

Tutorial

CREDIBLE: A Framework for Critical Source Evaluation—From Information Consumers to Critical Evaluators

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Abstract

With the rise of social media and the sharing of information, as well as the use of AI tools like ChatGPT in education, the ability to evaluate information credibility has become a crucial skill. The CREDIBLE framework, standing for Credibility, Reliability, Evidence, Date, Intent, Bias, Logic, and Expertise, offers a practical, student-friendly approach to source evaluation, especially suited for secondary and postsecondary learners. Unlike models and frameworks designed for higher education, CREDIBLE helps learners critically assess both online and AI-generated content. This paper introduces the framework and explores how educators can embed it into instruction to foster critical thinking, academic integrity, and responsible digital literacy.

Keywords: source evaluation; credibility; accuracy; reading online; writing

1. Introduction

The concept of information credibility has long been central to information science and education, traditionally focusing on attributes such as accuracy, authority, and objectivity (Flanagin & Metzger, 2007). However, the digital transformation of information access and production has complicated this landscape. The rise of social media, user-generated content, and algorithmically curated feeds has diluted traditional gatekeeping mechanisms, making it more difficult for learners to distinguish trustworthy information from misinformation or disinformation (Metzger & Flanagin, 2013; S. Wineburg & McGrew, 2019).

Many individuals, including students, tend to rely on surface-level criteria to judge credibility, such as the professional appearance of a website or familiarity with a brand (Fogg et al., 2003; Metzger et al., 2010). While these criteria can sometimes serve as useful shortcuts, they are unreliable in an era where visual design can be easily manipulated or even fabricated, especially with the advent of AI-generated content. The integration of artificial intelligence (AI) tools such as ChatGPT and other large language models (LLMs) into educational contexts is transforming how students engage with information. While these tools offer promising support for academic tasks (e.g., from summarization to idea generation), they also pose significant challenges to the credibility and reliability of the information students consume and also produce. Thus, the challenge for education is to foster critical, reflective evaluation skills.

The purpose of this work is to introduce the CREDIBLE framework (Credibility, Reliability, Evidence, Date, Intent (purpose), Bias, Logic, and Expertise (authority)) as a structured and adaptable approach to evaluating information credibility. The framework is designed to support learners in assessing the reliability and academic validity of information in AI-enhanced learning environments and evaluative tasks, and it is also applicable



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across a wide range of contexts in which individuals must critically examine the credibility of sources. In the following section, I outline the challenges of source evaluation. I then review relevant literature on credibility assessment and the epistemic implications of AI in education. Next, I present the CREDIBLE framework in detail, outlining its components and theoretical grounding. Finally, I discuss implementation strategies and challenges, and conclude with practical implications and research implications.

1.1. The Problem: Criticality in Access to Information

Concerns about AI-generated content extend beyond isolated factual errors or fabricated citations; they raise epistemic questions about knowledge justification, source transparency, and responsibility for verification. Generative AI systems (GenAI) produce fluent and plausible text but lack epistemic grounding and accountability (Himma-Kadakas & Ojamets, 2022; Kim & Lee, 2024). Consequently, students may encounter information that appears credible while being outdated, misleading, biased, or entirely fabricated (Tem-sah et al., 2024, 2025). Students routinely navigate environments where the line between credible and questionable content is more and more blurred and even more challenging to detect.

Existing digital and media literacy approaches have made important contributions to understanding how learners navigate online information, yet many were developed prior to the widespread adoption of GenAI and do not fully account for its epistemic implications (Kasthuri et al., 2024). In particular, traditional source evaluation frameworks often assume that sources are externally produced artifacts that can be traced and verified, assumptions that are increasingly challenged when content is detached from identifiable authorship.

The ability to evaluate information credibility, then, is no longer a supplementary skill; it is a central academic competency—and a life competency. Existing approaches may be examining source evaluation from print sources and even digital or media literacy, but may not sufficiently account for the complexity introduced by generative AI. While frameworks for teaching source evaluation exist, they were largely (Kasthuri et al., 2024) developed prior to the widespread adoption of online print and literacy as well as AI in learning environments.

I argue that there is a pressing need for an updated framework that explicitly addresses the credibility challenges overall and the challenges presented by wide access to information and to generative AI. To illustrate the need for such a framework, consider the following scenario, where a student working on a research paper uses an AI chatbot to generate background information and suggested references. The generated output includes accurate-sounding claims and citations to scholarly-sounding sources. Upon further inspection, however, several of the references do not exist, and others misrepresent the arguments made in the original texts. Without prior training in source verification or a framework for evaluating credibility, the student incorporates these inaccuracies into their work, inadvertently undermining academic standards of accuracy and integrity, and sharing inaccuracies. In a different scenario, a student is working on a project and uses information they found in a blog or a non-peer-reviewed journal, completes their paper without checking the information, prepares videos and presentations sharing inaccurate information, and communicates to a larger audience what is essentially misinformation. These examples, increasingly common across educational contexts, demonstrate the importance of teaching credibility evaluation as a foundational literacy, one that accounts for the affordances and limitations of source evaluation and of generative AI.

It could be argued that academic settings should forbid the use of GenAI by students. However, it is rather unlikely that such a directive would be effective, as students may use those systems outside of academic settings for academic work. Thus, it is important

to teach students how to evaluate outputs and how to evaluate sources for them to be critical readers and ethical users of such systems and of information at large. I argue that without structured strategies for evaluating source credibility, learners risk misinforming themselves and others, even when their intent is to engage ethically with online sources and GenAI outputs. Furthermore, an additional concern is the spreading of inaccurate information and the role of personal responsibility, as learners do not detect from the beginning that something is fabricated and share it on other platforms, spreading inaccuracies and engaging in misinformation.

