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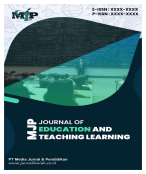

Deep Learning Pedagogy, Ethical Awareness, and Critical Digital Literacy in Higher Education: A Systematic Review

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ABSTRACT

This systematic literature review examines how deep learning pedagogy influences students' ethical awareness and critical digital literacy in higher education. Existing research has discussed deep learning, digital literacy, and ethical awareness separately, yet limited attention has been given to how these three constructs intersect as an integrated pedagogical concern in university learning. To address this gap, the review analyzed 16 articles published between 2016 and 2026, selected from Scopus, ERIC, ScienceDirect, SpringerLink, Taylor & Francis Online, and SINTA 1 and 2 journals. The review followed systematic review procedures informed by Zawacki-Richter et al. and PRISMA 2020, with analysis focused on publication trends, countries, research methods, conceptualizations, pedagogical strategies, and research gaps. The findings show that deep learning pedagogy is commonly associated with student-centered learning, higher-order thinking, reflection, problem-solving, and authentic digital inquiry. Its influence is more evident in critical digital literacy than in ethical awareness, although recent AI ethics studies show growing attention to academic integrity, moral sensitivity, and responsible technology use. The novelty of this review lies in synthesizing deep learning pedagogy as a potential pathway for developing ethically aware and critically literate university students in digital higher education.

Informasi Artikel

Kata Kunci:

pedagogi pembelajaran mendalam; kesadaran etis; literasi digital kritis; pendidikan tinggi; tinjauan pustaka sistematis

ABSTRAK

Tinjauan literatur sistematis ini mengkaji bagaimana pedagogi pembelajaran mendalam memengaruhi kesadaran etis dan literasi digital kritis mahasiswa di perguruan tinggi. Penelitian yang ada telah membahas pembelajaran mendalam, literasi digital, dan kesadaran etis secara terpisah, namun perhatian yang diberikan terhadap bagaimana ketiga konstruksi ini bersinggungan sebagai perhatian pedagogis terintegrasi dalam pembelajaran universitas masih terbatas. Untuk mengatasi kesenjangan ini, tinjauan ini menganalisis 16 artikel yang diterbitkan antara tahun 2016 dan 2026, yang dipilih dari jurnal Scopus, ERIC, ScienceDirect, SpringerLink, Taylor & Francis Online, serta SINTA 1 dan 2. Tinjauan ini mengikuti prosedur tinjauan sistematis yang didasarkan pada Zawacki-Richter dkk. dan PRISMA 2020, dengan analisis berfokus pada tren publikasi, negara, metode penelitian, konseptualisasi, strategi pedagogis, dan kesenjangan penelitian. Temuan menunjukkan bahwa pedagogi pembelajaran mendalam umumnya dikaitkan dengan pembelajaran berpusat pada mahasiswa, berpikir tingkat tinggi, refleksi, pemecahan masalah, dan penyelidikan digital yang autentik. Pengaruhnya lebih terlihat pada literasi digital kritis daripada kesadaran etis, meskipun studi etika AI terbaru menunjukkan perhatian yang semakin meningkat terhadap integritas akademik, kepekaan moral, dan penggunaan teknologi yang bertanggung jawab. Keunikan tinjauan ini terletak pada sintesis pedagogi pembelajaran mendalam sebagai jalur potensial untuk mengembangkan mahasiswa perguruan tinggi yang sadar etika dan memiliki literasi kritis dalam pendidikan tinggi digital.

Article History

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1. Introduction

Digital life has become one of the most influential learning spaces for university students. Academic reading, classroom discussion, assignment submission, peer collaboration, and public communication now happen through learning management systems, search engines, social media platforms, AI tools, online journals, and instant messaging applications. For many students, the first source of information is no longer a printed textbook or a lecturer's explanation, but a digital text that appears through Google search, TikTok, Instagram, YouTube, ChatGPT, or WhatsApp group discussion. This condition has changed the meaning of higher education because students are not only expected to access information quickly, but also to judge whether information is accurate, ethical, biased, manipulative, or socially harmful. Digital competence, in this sense, is no longer a technical matter. It is closely connected with judgment, responsibility, integrity, and critical consciousness [1].

Higher education institutions are facing a difficult pedagogical situation. Students can produce essays with AI assistance, summarize articles without reading the full text, share political or religious claims without checking the source, and use online materials without understanding plagiarism or authorship ethics. At the same time, digital platforms also offer rich opportunities for inquiry, collaboration, creativity, and social participation. A student analyzing climate-change misinformation on Instagram, comparing AI-generated summaries with peer-reviewed journal articles, or evaluating the ethical risks of facial-recognition technology is not simply using digital tools. The student is practicing critical digital literacy and ethical awareness in a real social context. Such learning requires more than memorization or surface-level comprehension. It needs a deeper form of pedagogy that invites students to question, evaluate, reflect, collaborate, and act responsibly[2][3].

Deep learning pedagogy offers a relevant framework for responding to this challenge. In educational literature, deep learning does not refer to machine-learning algorithms, but to a pedagogical orientation that helps students develop meaningful understanding, transferable knowledge, critical thinking, collaboration, creativity, citizenship, and character. Fullan et al. (2018) describe deep learning through the 6Cs, namely character, citizenship, collaboration, communication, creativity, and critical thinking. These competencies are important because digital learning environments demand more than cognitive achievement. A student who can identify the main idea of an online article but cannot recognize misinformation, algorithmic bias, unethical citation practices, or discriminatory digital representation has not yet developed the deeper capacities needed for responsible participation in contemporary society[4][3].

The connection between deep learning pedagogy and ethical awareness becomes clearer when learning is understood as a process of moral, social, and reflective formation. Ethical awareness refers to students' ability to recognize ethical issues, consider consequences, respect intellectual property, protect privacy, avoid harm, and make responsible decisions in academic and digital contexts. In higher education, ethical awareness appears in everyday academic practices, such as citing sources properly, using AI tools transparently, respecting peers during online discussion, avoiding manipulation of data, and questioning whether a digital text reinforces stereotypes or injustice. These examples show that ethics is not an abstract topic limited to philosophy courses. It is embedded in students' daily interaction with digital knowledge, academic tasks, and social media communication[5][6].

