International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

The Influence of AI Tools on Students Critical Thinking and Independent Learning

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Abstract

Artificial intelligence (AI) tools are increasingly influencing teaching and learning by providing explanations, generating ideas, offering feedback, and supporting personalized study. These capabilities create opportunities to strengthen students' critical thinking and independent learning, but they also raise concerns about overdependence, inaccurate information, and reduced intellectual effort. This article examines how AI tools may support or hinder students' abilities to analyse information, evaluate evidence, solve problems, regulate learning, and make independent judgments. A narrative literature review approach is used to synthesize selected scholarly studies and educational guidance on generative AI, critical thinking, and self-regulated learning. The discussion suggests that AI can support learning when students use it to explore alternative explanations, test their understanding, obtain formative feedback, and reflect on their progress. However, benefits are not automatic: copying generated answers, accepting unsupported claims, or outsourcing reasoning may reduce opportunities to practice essential cognitive skills. AI outputs can also contain factual errors and biased assumptions, making source verification and human judgment indispensable. The article argues that the educational effects of AI depend on task design, students' AI literacy, teacher guidance, and institutional expectations. Practical strategies include inquiry-based activities, staged assignments, reflective learning journals, oral explanations, problem-based learning, and explicit rules for acceptable AI use. The article also identifies research priorities, including longitudinal studies, discipline-specific investigations, and assessments that distinguish task completion from durable learning. It concludes that AI should function as a scaffold for learning rather than a substitute for students' thinking. Responsible integration requires educators to preserve learner agency, teach critical evaluation of AI-generated content, and ensure that students remain accountable for their conclusions and academic work.

Keywords: Artificial Intelligence, Critical Thinking, Independent Learning, Generative AI, Student Autonomy

Introduction

Artificial intelligence (AI) has become an increasingly visible feature of contemporary education. Generative AI systems, intelligent tutoring applications, adaptive learning platforms, and automated feedback tools can explain concepts, summarize material, generate questions, and assist with writing. For students, these tools may make academic support more immediate and accessible. They also change how learners locate information, approach assignments, and decide when to seek help. The educational purpose of learning, however, extends beyond obtaining correct answers or completing tasks efficiently. Students are expected to develop critical thinking, independent judgment, problem-solving, creativity,

and the capacity to continue learning throughout life. These competencies require active engagement: learners must question claims, compare evidence, recognize uncertainty, and explain the reasoning behind their conclusions. AI can support these aims when it acts as a resource for inquiry and feedback. A student might ask an AI tool to explain a difficult theory, compare the explanation with course readings, and identify where the accounts differ. The same tool may undermine learning if the student simply submits a generated response without understanding or evaluating it. Therefore, the central issue is not whether AI is inherently beneficial or harmful, but how its use is structured and what intellectual work remains with the learner. This article examines the influence of AI tools on students' critical thinking and independent learning, considers possible benefits and risks, and recommends practical approaches for responsible educational integration.

2. Objectives:

This article aims to:

- Explain the concepts of critical thinking and independent learning
- Examine ways AI tools may support students' analysis, evaluation, problem-solving and self-regulation
- Identify risks associated with cognitive offloading, inaccurate outputs and Overdependence
- Discuss the roles of teachers and institutions in guiding AI-supported learning
- Recommend strategies that preserve student agency while making responsible use of AI-enabled educational support.

3. Methodological Approach

The article uses a narrative literature review approach. It synthesizes selected scholarly publications and educational guidance relevant to generative AI, critical thinking, self-regulated learning, and student agency. Sources were selected for their conceptual or empirical relevance to the topic, including research on large language models in education, cognitive offloading, creative work, and systematic reviews of AI-supported learning. The review is thematic rather than systematic: it does not claim to identify every relevant publication, apply a formal risk-of-bias assessment, or calculate a pooled effect. No original student data were collected. Accordingly, the article presents a critical synthesis of existing literature rather than new empirical findings. Its conclusions should be interpreted in light of the rapidly changing technology and the limitations of a narrative review.