1.2. Source Evaluation and AI Literacy

AI-generated content, such as large language-model outputs, often lacks information about sourcing or does not include any information to support the reader in their ability to trace information and confirm facts (Bender et al., 2021; Fallis, 2015; Kim & Lee, 2024; Simion, 2024). This lack of information undermines essential evaluative criteria like authority and accuracy, making it difficult for learners to apply credibility criteria (Bender et al., 2021). Recent studies have underscored the limitations of LLMs in educational settings. Sison et al. (2024) note that LLMs might hallucinate references and generate answers that mirror common misconceptions. Generative AI models such as ChatGPT produce responses that are often coherent, well-organized, with context-relevant vocabulary, overall linguistically fluent, with exemplar syntax and well-constructed sentences (Hwang et al., 2025). However, this surface-level sophistication and accuracy can mask underlying issues; the content may be factually incorrect, biased, or misleading (Dashti et al., 2025). This can be troubling in academic contexts, where knowledge production is expected to be rigorous, evidence-based, and transparent. The challenges posed by AI are compounded by a broader digital information environment that routinely disseminates unvetted or biased content (Metzger & Flanagin, 2013; McGrew et al., 2017), and as Huang et al. (2025) point out, the dimensions of authenticity, accuracy, and relevance are foundational to high-quality learning experiences.

Understanding how learners evaluate and justify knowledge claims requires engagement with theories of epistemic cognition, which examine how individuals think about knowledge, knowing, and justification. Greene (2016) argues that epistemic cognition should be understood as a dynamic interaction among multiple epistemic systems and not as a fixed trait that learners possess. Epistemic systems are the different ways people think about and understand knowledge (Greene & Yu, 2016). People use several systems, like logic, intuition, and advice from others, depending on the situation. These systems are activated differently depending on contextual factors such as the nature of the task, the domain of knowledge, prior beliefs and experiences, and broader sociocultural influences, helping learners decide what information to trust. As a result, learners may apply different standards of evidence and justification across situations, even when evaluating similar information.

Thus, evaluating the credibility of information is not simply a technical or procedural skill (e.g., checking a source or verifying a fact), but an epistemic practice that reflects deeper beliefs about what counts as knowledge and how claims should be justified. Credibility judgments require learners to consider the quality and sufficiency of evidence, the authority and expertise of information producers, the intent and potential bias underlying a message, and the internal logic and coherence of claims. These judgments are shaped by learners' epistemic beliefs, such as whether they view knowledge as certain or tentative, and whether they privilege authority, evidence, or personal experience as the basis for knowing. Now, these challenges are amplified in AI-mediated information environments, where distinctions between expert knowledge and user-generated content are increasingly blurred. AI systems can produce fluent, authoritative-sounding responses that obscure

underlying uncertainty, bias, or lack of evidentiary grounding. Many learners, especially preadolescents and adolescents, have not yet developed the maturity or cognitive strategies required to evaluate complex information independently. This gap is particularly evident when students encounter AI-generated responses that mimic the tone and structure of authoritative sources without providing verifiable evidence, and even when “evidence” is provided, information may be completely fabricated (Dashti et al., 2025). In such contexts, students are often required to evaluate claims (that are often ambiguous) without reliable information, such as clear authorship and sourcing. Consequently, effective credibility evaluation in AI-enhanced environments depends on learners’ ability to engage in reflective epistemic reasoning about evidence, authority, and justification. And the latter is challenging.

1.3. Frameworks of Evaluation

To address this challenge, educators and researchers have developed a range of tools to scaffold information evaluation. One widely used method is the CRAAP test, which encourages learners to assess the Currency, Relevance, Authority, Accuracy, and Purpose of a given source (Blakeslee, 2004). This framework provides a structured and accessible entry point for students, particularly at the postsecondary level, and it is among the most adopted instructional frameworks for teaching information source evaluation in educational contexts (Blakeslee, 2004). CRAAP encourages learners to consider multiple dimensions of source quality in a structured manner. Within this framework, currency directs attention to the timeliness of information, relevance examines the appropriateness of a source for a given task or audience, authority emphasizes the credentials or institutional affiliation of the author or publisher, accuracy focuses on the presence of verifiable evidence and factual correctness, and purpose prompts attention to the intent or possible bias of the information. These criteria intend to help learners move beyond visual design or familiarity, and toward evaluative practices aligned with academic norms. However, despite its strengths, the CRAAP Test was developed for environments in which sources are externally authored, traceable, and accompanied by identifiable indicators of expertise and evidence. These assumptions are increasingly challenged in contexts involving generative AI. AI-generated outputs may present coherent and authoritative-sounding text while lacking verifiable sourcing, including the production of fake or misattributed references. The CRAAP framework does not explicitly prompt learners to interrogate the generative process itself, such as whether content was produced by an AI system or how such systems generate and assemble information. Further, it does not examine logical coherence or epistemic justification in the evaluative criteria. As a result, while CRAAP remains a valuable tool for source evaluation, its applicability to AI environments is limited.

AI-specific digital literacy models are also developed in efforts to examine information in a critical manner (e.g., Allen & Kendeou, 2024; Bozkurt, 2024; Carolus et al., 2023). For instance, the ED-AI Lit framework (Allen & Kendeou, 2024) offers a well-constructed structure that examines knowledge of AI systems, evaluation of AI-generated content, ethical reasoning, contextual awareness, and learner autonomy (its six components are knowledge, evaluation, collaboration, contextualization, and autonomy). A key contribution of ED-AI Lit is its explicit recognition that evaluating AI-generated information cannot be separated from understanding the underlying properties and limitations of AI systems. By encouraging learners to consider training data, probabilistic generation, and constraints within systems, the framework treats information sources beyond static artifacts. At the same time, ED-AI Lit primarily functions at a disposition level, and emphasizes what learners should understand and value rather than offering a concrete, step-by-step evaluative procedure for assessing the academic validity of claims. While the framework

underscores the importance of evaluation and is valuable in considering system constraints, it does not delineate specific criteria (such as evidence quality or logical coherence) that learners can apply when confronted with AI-generated outputs. Regardless, it is very well suited for fostering foundational awareness and ethical sensitivity. When used in classes, it may require some additional instructional tools to support practice-oriented credibility evaluation in such contexts.