Critical digital literacy strengthens this ethical dimension by asking students to examine not only what digital texts say, but also how they are produced, circulated, valued, and trusted. Earlier views of digital literacy often emphasized access, operational skills, and information searching. More recent scholarship argues that students must also understand power, ideology, platform logic, datafication, representation, and the social consequences of digital communication (Pangrazio, 2016; Pangrazio et al., 2020). For instance, when students evaluate an AI-generated image that repeatedly represents professionals as male, Western, or middle-class, they are dealing with critical digital literacy. When they compare a viral TikTok health claim with scientific evidence, they are practicing credibility assessment. When they ask whether an online source is sponsored, politically motivated, or algorithmically amplified, they move from functional digital literacy toward critical digital literacy[7].

Despite the strong conceptual relationship among deep learning pedagogy, ethical awareness, and critical digital literacy, existing studies tend to discuss these areas separately. Research on deep learning often focuses on engagement, student agency, collaboration, and twenty-first-century competencies. Studies on digital literacy frequently examine students' ability to access, evaluate, and communicate information through digital tools. Ethical awareness, especially in recent higher education research, is often connected with AI use, academic integrity, privacy, and responsible technology adoption. The problem is not the absence of literature, but the fragmentation of the literature. There is still limited synthesis explaining how deep learning pedagogy may influence students' ethical awareness and critical digital literacy as interconnected learning outcomes in higher education.

This gap is important because universities are now expected to prepare students for a digital society shaped by information disorder, platform capitalism, generative AI, surveillance, and automated decision-making. Traditional instruction that asks students to reproduce definitions or answer closed questions

may not be sufficient for this reality. A more powerful learning design would ask students to investigate authentic digital problems, discuss ethical dilemmas, evaluate conflicting sources, create multimodal responses, and reflect on the consequences of their digital actions. Such activities are closely aligned with deep learning pedagogy because they require students to move beyond passive reception of information and engage in purposeful, critical, and socially responsible learning[8].

A systematic literature review is needed to clarify this relationship. Through a careful review of empirical and conceptual studies, the article can identify how deep learning pedagogy has been defined, what learning strategies are commonly used, which dimensions of ethical awareness are addressed, and how critical digital literacy is developed among university students. The review can also map the dominant research methods, educational contexts, theoretical frameworks, and assessment instruments used in previous studies. Following systematic review standards such as PRISMA 2020, the study may offer a transparent synthesis of existing evidence and reveal where future research is still needed[9].

Based on this background, the proposed article is academically relevant and timely. Its contribution lies in bringing together three important conversations that are often treated separately: deep learning pedagogy, ethical awareness, and critical digital literacy. By synthesizing these areas, the review can show how higher education may move from technology use toward responsible digital learning, from information access toward critical interpretation, and from academic achievement toward ethical participation in digital society.

The following questions were formulated to review the articles:

1) How is deep learning pedagogy conceptualized and implemented in higher education studies?
2) What evidence exists on the influence of deep learning pedagogy on students' ethical awareness in higher education?
3) What evidence exists on the influence of deep learning pedagogy on students' critical digital literacy in higher education?
4) What pedagogical strategies within deep learning are most frequently associated with students' ethical awareness and critical digital literacy?
5) What research gaps exist in studies connecting deep learning pedagogy, ethical awareness, and critical digital literacy among university students?

2. Literature Review

Deep Learning Pedagogy in Higher Education

Deep learning pedagogy has become an important educational response to the changing demands of higher education in the digital era. In this article, deep learning is understood as a pedagogical approach, not as an artificial intelligence algorithm. It refers to learning that helps students construct meaningful understanding, connect knowledge with real-life problems, reflect on their own thinking, collaborate with others, and apply knowledge ethically in complex situations. Deep learning is defined through six global competencies, namely character, citizenship, collaboration, communication, creativity, and critical thinking. These competencies are not limited to academic achievement. They also guide students to become responsible learners who can participate thoughtfully in social, cultural, and digital life[10][8]. The new pedagogies for deep learning framework also highlights the 6Cs as the central competencies students need to flourish in a complex world.

In higher education, deep learning pedagogy is closely related to student agency, higher-order thinking, authentic inquiry, and reflective learning. Students are encouraged to move beyond memorizing definitions or repeating lecturers' explanations. Instead, they are expected to investigate problems, compare perspectives, evaluate evidence, and produce informed responses. For example, in a course on digital literacy, students may be asked to compare a peer-reviewed article with a viral social media post, identify the credibility of each source, discuss the ethical implications of sharing misleading information, and write a critical response. Such activities represent deep learning because students do not merely consume information. They interpret, question, evaluate, and act upon it.

Recent study shows that deep learning has a meaningful relationship with students' digital literacy.[8]examined the influence of deep learning on higher education students' digital literacy and found that deep strategies and higher-order thinking play important roles in strengthening digital literacy. Their study is particularly relevant because it directly connects deep learning with digital literacy in higher education. The article reports that deep learning is not only associated with motivation but also with strategic learning processes that encourage students to interpret and evaluate digital information more critically.

The Indonesian education context also shows increasing attention to deep learning pedagogy. A recent study on teachers' readiness to adopt deep learning pedagogy in Indonesia links this approach with critical thinking, digital literacy, collaboration, communication, and ethical global awareness. This is important for the present SLR because it shows that deep learning has begun to enter Indonesian educational discourse, especially in relation to twenty-first-century competencies and digital transformation. Within higher education, this orientation is highly relevant because students are expected to engage with digital texts, AI tools, online academic resources, and social media in more responsible and reflective ways[11].

Ethical Awareness in Digital Higher Education

Ethical awareness refers to students' ability to recognize

ethical problems, consider the consequences of their decisions, and act responsibly in academic and digital environments. In higher education, ethical awareness appears in many everyday practices, such as citing sources correctly, avoiding plagiarism, respecting intellectual property, protecting personal data, using AI tools transparently, and responding respectfully to different opinions in online discussions. The rise of digital learning and generative AI has made ethical awareness more urgent because students can now access, copy, remix, and generate academic content more easily than before.

Ethical awareness should not be treated as a separate moral subject outside disciplinary learning. It is embedded in students' academic behavior and digital participation. For instance, a student who uses AI to generate an essay without acknowledgement faces an issue of academic integrity. A student who shares a screenshot of a classmate's private message without consent deals with privacy ethics. A student who spreads an unverified political claim in a university WhatsApp group faces a problem of digital responsibility. These examples show that ethical awareness is directly connected with how students use, evaluate, and circulate digital information.