4. Concepts of Critical Thinking and Independent Learning

4.1 Critical Thinking

Critical thinking involves the purposeful interpretation, analysis, evaluation, inference, explanation, and monitoring of reasoning. Facione (1990) identifies these abilities as central elements of critical thinking. In educational settings, students demonstrate critical thinking when they assess the credibility of a source, identify assumptions, compare competing explanations, recognize gaps in evidence, and justify a conclusion with reasons.

For example, a student examining a public-health claim should not accept a polished AI response at face value. The student should locate reliable evidence, consider the quality of the sources, examine possible counterarguments, and explain why the evidence supports a particular conclusion. AI may help generate questions or offer an alternative perspective, but critical judgment remains the student's responsibility.

4.2 Independent Learning

Independent learning describes a learner's capacity to take responsibility for learning goals, strategies, progress, and evaluation. It is related to self-regulated learning, which involves planning, monitoring performance, and reflecting on outcomes. Zimmerman (2002) describes self-regulated learning as a cyclical process in which learners establish goals, apply strategies, observe their progress, and adapt future actions. Independent learning does not mean learning without any support. Students may appropriately use teachers, peers, books, and digital tools. Independence is demonstrated when learners make purposeful choices, assess the usefulness of support, and remain accountable for their understanding. AI can support this process through practice questions and feedback, but it can also weaken autonomy if students allow the system to make every decision or complete every task.

5. Potential Benefits of AI for Critical Thinking

5.1 Supporting Inquiry and Questioning

Conversational AI can help students explore a subject by answering follow-up questions, generating examples, and presenting alternative explanations. This can make it easier to begin investigating an unfamiliar topic. The strongest learning opportunities arise when students use responses as prompts for further inquiry rather than as final authority.

A teacher might ask students to develop an initial explanation of a concept, request a competing explanation from AI, and compare both with academic readings. Students then identify missing evidence and revise their own reasoning. In this model, the technology stimulates questioning while the learner carries out the evaluative work.

5.2 Comparing Arguments and Perspectives

AI tools can generate counterarguments, organize competing positions, or identify assumptions within a draft argument. These functions may help students see that complex questions often involve more than one plausible interpretation. Students can then evaluate each position against evidence and course concepts.

The process is not automatically critical. AI-generated counterarguments may be superficial, inaccurate, or based on hidden assumptions. Students should therefore assess whether each argument is relevant, logically coherent, and adequately supported. The educational value lies in the comparison and evaluation, not simply in the number of perspectives produced.

5.3 Feedback and Revision

AI may offer rapid feedback on clarity, structure, and the completeness of an explanation. When used formatively, such feedback can help students recognize areas that need revision.

Kasneci et al. (2023) note that language models have potential educational uses but require careful oversight because their responses may be unreliable. For feedback to support critical thinking, students should explain which suggestions they accepted or rejected and why. If they revise a paragraph only because the system recommended a change, they may not learn the principle behind it. If they compare the feedback with assignment criteria and subject knowledge, they can practice judgment and revision.

5.4 Problem-Solving and Metacognition

AI can present multiple approaches to a problem and provide practice tasks at different levels of difficulty. Students may compare solution methods, identify errors in their own reasoning, and consider how their approach could be improved. They can also ask for questions that test whether they understand a topic rather than merely remember a definition. Metacognition—the ability to monitor and regulate

one's own thinking—is central to effective learning. AI can prompt reflection by asking learners to explain their confidence, identify uncertainties, or describe the steps they used. Yet self-assessment should not be delegated entirely to AI. Learners need to check feedback against their actual performance and reliable standards.

6. Potential Benefits for Independent Learning

6.1 Flexible and Personalized Support

AI tools may provide explanations, examples, and practice opportunities when a teacher is not immediately available. Students can request a simpler explanation, ask for another example, or explore a topic at a different level of complexity. This flexibility can be useful for learners who need more time or alternative ways to approach a concept. Nevertheless, personalization is not necessarily accurate personalization. A system may misunderstand a student's difficulty or provide an explanation that is misleading. Students should compare AI guidance with course materials and ask teachers when uncertainty remains.