Similarly, Bozkurt's (2024) 3wAI framework focuses on Know What (conceptual understanding of AI), Know How (practical/technical skills), and Know Why (ethical/philosophical awareness). These frameworks promote critical review and engagement with digital information, emphasizing not just how tools are used, but why and when. However, it focuses on broad ethical reasoning instead of information judgments (e.g., whether a claim is factually accurate, well-supported, logically consistent, or academically reliable) and not on tools for evaluating the credibility of AI-generated information.

More recently, Li et al. (2025; preprint) proposed the A-Factor model as a psychometric framework designed to assess students' competencies in interacting with generative AI in responsible and informed ways. The A-Factor model focuses on measuring learner dispositions and capabilities related to attribution awareness, verification behaviors, and recognition of risks associated with AI-generated content. Its primary contribution lies in offering indicators that can be used to evaluate students' readiness to engage with generative AI tools. The A-Factor model is designed as an assessment instrument and does not articulate explicit evaluative criteria or scaffold the reasoning processes students must engage in when determining the reliability, logic, or evidentiary support of AI-generated outputs.

Overall, the frameworks mentioned reflect important and complementary advances in how educators and researchers conceptualize information evaluation and AI literacy. Traditional source evaluation tools, such as the CRAAP Test, provide accessible entry points for examining credibility but rely on assumptions of stable authorship and visible indicators of authority that are increasingly untenable in AI-mediated environments. Cognitive and digital literacy models help explain how learners make credibility judgments and why they often rely on surface-level cues, yet they offer limited guidance for instructional practice. More recent AI literacy frameworks, including ED-AI Lit and 3wAI, broaden evaluation by addressing ethical reasoning and contextual awareness. Further, psychometric approaches such as the A-Factor model contribute valuable tools for assessing learner readiness. However, across these approaches, a persistent gap remains between the conceptual understanding of AI and the practical work required to evaluate claims generated by AI systems. In particular, existing frameworks do not emphasize evidence quality, coherence of arguments, reliability across sources, and justification of claims in contexts where authorship and sourcing may be absent (or not as clear). The CREDIBLE framework is positioned to address this gap by offering a structured, pedagogically actionable approach that supports learners in evaluating claims across both traditional and generative AI contexts.

Additionally, there are some pragmatic and developmental challenges to consider beyond the organizational components of such frameworks (Livingstone, 2014). Young learners often lack the cognitive and metacognitive maturity to transfer general literacy skills into the complex, multimodal, digital environments they encounter daily. Without explicit scaffolding, they are more likely to rely—as stated earlier—on shallow cues (e.g., such as presentation and looks) (McGrew & Breakstone, 2023; S. Wineburg & McGrew, 2019). Furthermore, teachers frequently report limited training and support when it comes to integrating AI literacy into their curricula (Traga Philippakos & Rocconi, 2025; Tuomi, 2023). Indeed, the role of the student has shifted dramatically. No longer are learners

merely passive recipients of knowledge delivered through textbooks or curated classroom materials; students are now active participants in digital settings where information is abundant, constantly evolving, and generated in ways they may not be able to access (e.g., algorithmically).

1.4. Developing Strategic Learners and CREDIBLE

The *Developing Strategic Writers* program (Philippakos et al., 2015; Traga Philippakos & MacArthur, 2022) introduces a practical and teachable strategy, the CREDIBLE framework, which is applicable to learners in upper elementary (fifth graders), secondary, and postsecondary settings and can connect with their digital learning, responsible use of technology, and support their AI-literacy (Traga Philippakos, 2025). Designed specifically for integration into upper elementary, secondary, and postsecondary digital literacy instruction, CREDIBLE supports young learners in making informed judgments about the sources they encounter across platforms, including AI-generated responses, search engine results, and social media posts. The framework responds to the following needs in current practice: (1) the lack of pedagogical tools tailored to AI-mediated information contexts, (2) the need to scaffold students' epistemic awareness when engaging with AI-generated content, and (3) the need to responsibly evaluate information and confirm the accuracy and credibility of sources prior to use and dissemination of information.

The CREDIBLE acronym (Credibility, Reliability, Evidence, Date, Intent (purpose), Bias, Logic, Expertise (authority)) provides a structured, reflective process for evaluating the trustworthiness of sources, whether those are retrieved from a search engine, cited in an academic paper, or generated by an AI system video (See Table 1). Learners apply or consider a set of questions as they examine a source that may be in print or in digital form, and can be text or even video. This framework encourages learners to slow down and think critically about the information they encounter.

Table 1. Acronym and guiding questions for evaluation of source information.

Acronym Letter	Component	Guiding Questions
C	Credibility	Is the source trustworthy? Who is behind the content, and what is their reputation? Look for signs of professionalism, transparency, and accountability.
R	Reliability	Does the source have a track record of accuracy and consistency? Has it published factual, peer-reviewed, or well-substantiated information in the past?
E	Evidence	Are claims supported by data, citations, or links to verifiable sources? Is the reasoning backed by research or empirical support?
D	Date (Updated Information)	Is the information current? Does it reflect the most recent developments or scholarship? For historical content, is it appropriately contextualized?
I	Intent (Purpose)	What is the goal of the content? To inform, persuade, entertain, or sell? Is there transparency about the source's motives?
B	Bias	Does the source show objectivity, or does it reflect ideological, political, or commercial bias? Are multiple perspectives considered?
L	Logic	Is the content logically consistent? Are there signs of flawed reasoning, emotional appeals, or sensationalism?
E	Expertise (Authority)	Who is the author or organization? Are they recognized experts? What are their credentials or institutional affiliations?