Recent research on AI ethics strengthens this argument. [12] developed and validated an Artificial Intelligence Ethical Awareness Scale involving secondary and university students. Their study identified three dimensions of AI ethical awareness: human autonomy, beneficence, and justice. The findings also showed that students' ethical awareness could be enhanced through an AI literacy course that included problem-solving and reflective writing activities. This evidence is relevant to deep learning pedagogy because problem-solving and reflective writing are also central to deep learning. Rather than teaching ethics only through rules, students can develop ethical awareness when they are asked to analyze real digital dilemmas and reflect on their own decisions.

In the Indonesian context, the relationship between AI literacy and ethical awareness has also begun to receive scholarly attention. [13] for example, explored AI literacy and ethical awareness among Indonesian university students and emphasized the need to integrate AI ethics into higher education curricula. Other recent Indonesian discussions also connect academic ethics, AI use, and students' growing dependence on digital tools in completing assignments. This study suggests that ethical awareness is becoming a key concern in higher education, especially as students increasingly rely on AI, search engines, and social media as learning resources[10].

Deep learning pedagogy may offer a useful response to this issue because it emphasizes character, citizenship, reflection, and real-world problem-solving. Ethical awareness develops more meaningfully when students are not only told what is right or wrong, but are also guided to examine why an action is ethical or unethical. In a deep learning classroom, students might analyze a case of AI-assisted plagiarism, debate whether AI-generated content should be cited, compare university policies on academic integrity, and reflect on their own use of digital tools. Through this process, ethics becomes a lived academic practice rather than a memorized rule.

Critical Digital Literacy in Higher Education

Critical digital literacy is broader than the ability to operate digital devices. It involves the ability to access, evaluate, interpret, question, and produce digital texts with awareness of power, ideology, representation, credibility, and social consequences. [14] explain that digital literacy has been understood differently across contexts, but recent scholarship increasingly emphasizes its critical dimension [15]. Digital literacy should include the capacity to evaluate online content critically, especially in relation to misinformation, credibility, and expert knowledge[16].

Critical digital literacy is highly relevant for university students because they regularly encounter digital texts that are persuasive, multimodal, and ideologically loaded. Online news, TikTok videos, Instagram infographics, YouTube explanations, AI-generated summaries, and digital advertisements often combine language, image, sound, algorithmic visibility, and emotional appeal. Students need to ask who produces the text, what interest it serves, what evidence it uses, what voices are included or excluded, and how the platform shapes its circulation. Without this critical capacity, students may become passive consumers of digital information even if they are technically skilled users of technology.

Note that the landscape of digital literacy has shifted as digital communication becomes more multimodal, networked, and socially embedded [17]. This means that students must learn not only how to read digital texts, but also how to understand the social and political conditions behind them. For example, evaluating a viral Instagram post about public policy requires more than identifying the topic. Students must examine the source, the visual framing, the comments, the emotional language, the algorithmic amplification, and the possible intention behind the post. Such practices are closely related to critical reading, digital citizenship, and ethical awareness.

Several studies in Indonesian EFL and higher education contexts also support the importance of critical digital literacy. Investigated EFL students' ability to evaluate online sources and found that students needed stronger support in assessing credibility and bias [18]. Proposed a multifaceted framework for critical digital literacy in English language teaching in Indonesia by connecting theory, empirical research, policy, and pedagogical possibilities[19]. Examined critical digital literacy in a higher education EFL classroom and reported that teachers viewed CDL as important for helping students use technology critically, evaluate online resources, and produce multimodal texts[20].

These studies indicate that critical digital literacy is not only

relevant for media studies or communication studies. It is also important in EFL, academic writing, reading, teacher education, and general higher education courses. Students who read online English texts, translate information from digital sources, use AI for writing, or discuss global issues through social media need critical digital literacy to avoid superficial understanding and irresponsible digital behavior.

The Link between Deep Learning Pedagogy, Ethical Awareness, and Critical Digital Literacy

The relationship among deep learning pedagogy, ethical awareness, and critical digital literacy can be understood through their shared emphasis on reflection, judgment, responsibility, and meaningful action. Deep learning pedagogy encourages students to investigate authentic problems and develop transferable competencies. Ethical awareness helps students recognize the moral consequences of their academic and digital choices. Critical digital literacy enables students to evaluate digital texts, platforms, and information systems critically. When combined, these three areas form a strong pedagogical foundation for higher education in the digital age.

Deep learning pedagogy may influence ethical awareness because it creates learning experiences that involve dilemma analysis, collaborative discussion, reflective judgment, and real-world decision-making. For example, students may be asked to analyze whether it is ethical to use ChatGPT to draft an assignment, whether influencers should be trusted as sources of health information, or whether an AI-generated image reproduces racial or gender bias. These tasks require students to think critically, consider consequences, respect evidence, and justify their decisions. Such practices are consistent with the character and citizenship dimensions of deep learning[4][8].

The influence of deep learning pedagogy on critical digital literacy can also be seen through higher-order thinking. [8]found that higher-order thinking mediates the relationship between deep learning and students' digital literacy. This finding is important because critical digital literacy requires analysis, evaluation, interpretation, and creation. Students cannot develop strong critical digital literacy if learning remains limited to remembering definitions of digital citizenship or listing examples of online platforms. They need structured opportunities to examine authentic digital materials, challenge assumptions, and produce reasoned interpretations.

Ethical awareness and critical digital literacy also reinforce each other. A student with critical digital literacy can identify misinformation, hidden persuasion, bias, and unequal representation. Ethical awareness helps the student decide what to do with that knowledge. For instance, after identifying that a viral post contains misleading information, the student must decide whether to share it, correct it, ignore it, or discuss it responsibly. In this sense, critical digital literacy provides analytical capacity, while ethical awareness provides moral direction.

Recent studies on AI ethics and digital literacy further support this connection. [12] showed that AI ethical awareness can be strengthened through structured learning activities involving problem-solving and reflection. [21] discusses AI, representation, and critical digital literacy by focusing on visual bias in AI-generated images, showing that students need to understand how digital technologies can reproduce social inequalities. These studies suggest that students need pedagogical models that do not separate technical skill from ethical and critical judgment.