6.2 Goal Setting and Self-Monitoring

AI can help students break a large learning goal into smaller tasks, create revision questions, or organize a study schedule. A learner preparing for an examination might identify weak topics, practise them, and then evaluate progress through independent questions. These activities can support planning and monitoring when the student remains in control of the process.

The risk is that a study plan generated by AI may be followed mechanically without reflection. Effective self-regulation requires learners to adjust their strategies based on performance, available time, and changing needs. The tool can suggest a plan, but the student must judge whether the plan is realistic and effective.

6.3 Access, Confidence, and Lifelong Learning

AI may lower barriers to asking questions, particularly for students who are hesitant to speak in class or who need additional language support. It can offer opportunities for repeated practice and explanation without the social pressure some learners experience in public settings. It may also help students begin exploring subjects beyond a formal course.

However, access depends on devices, connectivity, cost, language performance, and digital skills. Institutions should not assume that all learners have equal access to the same systems. Responsible implementation should include accessible resources, guidance on privacy, and alternatives for students who cannot or do not wish to use a particular tool.

7. Risks to Critical Thinking and Independent Learning

7.1 Cognitive Offloading and Overdependence

Cognitive offloading occurs when a person relies on an external resource to perform mental work that could otherwise be carried out internally. Offloading is not inherently harmful: calculators, notes, and reference books can free attention for more complex tasks. The concern arises when learners routinely delegate the very reasoning they are expected to develop.

Gerlich (2025) reported an association between frequent AI-tool use, cognitive offloading, and critical-thinking measures in a mixed-method study. Because such evidence is not sufficient on its own to establish causation, it should be interpreted cautiously. A useful safeguard is to require an independent first attempt before AI assistance. Students can then compare their approach with the generated

response, explain differences, and decide what to revise. This preserves the learning value of effort while allowing the tool to provide support.

7.2 Accepting Errors and Bias

Generative AI can produce plausible but inaccurate information, invented references, incomplete explanations, or biased representations. Students with limited subject knowledge may find such outputs difficult to identify. Repeated uncritical acceptance can weaken source-evaluation habits and lead to errors in academic work. Students should be taught to verify factual claims using original research, scholarly books, official data, and other appropriate sources. They should also check whether cited publications actually exist and support the claims attributed to them. AI output should be treated as a starting point for verification, not as evidence by itself.

7.3 Reduced Persistence and Intellectual Effort

Learning often involves uncertainty, failed attempts, and revision. These experiences can help students develop persistence and more effective strategies. If an AI tool supplies a complete solution immediately, students may skip the effort needed to understand a concept.

Assessment design can unintentionally encourage this behaviour when it rewards only a polished final product. Requiring drafts, working notes, explanations of decisions, and oral discussion helps make the learning process visible. These practices do not assume that AI use is misconduct; instead, they help teachers assess whether meaningful learning has occurred.

7.4 Creativity and Similarity of Ideas

AI may help students overcome the blank-page problem by generating possible ideas. At the same time, reliance on similar prompts and systems may encourage convergence on familiar or conventional responses. Doshi and Hauser (2024), in research on generative AI and creative writing, found that AI assistance could improve some individual outputs while reducing the diversity of ideas across outputs. The findings concern a particular creative-writing context and should not be generalized automatically to every academic discipline.

One practical response is to ask students to develop initial ideas independently before consulting AI. They can then use AI to challenge, expand, or refine their thinking while preserving their own intellectual direction.