Although credibility and reliability are closely related constructs, the CREDIBLE framework treats them as analytically distinct features of source evaluation. The distinction lies in the focus of the judgment, who or what is being evaluated, and on what basis. Credibility refers to the trustworthiness and legitimacy of the source at a given moment. It is largely a contextual judgment that considers who is behind the content and whether the source presents itself in a transparent, accountable, and professional manner. Indicators of credibility include identifiable authorship, clear institutional affiliation, disclosure of methods or funding, and adherence to recognized norms of communication. Importantly, credibility judgments are often formed early in the evaluation process and can be influenced by contextual cues, such as design, tone, or authority.

In contrast, reliability refers to the demonstrated consistency and accuracy of a source over time. Rather than focusing on how trustworthy a source appears, reliability emphasizes whether the source has a documented history of producing accurate, well-substantiated information. This judgment requires readers/evaluators to look beyond the immediate text and consider prior publications, correction practices, peer-review processes, or alignment with established bodies of knowledge. Put differently, credibility is situational and perception-oriented, whereas reliability is longitudinal and evidence-oriented. A source may appear credible based on professional presentation or authoritative tone, yet prove unreliable when its claims are examined across time or compared with external evidence. A reliable source may temporarily lose credibility due to outdated information or a lack of transparency in a specific instance. This distinction is particularly important in digital and AI-environments. AI-generated content, for example, may appear highly credible due to fluent language and authoritative style, while lacking reliability if it produces inconsistent, fabricated claims that cannot be verified.

The CREDIBLE framework breaks the concept of credibility into eight teachable components, each of which prompts students to consider a specific dimension of the information they are evaluating. CREDIBLE is grounded in pedagogical strategy, can be connected with a process of rhetorical analysis (FTAAP rhetorical analysis of writing prompts and readings (Form, Title/topic, Author, Audience, Purpose); see [Philippakos, 2018](#)), and is designed to be embedded into classroom instruction, supporting both independent and guided practice. By making the evaluation process visible and actionable, the framework shifts learners from passive consumers of information to active, critical evaluators. However, CREDIBLE is not intended to be used as a checklist only, but as a cognitive and ethical guide to critical engagement with digital content.

Through such a critical application of rereading and with the assistance of the CREDIBLE framework, learners transition from passively consuming information and AI-generated text to actively engaging with it. AI outputs are best used as tools for exploration, rather than unquestioned final answers. This approach aligns with recent recommendations in AI literacy education, which emphasize that generative AI should augment human judgment and critical thinking and not replace it ([Traga Philippakos, in press](#); [Tzirides et al., 2024](#); [Tzirides et al., in press](#)). To make the process of applying CREDIBLE clearer to readers, we offer two examples. The first refers to the evaluation of an online source, and the second to the evaluation of AI-output. For this example, the former considers a postsecondary learner and the latter a postsecondary one.

1.5. Example: Student Evaluation of an Online Source Using the CREDIBLE Framework

To illustrate the application of the CREDIBLE framework, consider a student evaluating an online article about the impact of handwriting instruction on students' writing development. The article appears on an educational website and claims that handwriting instruction is no longer necessary because digital tools fully support writing development.

Credibility: The student first examines the overall trustworthiness of the source. The article lists an author's name but provides limited information about the author's background and no institutional affiliation. While the website appears professionally designed, there is no clear "About" section or contact information. Based on these observations, the student determines that the source presents limited indicators of transparency and accountability, raising initial concerns about its credibility.

Reliability: Next, the student considers whether the source has a track record of accuracy and consistency. A search of previous articles published on the website reveals that many posts are opinion-based and rarely reference peer-reviewed research. The student also notes the absence of corrections or revision histories. As a result, the student judges the source to have low reliability, as it does not demonstrate consistent engagement with well-substantiated information.

Evidence: The student then evaluates how claims are supported. The article makes broad assertions about handwriting instruction but includes no citations to empirical studies, systematic reviews, or reputable educational organizations. Several claims are presented as facts without accompanying data or references. Using the CREDIBLE framework, the student concludes that the evidence is insufficient to support the article's claims.

Date (Updated Information): The article was published eight years ago and has not been updated. The student recognizes that research on writing instruction and digital tools has evolved substantially during this period. Because the article does not reflect recent scholarship or developments in the field, the student determines that the information may be outdated.

Intent (Purpose): The student examines the purpose of the article and notes persuasive language aimed at promoting digital writing tools. Advertisements for educational software appear throughout the page, suggesting a potential commercial motive. This observation leads the student to conclude that the article's primary intent may be to persuade or market, rather than to inform objectively.

Bias: The student observes that the article presents only one perspective, dismissing handwriting instruction without acknowledging counterarguments or conflicting research findings. Alternative viewpoints and limitations are not addressed. This one-sided presentation signals ideological and commercial bias.

Logic: The student evaluates the reasoning used to support the claims. The article relies on anecdotal examples and generalizations rather than logically structured arguments. Several conclusions are drawn without clear connections to evidence, indicating weak logical coherence.

Expertise (Authority): Finally, the student assesses the author's expertise. The author is identified as an "education enthusiast" with no listed credentials in literacy research, education, or cognitive development. In contrast, the student compares this source with peer-reviewed articles written by established researchers in writing development, further reinforcing concerns about the author's authority.

Overall Evaluation: Based on the systematic application of the CREDIBLE framework, the student concludes that the source lacks sufficient credibility, reliability, and evidentiary support to be used in an academic assignment. While the source may reflect a personal opinion or commercial perspective, it does not meet the standards required for scholarly or evidence-based writing. The student, therefore, excludes the source and seeks peer-reviewed research to support their argument.