Research Gap

Although the literature on deep learning pedagogy, ethical awareness, and critical digital literacy has grown during the last ten years, several gaps remain visible. Many studies discuss digital literacy without connecting it explicitly to deep learning pedagogy. Other studies examine ethical awareness in relation to AI use, but they do not always explain what pedagogical approach can strengthen such awareness. Critical digital literacy studies often focus on source evaluation, media analysis, or classroom practice, yet the link with deep learning competencies such as character, citizenship, collaboration, creativity, and critical thinking remains underdeveloped.

A second gap concerns integration. The three constructs are strongly related, but they are often treated as separate research areas. Deep learning pedagogy is usually discussed in relation to engagement and higher-order thinking. Ethical awareness is frequently discussed in relation to academic integrity, AI use, and digital responsibility. Critical digital literacy is commonly discussed through online source evaluation, misinformation, and multimodal analysis. Few studies synthesize how deep learning pedagogy may influence ethical awareness and critical digital literacy together as interconnected outcomes of higher education.

A third gap concerns systematic evidence. Existing studies provide important insights, but the field still needs a systematic literature review that maps definitions, methods, contexts, pedagogical strategies, instruments, and outcomes across major databases such as Scopus, ERIC, ScienceDirect, SpringerLink, Taylor & Francis, and accredited Indonesian journals in SINTA 1 and 2. Without such synthesis, it is difficult to understand what has been established, what remains uncertain, and what future studies should investigate.

Conceptual Position of the Present Review

Based on the reviewed literature, this SLR positions deep learning pedagogy as a potential pedagogical pathway for strengthening students' ethical awareness and critical digital literacy in higher education. The review assumes that ethical awareness and critical digital literacy do not develop automatically from technology use. Students may be highly active online but still weak in evaluating credibility, recognizing bias, respecting academic integrity, or making responsible

digital decisions. Deep learning pedagogy becomes relevant because it emphasizes meaningful inquiry, authentic problem-solving, collaborative reflection, and responsible participation.

3. Method

Research Method

This study employed a systematic literature review design to examine how deep learning pedagogy influences students' ethical awareness and critical digital literacy in higher education. A systematic literature review was selected because it allows researchers to identify, screen, evaluate, and synthesize existing studies through transparent and replicable procedures. In educational research, systematic reviews are useful for mapping theoretical trends, methodological patterns, pedagogical practices, and research gaps across a defined body of literature[22]. The reporting procedure followed the PRISMA 2020 guideline, which provides a structured framework for reporting the identification, screening, eligibility assessment, and inclusion of studies in a systematic review [9].

The review adopted the PICO framework to clarify the scope of the study. The population was university students in higher education. The intervention or phenomenon of interest was deep learning pedagogy. The comparison referred to traditional, conventional, surface-level, or non-deep learning approaches when available. The outcomes were students' ethical awareness and critical digital literacy.

Information Sources and Databases

The literature search was conducted using major international and Indonesian academic databases. The databases were selected because they index peer-reviewed studies in education, digital learning, higher education, language education, educational technology, and interdisciplinary social sciences. The databases included: Scopus, ERIC, ScienceDirect, SpringerLink, Taylor & Francis Online, Google Scholar (specifically SINTA 1 and SINTA 2). The publication period was limited to 2016–2026. This ten-year range was selected to capture recent developments in deep learning pedagogy, digital literacy, AI-related ethical issues, and critical digital learning practices in higher education. Only studies published in English or Indonesian were considered.

Table 1. Search string used in searching for articles from the database

Database	Strings
Scopus, ERIC, ScienceDirect, SpringerLink,	TITLE-ABS-KEY (("deep learning pedagogy" OR "meaningful learning" OR "transformative learning" OR "student-centered learning") AND
Taylor & Francis Online	("ethical awareness" OR "digital ethics" OR "academic integrity" OR "AI ethics awareness") AND ("critical digital literacy" OR "digital literacy" OR "digital citizenship" OR "media literacy") AND ("higher education" OR "university students" OR "college students")) AND PUBYEAR > 2016 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE, "English" OR "Indonesian"))
SINTA 1 and SINTA 2	("pembelajaran mendalam" "deep learning pedagogy" "meaningful learning") ("etika digital" "kesadaran etis" "integritas akademik") ("literasi digital kritis" "literasi digital" OR "kewargaan digital") ("mahasiswa" "pendidikan tinggi")

The Inclusion Criteria

The inclusion criteria for this systematic literature review were established to ensure that all selected studies were relevant to the focus of the review. First, the articles had to be published within the last ten years, from 2016 to 2026, in order to capture recent developments in deep learning pedagogy, ethical awareness, critical digital literacy, digital learning, and higher education. Second, the studies had to be obtained from recognized academic databases, namely Scopus, ERIC, ScienceDirect, SpringerLink, Taylor & Francis Online, and Indonesian accredited journals categorized as SINTA 1 and SINTA 2. Third, the selected publications had to be peer-reviewed journal articles or peer-reviewed conference papers written in English or Indonesian. This criterion was applied to ensure academic quality and accessibility for analysis.

In terms of population, the included studies had to focus on university students, undergraduate students, postgraduate students, or learners in higher education contexts. Studies involving lecturers or teachers could be included only when they also provided direct findings related to students' learning, ethical awareness, or critical digital literacy. The studies also had to discuss deep learning pedagogy or related pedagogical approaches, such as meaningful learning, transformative learning, inquiry-based learning, problem-based learning, reflective learning, collaborative learning, or student-centered learning. In this review, deep learning refers to a pedagogical concept, not to deep learning as an artificial intelligence or machine-learning algorithm.

In relation to the outcomes, the articles had to address at least one of the main constructs of this review, namely ethical awareness or critical digital literacy. Ethical awareness may include digital ethics, academic integrity, AI ethics awareness,

ethical decision-making, privacy awareness, responsible technology use, or digital responsibility. Critical digital literacy may include students' ability to evaluate online sources, identify misinformation, analyze media bias, understand digital citizenship, interpret multimodal texts, or critically assess digital information. Finally, the studies had to be relevant to higher education learning contexts, including face-to-face, online, blended, digital, or EFL learning environments. These inclusion criteria helped the review focus on studies that could meaningfully answer the research problems and support a systematic synthesis of the relationship between deep learning pedagogy, ethical awareness, and critical digital literacy.