8. Implications for Teaching and Assessment

The educational impact of AI depends substantially on the design of learning activities. A task that asks students only to reproduce information may be easy to outsource. A task that requires local examples, evidence comparison, reflection, practical demonstration, or an oral defence is more likely to reveal the learner understands. Teachers can use staged assignments in which students submit a question, preliminary argument, source notes, draft, and final reflection. This sequence encourages planning and revision and gives educators a clearer view of how the work developed. Oral presentations and short follow-up questions can help students explain key claims in their own words. Assessment instructions should specify which uses of AI are permitted. For example, language editing may be allowed while generating the entire analysis may be prohibited. Rules should be clear before students begin work, and expectations should be consistent across a course where possible. AI detectors should not be treated as definitive proof of misconduct. Detector performance can vary, and a classification may be wrong. Fair assessment should rely on the quality of the work, process evidence, source accuracy, and the student's

opportunity to explain their decisions. The goal is to evaluate learning fairly rather than to assume that all AI assistance is either beneficial or dishonest.

9. Strategies for Responsible AI Integration

9.1 Develop AI Literacy

Students need to understand the general capabilities and limitations of AI, including the possibility of error, bias, fabricated citations, and privacy risks. AI literacy should include the practical ability to verify outputs, compare sources, and disclose assistance according to institutional requirements.

9.2 Use Inquiry-Based and Problem-Based Learning

Teachers can ask students to formulate their own answer before asking AI for an alternative. Students then compare responses, identify unsupported claims, and construct an evidence-based conclusion. Problem-based learning can similarly require students to justify a proposed solution and respond to counterarguments.

9.3 Encourage Reflective Learning

Learning journals can ask students to describe what they understood before using AI, what changed after reviewing its response, which claims they verified, and what they still need to learn. Reflection helps students recognize whether AI supported their reasoning or replaced it.

9.4 Maintain Human Guidance

Teachers provide disciplinary context, ethical judgment, encouragement, and feedback that AI systems cannot reliably replace. Professional development should help educators design meaningful AI-supported activities and communicate expectations. Institutions should review tools for accessibility, privacy, and suitability before recommending them.

9.5 Preserve Student Accountability

Students should remain responsible for the final work they submit. They must understand its content, verify important claims, follow assignment rules, and acknowledge AI assistance when required. AI should be positioned as a scaffold for learning, not as an author or substitute for the student's intellectual contribution.

10. Future Research Directions

Further research should investigate how different patterns of AI use affect learning over time. Longitudinal studies could assess whether guided AI use improves critical-thinking performance, knowledge retention, transfer, and independent problem-solving. Experimental studies could compare independent work, unrestricted AI assistance, and structured AI use with reflection.

Research should also examine differences by age, discipline, language background, prior knowledge, and educational context. Findings from university students may not apply directly to school learners or professional programs. Researchers should distinguish between perceived usefulness and demonstrated learning outcomes; confidence and faster task completion do not necessarily indicate deeper understanding.

Sardi et al. (2025), in a systematic review of generative AI and students' self-regulated learning and critical thinking, reported that many included studies identified potential benefits while also noting concerns about overreliance. As this evidence base continues to develop, future studies should use transparent methods, clear measures, and careful interpretation of causal claims. Research should

ultimately identify not only whether students use AI, but how, for what purpose, and under which instructional conditions it supports durable learning.

11. A Practical Framework for AI-Supported Independent Learning

A practical way to preserve learner agency is to structure AI-supported study as a four-stage cycle. First, students make an independent attempt: they state what they already know, outline an initial answer, or solve the problem without assistance. This first effort makes prior understanding visible and creates a basis for comparison. Second, they ask AI focused questions that support learning rather than request a finished product. For example, they might ask for a counterargument, a hint, an explanation of a difficult concept, or a set of practice questions. Third, they assess the response by checking factual claims against course readings and credible sources, identifying assumptions, and deciding which suggestions are useful. Finally, they apply what they have learned by revising their own answer, solving a related problem without AI, or explaining the concept in their own words.

