

ANALYSIS STUDENTS' CRITICAL THINKING THROUGH AI-BASED SYNTAX

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ABSTRACT

Important concerns regarding the calibre of students' writing and thinking have been brought up by the quick use of artificial intelligence (AI) techniques in higher education. When utilised thoughtfully and purposefully, AI-based syntactic tools like huge language model helpers can act as beneficial scaffolds for the development of critical thinking rather than acting as a shortcut for copying and pasting. study looks at how students in the English Education Study Program strengthen their critical thinking skills in relation to the use of AI-based syntax. design was used. The 2022 and 2023 cohorts, twenty-four students took part in semi-structured interviews, classroom observations, and document analysis of their writing assignments. The interactive model of data reduction, display, and conclusion drawing was used to analyse the data. The results show three main trends: students who used AI passively showed little metacognitive awareness; students who engaged analytically with AI-generated syntax showed stronger argument organization and sentence-level precision; and students who were guided to compare, evaluate, and revise AI outputs developed more reflective writing habits. The study comes to the conclusion that while AI-based syntactic tools do not automatically generate critical thinking, they can enhance students' reasoning, revision, and language assessment skills when integrated into structured educational activities. The pedagogical ramifications are examined for instructors who want to use AI as a tool for academic literacy rather than as a substitute for hard work.

Keywords: *Artificial intelligence; critical thinking; AI-based syntax; academic writing; English education; higher education*

A. Introduction

Artificial intelligence is becoming a pedagogical reality in higher education rather than a far-off possibility. As part of their daily academic routine, university students are increasingly using AI-powered writing helpers, grammar counsellors, syntax checkers, and language production tools. This change has

increased in Indonesia, especially among English education students who are expected to develop the critical and metacognitive skills necessary for academic and professional communication in addition to using the language fluently. In ways that earlier generations of students could not access, platforms like ChatGPT, Grammarly, and

associated big language model interfaces are now consulted for sentence writing, revision, and verification (Farida et al., 2023; Hidayat & Qomariyah, 2024).

Educators are worried about more than just the usage of AI tools. The more profound concern is how they are applied and what kind of thinking they encourage or impede. Instead of serving as a cognitive scaffold, the tool acts as a cognitive bypass when students paste AI-generated content without analysing it. However, the contact with AI might become a fruitful challenge for the development of critical thinking if students are directed to examine, edit, and selectively incorporate AI-produced syntax into their own reasoning (Lim et al., 2023; Noer & Andriani, 2024). In order to assess AI as a teaching tool, it is essential to distinguish between passive and reflective use.

In academic writing, critical thinking entails the capacity to assess assertions, structure arguments, identify logical fallacies, and make purposeful linguistic decisions that support communication (Fahim & Mirzaei, 2022). One area where critical thinking is evident is syntax,

which is defined here not just as grammatical structure but also as the intentional organization of ideas and propositions in written discourse. Pupils who think critically about syntax select words and sentence structures that indicate logical linkages rather than obfuscate them, show awareness of audience and register, and clarify rather than obscure. A new factor in this process is the ability of AI tools to quickly compose syntactically difficult phrases, which might either help students model complicated structures or eliminate the cognitive load that syntax practice is meant to create (Valizadeh, 2023).

Research on AI and writing in Indonesian higher education is still emerging. Studies have begun to document students' attitudes toward AI writing tools, noting that many students report finding them useful for grammar checking, vocabulary expansion, and text organization (Pratama & Sari, 2024; Fitriani et al., 2022). Concerns regarding academic integrity, over-reliance, and the decline of independent thought have also been brought up in discussions of institutional policy and faculty discourse. However, rather than focusing on pedagogy, these issues

are frequently framed around prohibition. Few research have looked at how students interact with AI syntactic tools in organised learning environments and whether or not this interaction can strengthen rather than weaken crucial capacities (Lim et al., 2023; Kurniasih & Nurdiana, 2023).

By concentrating on participants in the English Education Study Program, the current study fills this gap. According to preliminary observations and interview data, students in this program employed AI tools in a variety of, occasionally unreflective, ways. Without fully comprehending the syntactic choices involved, some pupils described replicating and modifying words produced by AI. Others talked about purposefully using AI outputs as models to test or enhance. Students who employed AI for revision after finishing a draft and contrasting their own creations with AI alternatives were involved in a third pattern. According to Hidayat and Qomariyah (2024) and Noer and Andriani (2024), these various forms of engagement indicated that the usage of AI is not consistent and that its effects on critical thinking vary greatly depending

on the educational setting in which it takes place.