The Exclusion Criteria

The exclusion criteria were applied to remove studies that did not match the focus and quality requirements of this systematic literature review. Studies were excluded if they were published before 2016 or after 2026, were not indexed in Scopus, ERIC, ScienceDirect, SpringerLink, Taylor & Francis Online, or SINTA 1 and 2 journals, or were not written in English or Indonesian. Articles were also excluded if they used the term deep learning only to refer to artificial intelligence, machine learning, neural networks, or computational models without any pedagogical connection. Studies focusing on primary school, secondary school, teachers, parents, or the general public were excluded unless they provided direct evidence related to university students or higher education learners. Publications such as books, book reviews, editorials, opinion papers, blog posts, unpublished theses, and non-peer-reviewed materials were not included. In addition, studies were removed if they discussed digital literacy only as technical skill use without critical, ethical, reflective, or evaluative dimensions. Articles were also excluded when ethical awareness, digital ethics, academic integrity, or critical digital literacy was mentioned only briefly and not treated as a major concept or outcome. Duplicate records, inaccessible full-text articles, and studies with weak relevance to deep learning pedagogy, ethical awareness, and critical digital literacy in higher education were also excluded from the final synthesis.

Screen Literature

Based on the PRISMA 2020 flow diagram, the initial identification process found 1,420 records from six database sources, consisting of 380 articles from Scopus, 210 from ERIC, 260 from ScienceDirect, 190 from SpringerLink, 230 from Taylor & Francis Online, and 150 from SINTA 1 and SINTA 2 journals. Before screening, 440 records were removed, including 320 duplicate records, 95 records outside the 2016–2026 publication range, and 25 records written in languages other than English or Indonesian. After this stage, 980 records were screened based on title and abstract. From this screening process, 760 records were excluded because they did not meet the focus of the review, such as studies outside higher education, studies using deep learning only as an AI algorithm, studies without ethical awareness or critical digital literacy focus, and studies with no pedagogical orientation. The remaining 220 full-text articles were assessed for eligibility. After full-text assessment, 204 articles were excluded because they had the wrong population, used the wrong meaning of deep learning, discussed digital literacy only as technical skill, lacked a clear pedagogical framework, mentioned ethics only briefly, had unavailable full texts, or were not peer-reviewed. Finally, 16 studies met all inclusion criteria and were included in the final synthesis of this systematic literature review.

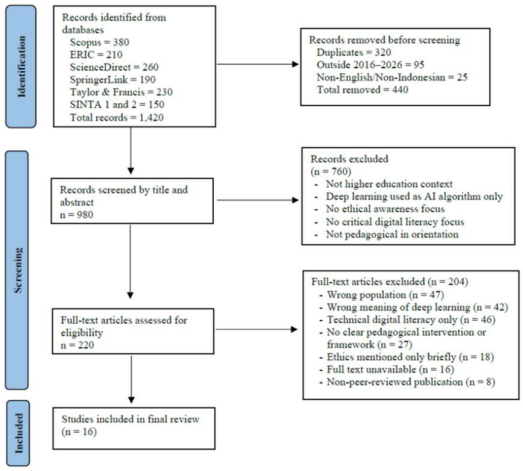

Figure 1. PRISMA flow chart

Quality Appraisal

The quality of included studies was assessed to ensure that the synthesis was based on credible evidence. Quantitative studies were reviewed based on clarity of objectives, sampling procedures, instrument validity, data analysis, and reporting of findings. Qualitative studies were assessed based on research context, participant selection, data collection procedures, analytical transparency, and credibility of interpretation. Mixed-methods studies were evaluated based on the integration of quantitative and qualitative findings.

The appraisal did not automatically exclude studies unless they were methodologically very weak or irrelevant to the review questions. Instead, quality assessment was used to interpret the strength of evidence and identify methodological limitations across the literature.

4. Result and Discussion

Research Demographic

Publication Years

Figure 2 shows that the 16 reviewed articles were published between 2016 and 2026. The distribution indicates that the topic

has become more visible in recent years, especially from 2023 to 2026. Only one article was published in each of 2016, 2018, 2019, 2021, and 2022, while three articles appeared in 2023, two in 2024, four in 2025, and two in 2026. This pattern suggests that scholarly attention to deep learning pedagogy, critical digital literacy, AI ethical awareness, and responsible digital participation has increased sharply after the expansion of online learning and generative AI in higher education. Earlier studies mainly established conceptual foundations for critical digital literacy, while more recent studies have focused on measurement, ethical awareness, AI use, and higher education learning practices (Kong & Zhu, 2025; Pangrazio, 2016; Pötzsch, 2019; Z. Wang et al., 2025).

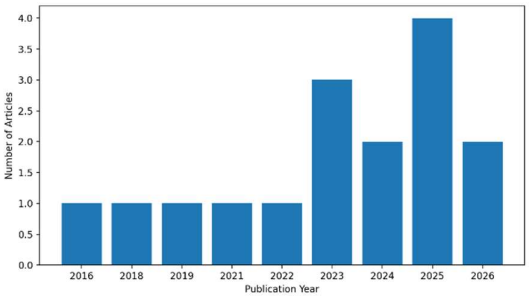

Figure 2. Publication Years of Included Articles

Countries and Research Contexts

Figure 3 shows that the reviewed articles came from diverse geographical and educational contexts. China was the most dominant context, represented by four studies, followed by Indonesia and Hong Kong with two studies each. Other contexts included India, South Korea, Jordan, the United States, Spain, Croatia, Australia, and Norway. This distribution shows that the topic is not limited to one region, although Asian higher education contexts appear strongly in the reviewed corpus. The Chinese studies mainly focused on deep learning, student-centered teaching, online EFL learning, and digital literacy, while the Hong Kong studies emphasized AI ethical awareness and ethical reflection among students (Jiang, 2022; Kong & Zhu, 2025; Tian et al., 2023; S. Wang & Zhang, 2018; Z. Wang et al., 2025). Indonesian studies contributed to the discussion of critical digital literacy in EFL and higher education contexts, especially through classroom practice and transformative digital literacy frameworks (Rini & Nabhan, 2023; Syatriana & Turdieva, 2026)