1.6. Example: Evaluating AI-Generated Content Using the CREDIBLE Framework

Even though the application of CREDIBLE may be straightforward when examining traditional sources, it may look more challenging when working with AI-generated

content and online content. The lack of transparency in source attribution means that AI outputs should be approached with skepticism. The CREDIBLE framework empowers students to systematically open a dialog that they initiate and interrogate AI outputs, rather than accepting them as they appear on their screens. Imagine a student receives an AI-generated summary on climate change policies from a tool like ChatGPT. The student applies the CREDIBLE framework to critically assess the output before incorporating it into their research.

Credibility: The student begins by asking, Who produced this content? Since AI-generated text lacks a traditional author or institutional affiliation, the student recognizes that the output does not have a clear, accountable source. This absence raises concerns about trustworthiness and calls for heightened scrutiny. Further, the student is encouraged to confirm the credibility and expertise of sources referenced by AI. When an AI output cites external materials, students should investigate the authors or organizations behind those sources. This involves examining their credentials, reputations, and backgrounds to determine whether the claims are supported by legitimate, authoritative expertise.

Reliability: Next, the student evaluates the AI's reliability by considering whether similar AI-generated responses have been consistent and accurate in the past. Knowing that AI models generate content based on patterns rather than verified facts, the student remains cautious, recognizing that AI may produce plausible but incorrect or outdated information. Similarly, when examining the authors included in the output, their reliability should be examined (in the same manner as the previous student would do).

Evidence: The student inspects the content for citations or references supporting its claims. If the AI provides references, the student verifies whether these sources exist and are credible. Often, AI models may fabricate or inaccurately cite sources, so the student cross-checks any provided data or studies. Lack of verifiable evidence undermines the output's reliability. It is not enough for AI to simply make a claim; it must be supported by relevant and specific evidence that, in turn, is credible.

In addition, students are taught to cross-reference and validate citations. AI systems can sometimes make up references (authors, titles, journals) or misattribute references to different journals or authors. Consequently, it is necessary for learners to locate and examine the original documents in academic databases or repositories (e.g., university libraries or programs that their schools include to access credible information). This process confirms that a source really exists and whether it is accurately represented in the AI output.

Date (Updated Information): The student considers the timeliness of the information. AI models like ChatGPT are trained on data up to a specific cut-off date (e.g., 2021). The student verifies whether the summary reflects the most recent policies or developments, noting that the AI might omit newer information. Another important step is to check how updated and up-to-date the information is and how relevant it is. Students learn to verify whether the data or studies referenced are up to date and relevant to the topic at hand, ensuring that their conclusions are informed by the most current knowledge available.

Intent (Purpose): The student reflects on the purpose of the AI output. Since AI generates content to respond to prompts rather than with an agenda, it is important to consider that the output may lack intentional bias but could reflect biases present in training data.

Bias: The student critically examines the text for ideological or political bias. AI outputs can mirror biases found in the datasets used for training, such as favoring certain perspectives or omitting others. The student evaluates whether multiple viewpoints are represented or if the text leans toward a particular stance without justification. Analyzing the author's motivation, the intended audience target, and the perspective of the original author helps learners understand the context in which the information was produced.

Logic: The student assesses the logical coherence of the content. Are arguments presented clearly and supported with sound reasoning? The student watches for signs of flawed logic, contradictions, or emotional appeals disguised as factual claims. Students assess whether the arguments are logically structured and whether the evidence provided is contextually appropriate, rather than vague (a common trend in AI-generated content).

Expertise (Authority): Finally, the student notes the lack of an identifiable expert author or organization behind the content. Recognizing that AI lacks genuine expertise or credentials, the student treats the output as a starting point for inquiry rather than authoritative knowledge.

Overall Evaluation: Through applying the CREDIBLE framework, the student concludes that while AI-generated content can offer a useful overview, it requires careful verification, supplementation with credible sources, and critical reflection before being used in academic work. The framework equips learners to responsibly navigate AI-generated information by encouraging active evaluation rather than passive acceptance.

1.7. CREDIBLE Implementation

The CREDIBLE framework has been integrated into genre-based writing instruction across multiple educational levels, including upper elementary (Grades 3–5; primarily grade 5), secondary (Grades 6–8), and, more recently, postsecondary contexts. In the studies conducted with upper elementary learners (Traga Philippakos, 2025) and secondary learners (Traga Philippakos & Rocconi, under review), CREDIBLE was embedded within genre-based writing instruction to support students' use of sources. Instruction initially focused on genre-based writing without sources and subsequently incorporated writing tasks that required students to evaluate and integrate information from external texts. These studies examined both students' genre-specific writing performance and their motivation for writing.

Results across both educational levels indicated that students' posttest writing performance was statistically significantly higher than their pretest performance. These findings suggest that the instructional model, which included explicit support for evaluating and using sources, was effective in strengthening students' writing when working with information from multiple texts.

The implementation of CREDIBLE with postsecondary learners occurred as part of regular classroom instruction in a writing course grounded in sociocognitive perspectives on writing development (see MacArthur & Graham, 2016; MacArthur, 2025). Within this course, the instructor explicitly modeled how to evaluate information sources using the CREDIBLE framework, including how to critically examine outputs generated by ChatGPT. Students were provided with AI-generated responses and, working in small groups, were asked to determine whether the output was reliable and accurate. Using CREDIBLE, learners analyzed both the content of the responses and the credibility of the cited references.

Following this guided practice, students completed an evaluative task in which they examined a set of five articles and identified the two that lacked credibility. Students then wrote an argumentative essay defending the claim that writing is a literacy outcome, drawing on credible sources to support their position. This instructional sequence was implemented across multiple course sections and was taught collaboratively by one clinical faculty member and one lecturer. Across sections, students were consistently able to identify the non-credible sources, demonstrating their ability to apply the CREDIBLE framework effectively.

Although this implementation was instructional in nature and no formal research data were collected, the work can be characterized as a form of action research. The primary

goal was to better support learners' understanding of the limitations of generative AI tools and to reinforce their responsibility as readers and writers to verify accuracy, evaluate credibility, and avoid uncritical reliance on information sources.