Thus, two questions are addressed in this study. First, how does the usage of AI-based syntax affect students in the English Education Study Program's ability to think critically? Second, in the context of academic writing, what cognitive and behavioural traits set reflective AI use apart from passive AI use? By tackling these issues, the study hopes to add to the expanding body of knowledge on AI-assisted learning and academic literacy and provide instructors with useful advice on how to present AI tools as tools for intellectual growth rather than as replacements for it.

B. Method

Pada Because the main goal of this study was to comprehend students' lived experiences, behavioural patterns, and cognitive processes as they interacted with AI-based syntactic tools in academic writing situations, a descriptive qualitative design was used. When a researcher wants to find recurrent meanings, contextual interpretations, and participant viewpoints that cannot

be reduced to numerical measurement alone, qualitative inquiry is acceptable (Creswell & Poth, 2022). Additionally, this approach is consistent with research that looks at how digital technologies influence language acquisition and the development of academic literacy (Farida et al., 2023; Valizadeh, 2023).

Twenty-four students from the English Education Study Program's 2022 and 2023 cohorts at a public institution in South Sulawesi, Indonesia, were purposefully chosen to participate. Active usage of at least one AI-based writing or syntactic tool (such ChatGPT, Grammarly, or DeepL), consistent participation in academic writing assignments, and readiness to take part in observation and interview sessions were among the selection criteria. The researchers were able to record a variety of engagement behaviours because the sample comprised a range of English proficiency levels and varying frequencies of using AI tools.

Three instruments were used to generate the data. In order to record how students engaged with AI technologies in real time, the researchers first used non-participant

classroom observation during writing workshops and academic composition sessions. Second, students' motivations for utilising AI-based syntactic tools, their understanding of the distinction between sentences created by AI and those created by themselves, and their methods for accepting, altering, or rejecting AI recommendations were all investigated through semi-structured interviews. Third, indications of AI engagement in students' drafts, revisions, and final submissions were investigated through document analysis of a subset of student writing assignments.

The interactive paradigm of data reduction, data display, and conclusion drawing was used for data analysis. Based on trends in passive use, reflective use, metacognitive awareness, and critical assessment of AI outputs, interview transcripts were thematically categorised. Behavioural indications of essential processing involvement or avoidance were examined in the observation notes. Syntactic complexity, revision patterns, and indications of intentional language choices were examined in document samples. To generate

grounded interpretative findings, recurring patterns were found across instruments and contrasted (Pratama & Sari, 2024; Kurniasih & Nurdiana, 2023).

C. Findings and Discussion

Secara singkat dan jelas uraikan hasil yang diperoleh dan dilengkapi dengan pembahasan yang mengupas tentang hasil yang telah didapatkan dengan teori pendukung yang digunakan.

The results show that students' critical thinking is influenced by AI-based syntactic tools in ways that are neither consistently positive nor consistently negative. Students' manner of engagement and the extent to which instructional guidance promotes analytical interaction with AI results determine the nature of the influence. The data revealed three patterns: systematic revision comparison, passive adoption, and analytical participation. development of critical thinking is affected differently by each pattern.

Analytical Engagement with AI-Generated Syntax

Pupils who used AI-generated syntax analytically showed

quantifiable gains in sentence-level precision and argument structuring. Students did not directly accept AI outputs in this pattern. Rather, they critically read sentences produced by AI, noted what made them logical or well-structured, and then revised those structures in their own language. A number of participants talked about thinking about logical connectors, argument sequencing, and the connection between claim and evidence after asking themselves why the AI put a sentence in a certain way. Researchers refer to this type of interrogative approach as syntactic metacognition, which is the intentional focus on how language encodes reasoning (Fahim & Mirzaei, 2022; Lim et al., 2023).

This pattern was validated by observational data. Students who openly contrasted AI terminology to their own drafts, highlighted AI ideas, or asked questions about AI outputs aloud during writing workshops were more likely to create changes that demonstrated real structural progress. Instead of completely replacing their original thinking with syntactic models provided by AI, their final texts showed a negotiation between the two. These

results support research on AI-assisted academic writing that demonstrates how, through instructional scaffolding, students' own analytical and compositional abilities can be expanded through reflective interaction with AI outputs (Valizadeh, 2023; Hidayat & Qomariyah, 2024).