11.1 Why the Cycle Matters

The cycle separates assistance from substitution. AI is used to extend inquiry, while the student remains responsible for interpretation and judgment. It also gives learners a repeatable strategy that can be applied across subjects, from language learning and social sciences to mathematics, engineering, and professional education. The final application stage is especially important: a student who can follow an AI-generated explanation but cannot solve a similar task independently may have completed an assignment without achieving durable learning. Teachers can therefore ask students to demonstrate transfer after using AI, such as applying a principle to a new case or explaining why a method works.

11.2 Example of Classroom Use

In a lesson on environmental policy, students could first write a short position on whether a proposed intervention is justified. They then ask an AI tool to generate two counterarguments and identify assumptions in their own reasoning. Students verify the evidence using original reports or scholarly sources, note any inaccurate or unsupported AI claims, and revise their position. In a brief reflection, they explain which ideas changed their view and which they rejected. The activity assesses not only the final argument but also evidence evaluation, intellectual openness, and the ability to justify decisions.

12. Equity, Privacy, and Ethical Considerations

12.1 Fair Access and Inclusion

The educational benefits of AI are unlikely to be distributed equally unless institutions plan for differences in connectivity, device availability, disability access, language proficiency, and prior digital experience. Some students may have access to paid tools with advanced capabilities, while others rely on free or institutionally provided systems. If assignments quietly assume access to a particular platform, students may be assessed partly on resources rather than learning. Institutions should provide clear alternatives, accessible learning materials, and guidance that does not disadvantage students who cannot use a specific tool. AI outputs should also be reviewed for cultural, linguistic, and contextual relevance; fluent language does not guarantee that an explanation reflects a learner's circumstances.

12.2 Privacy and Data Protection

Students may enter personal information, unpublished work, research ideas, or sensitive institutional material into AI systems without understanding how that information is stored or processed. Teachers should explain data minimisation: learners should avoid submitting identifiable or confidential

information unless the institution has approved the tool and its terms. Schools and universities should evaluate data practices, retention policies, age restrictions, and contractual protections before recommending a service. Privacy education is part of AI literacy because responsible use requires students to consider not only whether an output is useful, but also what information they disclose to obtain it.

12.3 Bias, Transparency, and Accountability

AI systems can reproduce biases in training data or present dominant perspectives as if they were neutral. Students should be encouraged to ask whose experiences are represented, whose perspectives are absent, and whether a response treats contested assumptions as settled facts. Transparency also matters: students need to know when AI assistance is permitted and how it should be acknowledged. Disclosure rules should be proportionate to the task and clearly communicated in advance. Accountability remains with the person submitting the work; an AI system cannot take responsibility for unsupported claims, harmful recommendations, or inaccurate references.

13. Assessing Learning Outcomes in AI-Rich Classrooms

13.1 Assess the Process as Well as the Product

When AI can produce a polished response quickly, the final product alone may provide incomplete evidence of a student's understanding. Assessment can be strengthened by collecting process evidence such as an initial outline, source annotations, a draft history, a short explanation of revisions, or a record of claims that were independently verified. These elements should be used thoughtfully rather than as excessive paperwork. Their purpose is to make reasoning visible and help students practice metacognition, not merely to monitor them.

13.2 Use Transfer and Oral Explanation

Transfer tasks require students to apply knowledge in a new context, where simply reproducing an earlier AI-generated answer is less useful. After an AI-supported assignment, a teacher might ask the student to solve a parallel problem, interpret a new data set, or explain the strongest objection to their conclusion. Short oral discussions can reveal whether learners understand key concepts and can defend their choices. These methods should be inclusive and aligned with course outcomes; oral performance should not become an unrelated barrier for students with different communication needs.

13.3 Distinguish Efficiency from Learning

Faster completion, increased confidence, and a more polished submission are not sufficient evidence of deeper learning. Institutions should evaluate whether students retain knowledge, reason accurately, recognize uncertainty, and work independently when assistance is unavailable. Recent reviews of generative AI in education report a conditional pattern: benefits are more likely when tools are embedded in structured inquiry and feedback, while unstructured use can encourage overreliance. Evidence is still developing, and findings from one subject, age group, or short intervention should not be assumed to apply to all learners. Assessment systems should therefore combine immediate performance with opportunities to demonstrate retention and transfer.