1.8. Building Instruction Around CREDIBLE

The CREDIBLE framework offers educators a versatile, actionable approach to embed critical evaluation skills directly into their instructional practices. To translate this framework from theory into effective pedagogy, educators can incorporate it into various types of learning activities, assignments, and assessments.

Inclusion of CREDIBLE in rubrics: One practical strategy involves integrating the CREDIBLE criteria into source evaluation rubrics used for research assignments. By requiring students to explicitly justify their selection of sources using specific CREDIBLE components, such as explaining how they assessed a source's authority, accuracy, or purpose, educators encourage deliberate, evidence-based evaluation. Students internalize the framework's principles and develop habits of critical inquiry that extend beyond the assignment (see Table 2 for a sample rubric demonstrating these criteria). In our practice, this table was used when working with postsecondary learners who evaluated the provided sources before determining which ones presented inaccurate information and excluded them from their synthesis.

Table 2. Rubric on CREDIBLE for evaluation purposes. Score of 2 = accurate, present, well done; score of 1 = partially accurate/present; score of 0 = inaccurate, absent, or inadequate.

CREDIBLE Categories	Guiding Questions	2—Strong	1—Developing	0—Limited/Absent
C—Credibility	Is the source trustworthy and professional? Is the author or organization reputable?	Clearly credible and published by a reputable organization or expert. Author credentials are easy to verify.	Author or publisher seems legitimate but lacks clear authority or transparency.	No identifiable or trustworthy author or organization. Signs of inaccuracy or lack of professionalism.
R—Reliability	Is the source consistent and dependable? Does it avoid errors or sensationalism?	Information is consistent, accurate, and well-edited.	Generally reliable but with occasional issues or unclear consistency.	Source is known to be unreliable or shows clear signs of misinformation or sensationalism.
E—Evidence	Are claims supported by data, research, or citations?	Claims are backed by strong, credible evidence. Sources are cited properly.	Some evidence is provided, but lacks depth, clarity, or reliability.	No meaningful evidence is provided; relies on opinion, anecdote, or unsourced claims.
D—Date	Is the information current or contextually appropriate?	Recently published or historically appropriate. Reflects up-to-date knowledge.	Somewhat outdated or not clearly relevant in terms of date.	Outdated, no publication date, or inappropriate for the topic.
I—Intent (Purpose)	What is the goal of the source—informing, persuading, entertaining?	Purpose is transparent and mostly to inform or educate. No hidden agenda.	Purpose includes both information and persuasion or marketing. Some bias present.	Purpose is manipulative, unclear, or misleading. Strong commercial or ideological agenda.
B—Bias	Is the content balanced or one-sided? Are multiple perspectives considered?	Neutral, balanced, and objective. Multiple viewpoints are acknowledged.	Some bias present; limited perspectives shown.	Clearly biased or one-sided. No attempt at objectivity.

Table 2. *Cont.*

CREDIBLE Categories	Guiding Questions	2—Strong	1—Developing	0—Limited/Absent
L—Logic	Are arguments coherent and logically structured?	Reasoning is sound, well-organized, and free of logical fallacies.	Arguments are mostly logical but include minor inconsistencies or weak points.	Argument is illogical, incoherent, or emotionally manipulative.
E—Expertise (Authority)	Does the author have relevant expertise or qualifications?	Author is an expert in the field with clear, relevant credentials.	Some relevant experience or knowledge is indicated, but not clearly established.	No evidence of expertise or credentials. Anonymous or unqualified source.

Total Possible Score: 16. Score of **14–16** = Excellent: Strong source(s) demonstrating high-level critical evaluation across all categories. Source selection is rigorous and well justified. Score of **10–13** = Adequate: Source(s) are generally appropriate, but may have some weaknesses in credibility, recency, or depth of evidence. Evaluation shows developing skill. Score of **0–9** = Inadequate: Source selection and evaluation are inconsistent, weak, or flawed. Key criteria are missing or misapplied. Reflects a need for additional instruction or revision.

Scaffolding AI use with CREDIBLE in research assignments: Instructors can enhance students’ critical thinking by designing assignments that explicitly require the thoughtful use of AI-generated content. This involves fact-checking AI-generated information by verifying cited sources, confirming the accuracy of factual claims, and assessing the coherence and validity of arguments using the CREDIBLE framework. As part of this process, students should also reflect on the reliability and limitations of AI-generated material, articulating what they learn through their critical examination. Ultimately, this process cultivates a reflective mindset, helping students shift from passive recipients of AI-generated text to active examiners who engage with information thoughtfully before integrating it into their own academic work.

Guided Practice through comparison and reflection: Another effective instructional method is to engage students in guided practice that contrasts credible and non-credible sources. Educators can curate paired examples, one demonstrating high credibility and another with clear challenges such as outdated data, lack of evidence, or biased perspectives. Through classroom discussions and written reflections, learners practice applying CREDIBLE’s components to dissect the strengths and weaknesses of each source. This use of expert and coping models (also see [Traga Philippakos, 2021](#)) can sharpen students’ critical thinking and problem-solving skills.

Indeed, this side-by-side comparison fosters metacognitive awareness, helping students understand not only what to evaluate but why these elements matter when considering trustworthiness. Reflective prompts, such as “What did I learn about identifying credible sources through this exercise?” or “How will this influence my future processes of researching?” further reinforce students’ evaluative skills and encourage transfer to contexts other than English Language Arts (ELA).

1.9. Potential Challenges with Implementation

While the CREDIBLE framework offers a structured and comprehensive approach to evaluating information credibility, several challenges may arise during its implementation across educational and professional contexts. These challenges are not unique to CREDIBLE but reflect broader issues associated with teaching and applying epistemic evaluation frameworks in complex digital and AI-mediated environments.