Passive Adoption and Limited Metacognitive Awareness

A second tendency was the passive adoption of text produced by AI, which was marked by little critical thinking and little metacognitive awareness. Students in this pattern stated that they mostly used AI tools to speed up sentence generation, cut down on writing effort, or get around grammatical and structural ambiguity. These pupils received recommendations as authoritative adjustments and incorporated them without conscious thought, instead of comparing AI results to their own thinking. Their texts occasionally included complex surface-level structures that were at odds with the concepts they had vocally articulated in interviews, according to document analysis, indicating that the writer did

not completely comprehend or own the AI-supplied syntax.

This result is consistent with worries about the cognitive effects of passive AI use expressed in recent Indonesian and global literature. Students are relieved of the very cognitive difficulty that develops academic writing skill when AI tools take over the syntactic decision-making process (Noer & Andriani, 2024; Pratama & Sari, 2024). The issue is really one of intellectual growth rather than just academic integrity. Students who simply copy and paste AI syntax without questioning it miss out on the chance to learn how sentence structure, word choice, and argument structure interact to create effective academic discourse. These students might write writings that are technically correct but lack a deeper comprehension of the reasons for their success (Fitriani et al., 2022).

Discussion: AI as Scaffold, Not Substitute

When combined, the three patterns lead to a key finding: depending on how they are presented pedagogically, AI-based syntactic

tools have varying effects on critical thinking. The tools serve as useful scaffolds that increase students' analytical abilities when they are encouraged to examine AI outputs. Without instructional structure, pupils are more likely to acquire AI passively, which hinders their ability to develop metacognition. The pedagogical interaction between the student, the tool, and the educational setting is more important than the technology itself (Farida et al., 2023; Valizadeh, 2023).

The positioning of AI in English education courses will be significantly impacted by this discovery. Given how deeply ingrained AI technologies have become in students' daily academic practices, prohibiting them is neither practical nor sound from an educational standpoint. Unrestricted and unguided use, however, runs the risk of creating what could be referred to as syntactic outsourcing, a situation in which students generate writings that are acceptable for academic purposes while assigning algorithmic systems the task of thinking. According to the current research, the middle option entails creating assignments that force students to

interact critically with AI outputs, justify their syntactic decisions, and use AI recommendations as information for introspection rather than as pre-written solutions (Hidayat & Qomariyah, 2024; Noer & Andriani, 2024).

Additionally, the study discovered a strong correlation between students' understanding of register and academic purpose and their critical engagement with AI. Students were better able to critically assess AI recommendations when they realised that academic writing demands argument openness, logical correctness, and audience awareness. This implies that using AI-based syntax for critical thinking involves both disciplinary literacy and tool use. Students are more likely to view AI results as partial and correctable rather than authoritative and final when they understand the purpose of academic writing and what makes it effective (Fahim & Mirzaei, 2022; Fitriani et al., 2022).

There are three real-world ramifications for teaching English. First, instructors should create clear AI-comparison assignments that ask students to assess, annotate, and

defend their choices about syntax produced by AI. Second, rather than depending on AI outputs as implicit models, writing instruction should explicitly describe the norms that separate excellent academic syntax from seemingly acceptable syntax, providing students with evaluation criteria. Third, whether or not AI tools are used, writing tasks should incorporate metacognitive reflection so that students consistently explain their thought processes. These instructional strategies align with research-based methods for developing academic writing that prioritise reflective scaffolding over product-oriented correction (Kurniasih & Nurdiana, 2023; Pratama & Sari, 2024).

D. Conclusion

This study looked at how students in the English Education Study Program enhance their critical thinking skills in relation to AI-based syntax tools. The results show that the cognitive effects of AI tools depend on how students interact with them and how instructional contexts frame that interaction. AI tools do not intrinsically encourage or hinder critical thinking. Students who critically examined AI

results showed improved revision ability, grammatical metacognition, and argument structuring. The cognitive demands of academic writing were not well engaged by students who passively adopted AI outcomes. The most significant improvements in critical thinking were made by students who took part in organised revision comparison assignments.

Therefore, the study comes to the conclusion that the main pedagogical difficulty is not whether or not to use AI tools, but rather how to create learning experiences that change the usage of AI from passive copying to active, critical, and reflective involvement. In terms of English instruction, this entails educating students to compare AI-generated syntax to their own logic, to explain the rules governing academic writing, and to view AI recommendations as beginning points rather than conclusions. Future studies could build on this work by comparing students at different skill levels, analysing how AI is used in various writing genres, or creating and evaluating particular instructional frameworks for AI-critical syntax

teaching. The ability to use AI technologies critically and reflectively will become a crucial component of academic literacy in higher education as they become more potent and widely available.

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