, the learning model must intentionally create conditions that compel students to apply their digital skills within higher-order cognitive tasks. Conceptually, this transition is illustrated in the figure below:




**Figure 1**. The Transition to Digital Literacy

This sequence represents a conceptual expansion of the DCLT cycle. 'Information Input' serves as the entry point for digital engagement; 'Cognitive Evaluation' fosters critical evaluation skills; 'Knowledge Integration' transforms raw information into collaborative understanding; and 'Reflection' strengthens the students' metacognitive awareness (Kurniawan & Saksana, 2026b; Sweller et al., 1998).

### 2. Analytical Evidence: Mapping Cognitive Mechanisms to Literacy Phases

Before formulating the specific instructional steps, this study conducted a conceptual analysis mapping the fundamental principles of Dynamic Cognitive Learning Theory (DCLT) and existing digital literacy literature against the cognitive mechanisms required for epistemic growth. This analysis yielded four distinct evidential transitions that serve as the foundation for the model:

a. From Access to Engagement: Literature indicates that passive information consumption is insufficient (Siemens et al., 2019). The analytical evidence suggests

that DCLT 'Information Input' stage must be pedagogicalized into active "Engagement," where students purposefully interact with search engines and AI to retrieve data based on specific problem prompts.

b. From Assumption to Interrogation: Research on lateral reading Wineburg & McGrew (2019) highlights a critical vulnerability in students evaluation skills. Analytically, DCLT 'Cognitive Evaluation' stage translates into a necessary pedagogical intervention where information, especially AI-generated outputs is treated as a hypothesis rather than truth, requiring rigorous cross-checking.
c. From Isolation to Synthesis: Digital competence frameworks (Falloon, 2020) emphasize the creation of new knowledge. The evidence indicates that DCLT 'Knowledge Integration' must be facilitated collaboratively, forcing students to negotiate meaning and synthesize verified data into novel digital artifacts.
d. From Task-Completion to Metacognition: Reflective learning environments are proven to solidify cognitive gains (Meyers et al., 2013). Analytically, DCLT 'Reflection' stage requires a structured mechanism, specifically the 'Cognitive Audit Trail,' to track how students internal schemas adapt after encountering new digital evidence.

## 3. Design of the Interactive Learning Model

Based on the analytical evidence and synthesis above, the researchers interpreted these foundational mechanisms into a practical instructional design: the Interactive Digital Literacy Learning Model (IDLLM). This model is proposed to operationalize the theoretical transition into classroom-ready practices.

This model comprises four primary cyclical phases. To address the need for a comprehensive guide for classroom implementation, the detailed syntax, including activities, resources, and assessment indicators, is presented in Table 1.

**Table 1.** Comprehensive Syntax of the Interactive Digital Literacy Learning Model (IDLLM)

| Phase | DCLT Foundation | Focus | Teacher Activities | Student Activity | Expected Outputs |
|---|---|---|---|---|---|
| Phase 1 - Digital Information Engagement | Information Input | Accessing and exploring information | Poses complex, open-ended problems; acts as a facilitator. | Searching, prompting, browsing | A compilation of raw data, links, and initial AI responses. |
| Phase 2 - Critical Digital Evaluation | Cognitive Evaluation | Assessing information credibility | Guides lateral reading; models fact-checking techniques. | Lateral reading, cross-checking, triangulation | Source evaluation notes; identification of bias or misinformation. |
| Phase 3 - Collaborative Knowledge Integration | Knowledge Integration | Constructing and synthesizing knowledge | Facilitates group negotiation; provides technical scaffolding | Discussion, collaboration, synthesis, production | Digital artifacts (reports, infographics, videos). |

| | | | | | |
|---|---|---|---|---|---|
| | | | for production. | | |
| Phase 4 - Cognitive-Digital Reflection | Reflection | Evaluating changes in thinking | Reviews the Cognitive Audit Trail; asks metacognitive questions. | Cognitive audit trail, reflection, dialogue | A completed Cognitive Audit Trail document. |

The first phase is not intended for passive information reception. Instead, students are presented with a problem or question that necessitates the active exploration of digital resources. Technology is utilized to search for data, navigate search engines, read digital texts, or interact with AI tools. Within the DCLT framework, technology provides access to a vast expanse of information, but this access is not yet considered validated knowledge.

The second phase is a critical component that distinguishes this model from digital learning approaches focused solely on technology usage. After acquiring information, students are required to interrogate it. Techniques such as lateral reading (Wineburg & McGrew, 2019), for example, prompt students to leave the source page they are currently viewing and search for information about that source from other credible outlets. This phase is particularly relevant when dealing with generative AI. The AI's response serves as a starting point for exploration, not the endpoint of reasoning. Students must cross-reference AI outputs with other sources to determine the reliability of the information (Caulfield, 2017).

The third phase shifts students from being evaluators to knowledge builders. The verified information is not merely collected as a list of links or notes; it is actively processed through discussion, collaboration, synthesis, and production (Falloon, 2020). During this stage, students might create reports, infographics, presentations, videos, articles, or other digital artifacts based on the rigorously evaluated information.