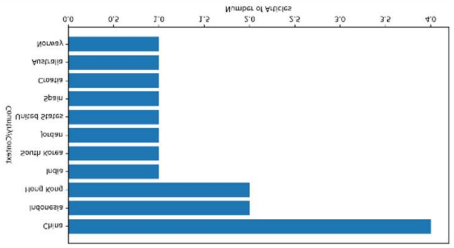

Figure 3. Countries of Included Articles

Research Methods of the Articles

Figure 4 presents the methodological distribution of the 16 articles. Quantitative research was the most common method, with seven articles using surveys, statistical testing, structural equation modeling, regression analysis, or scale validation. Four articles were categorized as conceptual or review-based studies because they primarily developed theoretical arguments or synthesized previous literature. Three articles used qualitative approaches, including case study, classroom discourse analysis, and teacher-practice exploration. Two articles used mixed-method designs by combining quantitative instruments with qualitative data such as reflective writing, interviews, or interpretive analysis. This methodological pattern suggests that the field is moving toward empirical measurement, especially in AI ethical awareness and digital literacy, but still depends heavily on conceptual work to clarify what critical digital literacy and deep learning mean in higher education (Gutiérrez-Ujaque, 2024; Kong & Zhu, 2025; Rini & Nabhan, 2023; Z. Wang et al., 2025; Yang, 2024).

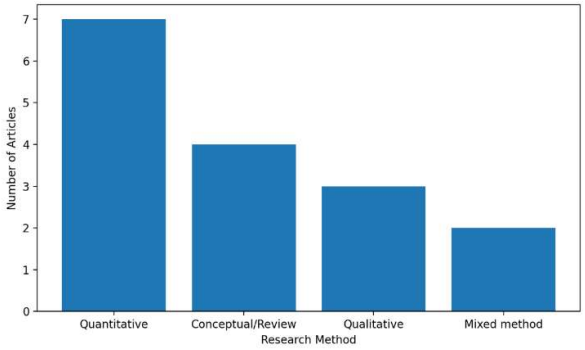

Figure 4. Research Methods of Included Articles (n=16)

Characteristics of the Included Studies

Table 2. Comparative Synthesis of Selected Studies on Deep Learning Pedagogy, Ethical Awareness, and Critical Digital Literacy

No	Author(s)	Year	Research Method	Main Findings	Innovative Contribution
1	Jiang	2022	Quantitative survey	The study found that deep learning in online EFL learning is shaped by students' motivation, engagement, learning strategies, and directional competence. Chinese college students' deep learning was connected with autonomy, problem-solving, critical thinking, and online information processing.	Provides a clear model for understanding deep learning in online EFL higher education. It is useful for linking deep learning pedagogy with digital learning practices.
2	Pramod	2025	Quantitative study	The study showed that digital literacy and ethical awareness influence responsible AI use. Students with stronger digital literacy and ethical awareness are more likely to use AI tools responsibly in academic contexts.	Connects digital literacy, ethical awareness, and responsible AI use in one framework. It strengthens the ethical dimension of digital higher education.
3	Shi et al.	2023	Qualitative classroom discourse analysis	The article found that deep learning in L2 higher education can be supported through interactive lecturing, languaging, embodiment, gesture, dialogue, and multimodal classroom interaction.	Expands deep learning beyond cognition by showing its embodied, social, and interactional dimensions in language education.
4	Wang & Zhang	2018	Quantitative survey	Student-centred teaching was found to support deep learning and students' self-reported ability improvement in higher education. Students learn more deeply when teaching practices encourage participation, autonomy, and active engagement.	Offers empirical evidence that student-centred pedagogy can promote deep learning and ability development in university contexts.
5	Yang	2024	Quantitative correlational study	Digital literacy and moral sensitivity were found to influence AI ethics awareness among nursing students. Moral sensitivity played an important role in shaping students' awareness of ethical issues related to AI.	Links digital literacy with moral sensitivity and AI ethics awareness. It is useful for explaining ethical awareness as both a cognitive and moral construct.
6	Abuadas & Albikawi	2026	Quantitative scale development and validation	The study developed and validated a scale related to AI ethical awareness and academic integrity in higher education. The findings indicate that ethical AI use is closely related to students' understanding of academic honesty and responsible technology use.	Provides an instrument for measuring AI ethical awareness and academic integrity among higher education students.

7	Beck et al.	2021	Conceptual and pedagogical article	The article argued that critical digital literacy can be used as a method for helping students respond to online surveillance and privacy erosion. It emphasizes that students should learn how digital systems collect, monitor, and use personal data.	Introduces critical digital literacy as a practical pedagogical method for teaching privacy, surveillance, and digital resistance.
8	Syatriana & Turdieva	2026	Conceptual review	The article positioned critical digital literacy as a transformative framework for Indonesian higher education in the digital age. It emphasized the need for students to evaluate digital information critically and participate responsibly in digital society.	Provides Indonesian higher education relevance by framing critical digital literacy as a transformative educational framework.
9	Gutiérrez-Ujaque	2024	Conceptual/theoretical study	The article argued that critical digital pedagogy can develop critical digital literacy and consciousness in higher education. It emphasized emancipation, critical awareness, and students' ability to question digital power structures.	Links critical digital literacy with critical consciousness and emancipatory pedagogy in higher education.
10	Kong & Zhu	2025	Mixed method / scale valid	The study developed and validated an AI ethical awareness scale. It also showed that ethical awareness can be cultivated through problem-solving activities and reflective learning with AI tools.	Provides both a measurement tool and pedagogical evidence showing how AI ethical awareness can be developed through learning activities.
11	Milković et al.	2025	Quantitative survey	The study found that critical digital literacy is viewed as an important skill in higher education by both students and professors. It highlights the need to strengthen students' ability to evaluate digital information and use technology critically.	Presents comparative insight into students' and professors' attitudes toward critical digital literacy in higher education.
12	Pangrazio	2016	Conceptual article	The article argued that critical digital literacy must move beyond technical skills. It should include critical awareness of affect, digital design, ideology, power, and social inequality.	Offers a foundational reconceptualization of critical digital literacy. It is one of the key theoretical sources for this SLR.
13	Pötzsch	2019	Conceptual critical review	The study criticized narrow views of digital literacy that focus only on user competence and employability. It argued that critical digital literacy should address digital capitalism, power, exploitation, and the political economy of technology.	Broadens digital literacy into a critical socio-political framework. It helps position digital literacy as a matter of power, not only skill.