Cognitive load and developmental readiness: One potential challenge involves the cognitive demands associated with applying multiple evaluative criteria simultaneously. For younger learners or those with limited prior knowledge, systematically attending to credibility, reliability, evidence, bias, logic, and expertise may impose a high cognitive load.

Without sufficient scaffolding, learners may focus on only one or two criteria or apply the framework superficially. This challenge underscores the importance of developmentally appropriate instruction, modeling, and gradual release of responsibility when introducing CREDIBLE, particularly in elementary and secondary settings.

Superficial or checklist-based use: Another challenge is the risk that learners may treat CREDIBLE as a procedural checklist rather than as a tool for reflective reasoning. When frameworks are applied mechanically, students may answer guiding questions without critically engaging with the underlying epistemic judgments. For example, learners may identify the presence of citations without evaluating their quality or relevance. This challenge highlights the need for explicit instruction that emphasizes reasoning, justification, and discussion rather than simple completion of criteria. In this process skepticism may assist in judgement.

Overlapping constructs and conceptual distinctions: As noted earlier, some components of CREDIBLE, particularly credibility and reliability, may initially appear conceptually overlapping to learners. Without careful explanation and illustrative examples, students may struggle to distinguish between situational judgments of trustworthiness and longitudinal judgments of accuracy. Addressing this challenge requires instructors to explicitly model how different criteria serve distinct epistemic functions and to provide opportunities for comparison across sources.

Context sensitivity and transfer: Applying CREDIBLE effectively requires learners to adapt the framework to different contexts, such as academic research, social media, news consumption, or AI-generated content. Learners may struggle to transfer evaluative strategies across contexts, especially when cues of authority or evidence differ. For instance, evaluating a peer-reviewed article requires different considerations than evaluating AI output or a social media post. Supporting transfer requires varied practice and explicit reflection on how criteria are weighted differently depending on purpose and context. Also, what matters is that students' criticality is scaffolded, and gradually, they develop fluency in their skepticism.

Time constraints and instructional integration: In instructional settings, time limitations may constrain the depth with which CREDIBLE can be taught and practiced. Educators may find it challenging to integrate explicit credibility evaluation instruction alongside existing curricular demands. Without sustained and repeated opportunities for application, learners may not fully internalize the framework. This challenge points to the need for thoughtful integration of CREDIBLE within existing writing, research, or inquiry-based activities rather than treating it as an isolated skill. In our practice (both in the upper elementary, secondary, and postsecondary settings), the introduction and application of CREDIBLE was within the genre-based strategy instruction practice, with time devoted to evaluation.

Navigating AI-specific limitations: Finally, evaluating AI-generated content presents unique challenges that may not be immediately intuitive to learners. AI outputs often lack clear authorship, stable references, or transparent reasoning processes, complicating judgments related to expertise, evidence, and intent. Learners may overestimate the authority of AI due to its fluent language and confident tone. Addressing this challenge requires explicit discussion of how generative AI systems produce content and why traditional credibility cues may be absent or misleading. Importantly, addressing this challenge requires the development of an understanding from learners of the source of AI output and of the ways that AI systems are trained, so learners are users of AI but skeptical ones who will read and actively examine output instead of accepting it as it is presented.

2. Discussion

The present work advances research on information credibility, writing with sources, and AI literacy by introducing and examining the instructional use of the CREDIBLE framework across upper elementary, secondary, and postsecondary contexts. Findings from classroom-based implementations suggest that embedding explicit credibility evaluation within genre-based writing instruction can meaningfully support learners' ability to write with sources. These findings reinforce the claim that writing quality is strengthened when students are taught not only how to compose texts, but also how to critically engage with and integrate information from multiple sources.

From a sociocognitive perspective, CREDIBLE aligns with models of writing development that emphasize the interaction among task demands, strategies, prior knowledge, and metacognition (Zimmerman & Risemberg, 1997). By foregrounding evaluation as a deliberate, reflective process, the framework supports learners in regulating their reading–writing processes when working with sources. This is particularly important given evidence that students often rely on surface-level heuristics, such as familiarity, presentation quality, or search rank, when evaluating online information (Fogg et al., 2003; Metzger et al., 2010; S. Wineburg & McGrew, 2019). CREDIBLE directly counters these tendencies by prompting learners to interrogate evidence, authority, logic, and intent, thereby supporting deeper engagement.

The framework also contributes to research on epistemic cognition by operationalizing credibility evaluation as an epistemic practice rather than a discrete technical skill (Greene, 2016; Rinehart et al., 2014). The explicit distinction between credibility and reliability reflects contemporary understandings of epistemic judgment as context-sensitive and multidimensional. Treating credibility as situational and perception-oriented, and reliability as longitudinal and evidence-oriented, allows learners to move beyond binary judgments of “trustworthy” versus “untrustworthy.” This distinction is especially important in digital and AI-related environments, where authoritative tone and fluent language may mask inconsistencies, inaccuracies, or fake references (Tzirides et al., *in press*). The examples presented demonstrate how learners can apply these distinctions productively when evaluating both traditional online sources and AI-generated content.

The postsecondary classroom implementation, while instructional rather than experimental, provides additional insight into how CREDIBLE may function as a form of guided epistemic apprenticeship. Through modeling, collaborative evaluation, and comparative analysis of sources, learners engaged in practices consistent with expert reading and sourcing behaviors identified in prior research (S. S. Wineburg, 1991; McGrew et al., 2018). Students' ability to consistently identify non-credible sources suggests that structured evaluation frameworks, when embedded within authentic writing tasks, can foster discernment even in complex information environments. This work aligns with emerging AI literacy research that emphasizes the need for users to engage critically with generative AI outputs rather than accept them as definitive answers. Studies on AI literacy highlight the importance of understanding AI mechanisms, verifying information, and using generative AI as an exploratory tool that supports learning and reasoning within broader evaluative practices rather than replacing them (Ding et al., 2024; Tadimalla & Maher, 2024). At the same time, the challenges identified in implementation mirror concerns raised in the broader literature on information literacy and epistemic instruction. Cognitive load, superficial checklist use, and difficulties with transfer across contexts are well-documented obstacles when learners are introduced to multi-criteria evaluation frameworks (Bråten et al., 2019; List & Alexander, 2019). These challenges underscore the importance of sustained, scaffolded instruction and of embedding credibility evaluation within existing curricular structures—such as genre-based writing, rather than treating it as a standalone

skill. The integration of CREDIBLE within genre-based strategy instruction appears particularly promising, as it allows evaluation to be revisited across tasks, texts, and purposes, supporting gradual internalization and transfer.