The fourth phase centers on reflection. Students are asked not only "what did you learn?" but more importantly, "how has your thinking changed after acquiring and evaluating this information?". This principle aligns directly with the Cognitive Audit Trail concept in DCLT, which positions the evolution of a student's thought process as a vital component of the learning journey (Meyers et al., 2013).

## 4. The Role of Teachers and Technology in the Model

The proposed model also redefines the roles of both the teacher and the technology. The teacher is no longer the sole dispenser of information; instead, they function as a cognitive mentor who guides students in questioning, evaluating, and reflecting upon information.

In DCLT, teachers are positioned as architects of learning experiences who design metacognitive challenges and support students in cultivating thinking skills that automation cannot replicate. Similarly, technology is not positioned as the ultimate goal of learning. AI, search engines, digital media, and other applications are integrated as components of the broader learning ecosystem. DCLT explicitly frames AI as a thinking partner, rather than an infallible "oracle."

Consequently, the interactions within the model can be depicted as follows:

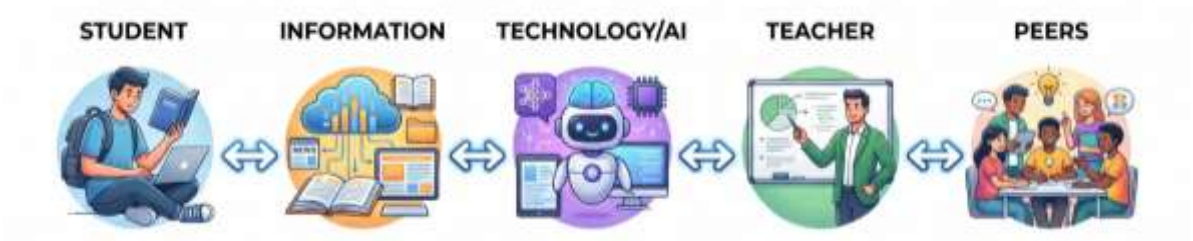



**Figure 2**. Interaksi Dalam Model

These interactions facilitate a shift from simple human-machine interaction to epistemic interaction, interaction focused on how knowledge is acquired, tested, constructed, and reflected upon.

## 5. The Model's Relationship with Digital Literacy

The primary strength of the IDLLM lies in its deliberate alignment of learning activities with the multi-dimensional aspects of digital literacy.

In the first stage, students deploy their digital skills to access and retrieve information. In the second stage, these skills are channeled into critical digital literacy through rigorous verification and evaluation processes. In the third stage, students utilize the validated information to construct new knowledge and generate content. In the final stage, students critically reflect on their own cognitive processes and their use of technology.

Thus, the model does not treat digital literacy as a single, isolated skill, but rather as a complex competency that matures through a sequenced series of learning experiences.

Findings from previous research underscore the importance of such an approach. Studies involving senior high school students indicate that interactive learning can enhance digital literacy, while other research confirms that technology-based interactive learning media positively impacts students' digital literacy skills. However, the model proposed in this study broadens the focus from merely utilizing interactive media to engaging in an interactive learning process.

This distinction is crucial. Media can be deemed “interactive” simply because it features buttons, videos, quizzes, animations, or other digital elements. However, truly interactive learning requires students to engage meaningfully with problems, information, diverse sources, their peers, the technology itself, and their own thought processes.

## 6. Potential Contributions of the Model

Conceptually, this model offers three key contributions.

- First, the model establishes a conceptual bridge between digital skills and digital literacy. Technical skills are not dismissed; rather, they are leveraged as the necessary foundation for higher-order critical and reflective thinking.
- Second, the model translates the broad principles of DCLT into a specific instructional design tailored for senior high school students. This addresses the recommendations of previous DCLT research, which highlighted the need for the development of targeted instructional models.
- Third, the model integrates reflection as a core, mandatory component rather than an optional add-on. This ensures that digital literacy is understood not just as the ability to perform tasks with technology, but also as the capacity to

comprehend how technology and information shape one's own cognitive processes.

## D. CONCLUSION AND SUGGESTIONS

This study outlines the design of an Interactive Digital Literacy Learning Model intended to bridge the gap between basic digital skills and comprehensive digital literacy for high school students. The model is grounded in the principles of Dynamic Cognitive Learning Theory and comprises four primary phases: Digital Information Engagement, Critical Digital Evaluation, Collaborative Knowledge Integration, and Cognitive-Digital Reflection.

The model positions the technical ability to use technology as the starting point, subsequently guiding students through processes of critical evaluation, knowledge integration, collaboration, content production, and reflection. Consequently, the use of technology in learning extends beyond mere operational capability; it is purposefully directed toward cultivating students' abilities to assess information, construct knowledge, and engage with technology in a critical and responsible manner.

Because this research is currently at the conceptual design stage, the resulting framework cannot yet be claimed as an empirically proven model. Expert validation, feasibility testing, limited implementation, and comprehensive efficacy evaluations are essential next steps for future research. Acknowledging these limitations is consistent with the current status of DCLT, which itself requires further empirical investigation.

Future research is recommended to test the proposed model design across various academic subjects and different school demographics. Empirical studies are also necessary to determine the specific extent to which each phase of the model contributes to the overall development of students' digital literacy.

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