14	Rini & Nabhan	2023	Qualitative study	The study found that critical digital literacy in Indonesian EFL higher education was practiced through online material selection, source evaluation, multimodal text use, and digital identity development. Teachers viewed CDL as important but still challenging to implement.	Provides empirical evidence from Indonesian EFL higher education and shows how critical digital literacy can be embedded in classroom practice.
15	Tian, Park, & Liu	2023	Quantitative study	The study found that deep learning influences higher education students' digital literacy, with higher-order thinking playing a mediating role. Deep motivation and deep learning strategies were important predictors of digital literacy.	Provides direct empirical evidence connecting deep learning and digital literacy in higher education. It strongly supports the main argument of the SLR.
16	Wang et al.	2025	Quantitative scale development and validation	The study developed and validated the AI Ethical Reflection Scale for university students. The scale covers ethical awareness, critical evaluation, and AI for social good.	Offers a validated instrument for assessing university students' AI ethical reflection and connects ethics with critical evaluation and social responsibility.

Table 2 presents the comparative synthesis of the 16 reviewed articles included in this systematic literature review. The table shows that the studies were published between 2016 and 2026, with stronger publication growth from 2023 onward. Quantitative studies were dominant, especially in articles examining digital literacy, AI ethical awareness, and scale validation. Conceptual and qualitative studies contributed mainly to the theoretical development of critical digital literacy, critical digital pedagogy, and deep learning in classroom practice.

Key Themes Based on the Research Questions

RQ1: How is deep learning pedagogy conceptualized and implemented in higher education studies?

The reviewed studies conceptualize deep learning pedagogy as a learning orientation that moves students beyond memorization and passive reception toward active engagement, higher-order thinking, problem-solving, reflection, and meaningful knowledge application.[23] for example, developed a four-dimensional model of deep learning in online EFL learning, consisting of deep learning motivation, deep learning engagement, deep learning strategy, and directional competence. Directional competence includes language application, problem-solving, critical thinking, learner autonomy, and online information processing, which are closely related to critical digital literacy.

In another study,[24] connected deep learning with student-centered teaching and found that student-centered pedagogy positively predicted students' deep learning and self-reported ability improvement in higher education. [25] added a more interactional perspective by showing that deep learning can be facilitated through embodied and multimodal lecturing practices in L2 higher education contexts. Their study suggests that deep learning is not only cognitive but also social, embodied, and dialogic. [8]further confirmed that deep learning, especially deep motivation and deep strategy, is associated with students' digital literacy through the role of higher-order thinking.

RQ2: What evidence exists on the influence of deep learning pedagogy on students' ethical awareness in higher education?

The direct evidence connecting deep learning pedagogy with ethical awareness is still limited. Most studies do not examine this relationship explicitly. However, indirect evidence appears in studies that link reflective, problem-solving, and student-centered learning with ethical awareness, especially in AI-related contexts. Kong & Zhu (2025) showed that students' AI ethical awareness could be cultivated through problem-solving activities using AI tools within an AI literacy course. Their study developed the AI Ethical Awareness Scale and reported improvement in students' ethical awareness through structured learning and reflective writing.

[21]found that digital literacy and moral sensitivity were positively correlated with AI ethics awareness among nursing students, with moral sensitivity emerging as a significant

predictor. [26] also focused on AI ethical awareness and academic integrity in higher education by developing and validating a new scale. [24] developed the AI Ethical Reflection Scale for university students and identified three dimensions: AI ethical awareness, AI critical evaluation, and AI for social good. These studies suggest that ethical awareness develops when students are guided to reflect on autonomy, fairness, responsibility, academic integrity, and the social consequences of AI use. However, the reviewed literature still lacks sufficient empirical studies that test deep learning pedagogy as a direct predictor of ethical awareness.

RQ3: What evidence exists on the influence of deep learning pedagogy on students' critical digital literacy in higher education?

The evidence is stronger for the relationship between deep learning pedagogy and critical digital literacy than for ethical awareness. [18] directly examined the influence of deep learning on higher education students' digital literacy and found that deep motivation and deep strategy were positively related to digital literacy, with higher-order thinking playing an important role in the relationship. [23] also included online English information processing capacity as part of directional competence in deep learning, suggesting that deep learning in EFL contexts requires students to process digital information meaningfully and critically.

Critical digital literacy studies provide further support. [27] argued that critical digital literacy must move beyond technical skill and include critical digital design, affect, ideology, and social inequality. [14] emphasized that critical digital literacy should address digital capitalism, commodification, exploitation, and the structural dimensions of technology. [20] showed that critical digital literacy in Indonesian higher education EFL classrooms involved online material selection, internet source analysis, multimodal texts, and students' digital identity development. These findings indicate that deep learning pedagogy can support critical digital literacy when students are given tasks that require inquiry, source evaluation, multimodal analysis, reflection, and critical production of digital texts.

RQ4: What pedagogical strategies within deep learning are most frequently associated with students' ethical awareness and critical digital literacy?

The most common pedagogical strategies identified in the 16 articles are student-centered learning, problem-solving, reflective writing, critical digital pedagogy, multimodal analysis, online source evaluation, classroom interaction, and project-based AI literacy activities. [24] emphasized student-centered teaching as a pathway to deep learning and ability improvement. [12] used problem-solving with AI tools and reflective writing to cultivate AI ethical awareness. [28] positioned critical digital pedagogy as an emancipatory framework that can help higher education students become critical and reflective agents in digital society.

Other strategies are more specific to language and literacy learning. [25] highlighted interactive lecturing, embodied teaching, and multimodal representation as ways to facilitate deep learning in L2 higher education.[29] found that teachers integrated critical digital literacy through online materials, internet source analysis, multimodal texts, and digital identity development.[13] contributed a pedagogical model for teaching responses to online surveillance and privacy erosion, indicating that ethical and critical digital literacy can be taught through real digital problems such as data privacy, platform surveillance, and online tracking. In general, the strongest strategies are those that ask students to analyze authentic digital issues, make ethical judgments, reflect on consequences, and produce critical responses.

RQ5: What research gaps exist in studies connecting deep learning pedagogy, ethical awareness, and critical digital literacy among university students?