2.1. Implications for Practice

To effectively integrate the CREDIBLE framework into classroom instruction and cultivate students' critical evaluation skills, teacher preparation programs and ongoing PD of in-service teachers are essential, especially when the latter find that they are in need of such support (Traga Philippakos & Rocconi, 2025; Tan et al., 2025). Prospective and practicing educators require comprehensive training to confidently teach source evaluation, particularly given the complexities introduced by the digital information landscape and AI-generated content (Ding et al., 2024). Teacher preparation programs should incorporate robust instruction on AI-literacy, digital literacy, and epistemic cognition, ensuring that educators develop a deep understanding of the challenges students face when assessing the credibility of online sources. This foundational knowledge should include insights into cognitive biases that learners employ when evaluating information, as well as an understanding of the capabilities and limitations of AI-generated content.

Beyond foundational knowledge, PD must provide educators with concrete pedagogical tools and resources that can be tailored to diverse classrooms and grade levels. Training workshops and sessions that model the integration of frameworks such as CREDIBLE into research assignments, rubrics, and classroom discourse are valuable. These opportunities allow teachers to practice facilitating activities such as comparative analysis of credible versus non-credible sources and guiding students through the process of fact-checking AI-generated text.

Furthermore, professional learning communities (PLCs) could serve as platforms for educators to exchange best practices, address challenges, and adapt their instruction. Reflective practice is a crucial component of effective teaching in this domain. Educators themselves benefit from examining their own information consumption habits and recognizing potential biases. Developing this reflective stance, alongside increasing confidence in navigating digital and AI-related challenges, empowers teachers to lead critical source evaluation instruction with authority and clarity.

The successful implementation of CREDIBLE-based instruction also hinges on institutional support and policy alignment. Educational authorities at the district, school, and higher education levels play a pivotal role in prioritizing digital literacy and critical thinking. Embedding expectations for information evaluation within curricular standards and assessment frameworks helps create a coherent instructional environment. Providing teachers with adequate time, resources, and incentives further enables them to sustain and scale these instructional innovations effectively. While traditional digital literacy frameworks have provided useful scaffolding for information evaluation, there is a pressing need to prepare learners to navigate a digital landscape increasingly shaped by generative AI.

The next generation of digital literacy education and AI literacy must be multidimensional, age-appropriate, and critically engaged, accounting for not just the tools learners use, but the infrastructures and ideologies shaping those tools. In an information-rich but often credibility-poor digital environment, students must become strategic, discerning consumers and users of information to responsibly access and use information in their academic life and later in their professional and personal lives as citizens.

2.2. Limitations and Implications for Research

Despite its instructional promise, the CREDIBLE framework presents several limitations that warrant consideration and suggest important directions for future research.

Firstly, the framework's multi-component structure may impose substantial cognitive demands, particularly for younger learners or those with limited prior knowledge, potentially leading to partial or superficial application. In our work, we incorporated the evaluation of sources in the broader instruction of genre-based writing and had the opportunity to discuss the topics of credibility and reliability across readings (as part of the FTAAP rhetorical analysis; see [Philippakos, 2021](#)). Future research should examine developmentally appropriate sequencing, scaffolding, and fading of support to determine how learners internalize the framework over time. Further, future research could examine the effects of CREDIBLE on its own in supporting students' source evaluation to better determine the profile of those learners who are challenged and what causes such challenges (e.g., prior knowledge).

Secondly, there is a risk that CREDIBLE may be implemented as a procedural checklist rather than as a tool for reflective epistemic reasoning. Even though we have provided a sample table, the goal is for learners to internalize such criteria and not use the table as a checklist. Empirical studies are needed to investigate instructional conditions that promote deep justification, transfer, and metacognitive engagement rather than surface-level compliance.

Thirdly, conceptual overlap among components, especially credibility and reliability, may challenge learners' understanding, highlighting the need for research that examines how students differentiate these constructs across contexts and how instructional language and examples support clarity. The incorporation of think-aloud protocols may better assist in understanding learners' challenges. Additionally, learners may struggle to transfer the framework across diverse information environments, including academic texts, social media, and AI-generated content; future work should explore how context, genre, and task demands shape the weighting of evaluative criteria.

Finally, while CREDIBLE addresses AI-specific challenges, generative AI systems evolve rapidly, raising questions about how learners interpret AI authority, detect fabricated citations, and respond to increasingly sophisticated outputs. Longitudinal, design-based, and classroom-based research is needed to examine how CREDIBLE supports sustained writing with sources and responsible AI use across educational levels and institutional contexts.

3. Conclusions

The combination of rapidly evolving online content and the widespread use of AI tools demands more than intuition to determine what is and is not credible. It requires structured, evidence-based evaluation strategies. The CREDIBLE framework offers a practical and rigorous method to support that goal, empowering learners to critically assess the quality of sources and to make informed, ethical decisions in their academic work. By embedding CREDIBLE into curricula, educators (and institutions) can foster a culture of intellectual responsibility and resilience, one in which students question, verify, and think deeply about the information they encounter, regardless of its origin, avoiding spreading misinformation and protecting a healthy democracy.

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