14. Emerging Evidence and Implications for Practice

14.1 Recent Review Suggestions

Recent reviews provide a more nuanced picture than the claim that AI either improves or damages thinking in every situation. Sardi et al. (2025) reviewed studies on self-regulated learning and critical

thinking and reported that many studies identified benefits associated with personalized feedback and metacognitive support, while also warning about overreliance. Liu et al. (2025), focusing on English-as-a-foreign-language education, found both positive and negative outcomes across the studies reviewed, highlighting reliability, dependency, and pedagogical integration as important concerns. These findings support a conditional interpretation: the educational design surrounding AI use is a major factor in determining whether it helps studentspractise higher-order thinking.

14.2 Instructional Scaffolding Is Central

A 2026 systematic review of ChatGPT and critical-thinking outcomes similarly emphasizes the importance of inquiry-oriented and scaffolded instructional designs, while noting that evidence for changes in deeper critical-thinking dispositions is less consistent. A separate 2026 review of generative AI in STEM education reports positive average learning outcomes but substantial variation between studies, which cautions against treating a pooled result as a guarantee for every course. UNESCO's AI competency framework for teachers also stresses human-centred practice, ethics, AI foundations, pedagogy, and professional learning. Taken together, these sources suggest that tool availability is not a teaching strategy by itself. Teachers need clear objectives, carefully sequenced activities, and assessment methods that require students to explain and verify their work.

14.3 A Balanced Institutional Approach

Institutions should avoid both unrestricted adoption and blanket assumptions that any AI use is harmful. A practical policy can define permitted, restricted, and prohibited uses for different assignment types; explain disclosure expectations; protect confidential information; and provide a process for students to ask questions. Policies should be reviewed as tools and evidence change. Educators should also receive professional development that includes task redesign, bias and accuracy checks, privacy, accessibility, and fair assessment. Above all, the institution should articulate the learning purpose behind each restriction or permission. When students understand why they must perform some cognitive work independently, rules are more likely to support learning rather than appear arbitrary.

15. Limitations of the Current Review

This article is a narrative review of selected research and educational guidance rather than a systematic review or meta-analysis. It does not claim to include every relevant publication, assess every study with a formal quality tool, or establish causal effects of AI use on critical thinking. The field is changing rapidly, and studies differ in participant age, discipline, AI tool, duration, outcome measures, and instructional design. Some findings concern self-reported perceptions or short-term performance rather than long-term retention and independent transfer. The conclusions should therefore be understood as a synthesis of emerging evidence and a basis for practice, not as proof that a particular AI approach will work in every context. Future research should use transparent search methods, validated measures, comparison groups where appropriate, and longer follow-up periods.

16. Conclusion

AI tools offer meaningful opportunities to support students' critical thinking and independent learning through explanations, practice, feedback, and exploration of alternative perspectives. They may help learners plan study, identify gaps in understanding, and access support beyond the classroom. However, these benefits are not automatic. Overdependence, unverified information, reduced intellectual effort, and diminished ownership of learning may undermine the very competencies education seeks to

develop.The key distinction is between using AI to support thinking and using it to avoid thinking. When students attempt tasks independently, critically evaluate AI-generated material, verify evidence, and reflect on decisions, AI can serve as a useful learning scaffold. When they simply copy answers or delegate judgment, the same technology may limit opportunities to develop reasoning and autonomy.

Teachers and educational institutions should therefore combine clear policies with AI literacy, inquiry-based learning, reflective tasks, and assessment practices that reveal students' understanding. Students must remain accountable for the work they submit and the conclusions they reach. The long-term objective should not be maximum dependence on AI or its complete exclusion, but responsible use that strengthens human judgment. AI is most educationally valuable when it helps students become more questioning, self-regulated, reflective, and independent learners.

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