The reviewed studies reveal three major gaps. First, the connection among deep learning pedagogy, ethical awareness, and critical digital literacy remains fragmented. Deep learning studies usually focus on student engagement, learning strategies, higher-order thinking, and digital literacy, while ethical awareness studies mostly focus on AI ethics, academic integrity, moral sensitivity, and scale development. Critical digital literacy studies, meanwhile, often focus on digital power, online source evaluation, multimodality, surveillance, and critical pedagogy. Few studies integrate all three constructs in one empirical model.

Second, most empirical studies are quantitative and measurement-oriented. This is useful for validating scales and testing relationships, but it provides limited explanation of how students actually experience ethical dilemmas, interpret digital texts, or negotiate responsible digital behavior in classrooms. Qualitative and mixed-method research is still needed to explore students' reasoning, classroom interaction, digital practices, and ethical decision-making processes.

Third, there is a lack of intervention-based research in higher education. [12] offer a strong example by showing how problem-solving and reflective writing in an AI literacy course can cultivate ethical awareness. However, similar intervention studies connecting deep learning pedagogy with both ethical awareness and critical digital literacy are still rare. Future studies should design and test deep learning-based instructional models that combine digital text analysis, AI ethics, reflective judgment, collaborative inquiry, and critical digital production.

Discussion

The findings of this review suggest that deep learning pedagogy has strong potential to support students' ethical awareness and critical digital literacy, although the empirical

connection among the three constructs remains uneven. Studies on deep learning in higher education consistently describe it as a process involving student engagement, meaningful inquiry, higher-order thinking, active learning strategies, and the transfer of knowledge to authentic contexts. [23][24] show that deep learning is not simply about learning more content, but about learning in ways that require students to interpret, evaluate, apply, and reflect. This meaning is consistent with [6] argument that deep learning should be supported by curriculum coherence, where knowledge, pedagogy, and learning purposes are connected rather than treated as isolated classroom activities.

A strong point emerging from the reviewed articles is that higher-order thinking functions as a bridge between deep learning pedagogy and critical digital literacy. Digital literacy in contemporary higher education cannot be reduced to the ability to operate devices or use online platforms. Students need to evaluate online claims, compare sources, identify misinformation, recognize bias, understand platform influence, and produce responsible digital content. [8] provide direct evidence that deep learning and higher-order thinking are associated with students' digital literacy. This supports the argument that critical digital literacy develops more effectively when students are engaged in deep, reflective, and problem-based learning rather than surface-level digital tasks.

The ethical dimension is also increasingly important because students now interact with AI tools, online databases, learning management systems, and social media in their academic lives. The studies by [26] show that AI ethical awareness is becoming a measurable and teachable construct in higher education. These studies indicate that students need more than technical AI literacy. They need to understand fairness, transparency, autonomy, academic integrity, privacy, social good, and responsible use. In practical terms, this means that a student should not only know how to use AI to summarize an article, but also understand when AI use becomes plagiarism, how AI can reproduce bias, and why transparency matters in academic work.

Critical digital literacy studies add a broader socio-political layer to this discussion. [2] argue that digital literacy should include ideology, affect, inequality, digital capitalism, and structural power. [30] [31]extends this argument by positioning critical digital pedagogy as a way to develop critical consciousness in higher education. This is important because ethical awareness cannot be separated from the digital systems in which students learn. For example, when students evaluate AI-generated content, they are not only checking grammar or accuracy. They are also dealing with questions of representation, authorship, bias, accountability, and power.

The Indonesian higher education context deserves special attention. [32] show that critical digital literacy has been integrated into Indonesian EFL classroom practices through online materials, source analysis, multimodal texts, and digital identity work. [25] also frame critical digital literacy as a transformative framework for Indonesian higher education in the digital age. These studies indicate that Indonesian universities have a strong opportunity to connect EFL learning, digital literacy, and ethical awareness. For example, students in an EFL classroom can analyze English-language online news, compare it with Indonesian social media discourse, evaluate source credibility, identify bias, discuss ethical sharing, and write a critical response. Such an activity reflects deep learning because it combines language learning, digital analysis, critical thinking, and ethical reflection.

Even so, the field still has clear limitations. The 16 reviewed articles do not yet provide a complete empirical model showing how deep learning pedagogy influences both ethical awareness and critical digital literacy at the same time. The evidence is still distributed across different clusters. One cluster focuses on deep learning and digital literacy. Another cluster focuses on AI ethical awareness and scale validation. A third cluster focuses on critical digital literacy and critical digital pedagogy. This fragmentation confirms the need for further empirical research, especially quasi-experimental, mixed-method, and classroom-based studies that test whether deep learning pedagogy can improve students' ethical awareness and critical digital literacy together.

5. Conclusion

This review of 16 articles published between 2016 and 2026 shows that deep learning pedagogy, ethical awareness, and critical digital literacy are strongly related, but they are not yet fully integrated in existing higher education research. The demographic mapping indicates that interest in the topic has increased sharply since 2023, with studies coming from diverse contexts, especially China, Indonesia, Hong Kong, South Korea, India, Jordan, Spain, Croatia, Australia, Norway, and the United States. Quantitative studies dominate the field, particularly in relation to digital literacy, AI ethical awareness, and scale validation, while qualitative, mixed-method, and conceptual studies provide important theoretical and pedagogical insights.

The key findings suggest that deep learning pedagogy is commonly conceptualized through student-centred learning, engagement, motivation, higher-order thinking, problem-solving, reflection, and authentic knowledge application. Its influence on critical digital literacy is more visible than its direct influence on ethical awareness. Evidence shows that deep learning strategies and higher-order thinking can support students' digital literacy, especially when students are asked to analyze, evaluate, and apply digital information critically. Ethical awareness is strongly discussed in AI-related studies, particularly through moral sensitivity, academic integrity, ethical reflection, fairness, autonomy, and social good. However, only a few studies directly connect ethical awareness with deep learning pedagogy.

The main conclusion is that deep learning pedagogy can serve as a promising pedagogical pathway for developing ethically aware and critically literate university students. Its strongest contribution lies in its capacity to move students from passive digital use to reflective, responsible, and critical digital participation. Future research should develop and test instructional models that integrate deep learning pedagogy, AI ethics, academic integrity, critical digital literacy, and authentic digital problem-solving in higher education classrooms.

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