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Validation of Artificial Intelligence (AI) In Syntactic Analysis to Improve Students' Linguistic Competence and AI Literacy

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ABSTRACT

The advancement of artificial intelligence (AI) presents both opportunities and challenges in language learning, particularly in Indonesian syntax analysis, which is characterized by its flexible and complex structures. The main problem arises from AI limitations in accurately distinguishing syntactic functions, especially between objects, complements, and adverbials, which may lead to misinterpretations among students. This study aims to validate AI's accuracy in sentence pattern analysis and to emphasize its role as a supporting tool rather than a primary authority in syntactic studies. Employing a qualitative descriptive approach with documentation techniques, the research analyzed 60 student-produced sentences processed by AI and compared them with conceptual analysis based on Chaer's syntactic theory. Findings reveal that AI demonstrates relatively high accuracy in identifying subjects and predicates (90%), moderate accuracy in objects (80%), but lower accuracy in complements and adverbials (75%). These results highlight that while AI is useful for recognizing basic syntactic patterns, it remains weak in distinguishing between obligatory and optional grammatical functions. The implication is that AI integration in language learning must be accompanied by theoretical validation from students and lecturers to ensure that sentence analysis is not merely mechanical but grounded in comprehensive linguistic understanding.

Key words: Artificial Intelligence; Syntax Analysis; Validation

INTRODUCTION

The era of digital transformation has created significant changes and developments in various aspects of life, especially in the field of education. One innovation that has had a strong influence is the use of artificial intelligence (AI). Based on its definition, AI is an intelligent tool that provides answers or responses to various

requests through searches of available data. From a different perspective, AI is considered to resemble human intelligence. However, AI cannot be equated with human capabilities, because AI only provides logical and realistic answers based on data connected to the purpose of technological searches, while human intelligence is much more complex, involving cognitive processes in understanding emotional issues and being able to balance them based on context (Lubis, 2021; Santoso, 2023; Dhedhe & Nahak, 2024).

In today's world of education, the technology-based learning revolution demands the intensive use of AI. This is evidenced by adaptive learning styles through virtual assistants and analytics. Artificial intelligence (AI) can present a variety of comprehensive and interesting learning materials. For example, AI can combine interactive games, simulations, and text-based activities developed to strengthen language skills in various fields, ranging from vocabulary mastery to reading comprehension and speaking skills (Mambu et al., 2023; Syahlan et al., 2024). In addition, current learning styles are also demanded by various developments and changes in the curriculum, so learning strategies must also adapt quickly.

In its application, AI is an effective alternative in realizing modern learning that is capable of quickly solving problems. This is also a central part that distinguishes AI from human intelligence, namely its speed. AI is immediately capable of providing answers, but humans need time to think in order to decide on a problem. This reason is certainly a specific reason why AI is considered very helpful in the learning process. One example is in higher education, where students are required to be able to write and produce a wide variety of written works quickly, so utilizing AI has become a strong strategy. Even in writing theses or final projects, students are more likely to utilize AI.

The convenience offered by AI is also a complex concern and challenge to avoid. The intensity of AI use can have an impact on low literacy and a lack of motivation and creativity among students to think in the learning process (Sutrisna, 2024; Nasution et al., 2025). In addition, excessive use of artificial intelligence (AI) has the potential to cause quite serious social consequences, especially in terms of a decline in students' collaborative abilities. Collaborative activities, which are essentially built through discussion, exchange of ideas, and interaction between students, are slowly shifting because various AI platforms are able to offer instant solutions to various academic problems (Berliana & Cahya, 2024). The AI platforms that are often used by students include ChatGPT, Perplexity, Gemini, Quillbot, and others that continue to develop.

One of the dynamics of AI application that is often encountered among students is in learning Indonesian syntax. Syntax is a micro linguistic study that focuses on sentence structure and the ins and outs of sentence formation based on its constituent elements. Its constituent elements include phrases and clauses. Basically, syntax plays a vital role in grammar because it provides a foundation for users to construct concepts to express their ideas both verbally and in writing. The

higher the ability to construct sentences according to the rules, the better the language is produced. In addition, syntax plays an important role in language learning (Emidar & Herlin, 2025). In language learning, writing a text requires the ability to construct sentences well. This is one of the basics of writing. In addition, the structure of the Indonesian language has complex and flexible characteristics. This contrasts with English, which tends to have a fixed and regular syntactic pattern. This flexibility is an obstacle in the natural language processing system, especially when identifying grammatical relationships between components in a sentence. On the other hand, Indonesian is also characterized by a variety of complex affixation processes, which increases the level of difficulty in the morphological processing stage, which then has implications for syntactic analysis (Suryaningsih et al., 2024). For example, variations in word forms due to the use of prefixes, suffixes, infixes, and confixes often cause errors in determining word classes and in automatically interpreting sentence structures, making it difficult for students to gain a deep understanding.

Such learning problems have led students to often use AI as a quick alternative for completing sentence analysis in assignments and other written work. Although research conducted by Kiranawati, et al (2025) concluded that AI models in syntax learning help in producing simple and effective sentence analysis for quick identification, it is also necessary to test the accuracy and precision of prompts (commands) in the use of AI. In addition, the most important thing in understanding syntax concepts is still based on a clear theoretical study from accurate sources. Therefore, research is needed to provide an overview to AI users, especially students, so that they can wisely use AI as a supporting tool and not as the main tool in learning.In this part, the author should explain the background of the research. In this case, the author explains about previous problems related to the research issue. At the end of the introduction the author should state the purpose of the research. If the author needs to mention some points in number, do not use the list but just make it in paragraph, for example this paper should contain; 1) introduction, 2) literature review and 3) conclusion.

LITERATURE REVIEW

This study is not the first to discuss syntactic analysis and the use of AI, but in terms of the focus of validation testing, it is still rarely observed. In general, research on AI focuses more on its usefulness and positive impact as a tool for innovation in learning. The research conducted by Tristianto et al. (2025) was about “The Influence of Artificial Intelligence (AI) in Evaluating Indonesian Language Learning among Students.” The study concluded that the use of artificial intelligence (AI) in evaluating Indonesian language learning has greatly helped students in understanding complex material, organizing ideas, and reducing language errors. AI is considered effective because it can provide more detailed, faster, and more accurate feedback than manual evaluation. Then, research by Amelia et al. (2024) is about “Syntactic Study of Sentence Structure and Types Assisted by Artificial Intelligence in Indonesian Textbooks.” The study concluded

that the application of artificial intelligence (AI) technologies such as Word Counter Tool and Natural Language Toolkit (NLTK) can contribute significantly to syntactic analysis in Indonesian language learning texts. Using this software, the structure and variety of sentence types in the Indonesian language textbook for grade VIII published by the Ministry of Education and Culture can be identified more systematically and accurately, including simple sentences, compound sentences, complex sentences, as well as declarative, imperative, and interrogative forms. Additionally, research conducted by Ilham (2024) entitled "The Use of Artificial Intelligence Technology Media in Improving Arabic Language Skills at PPM Rahmatul Asri" concluded that there was a significant increase in Arabic language skills in the group using AI-based media compared to the group using PowerPoint. The study concluded that there was a significant increase in Arabic language skills in the group that used AI-based media compared to the group that used PowerPoint. The average pretest score for students using AI was 72.00, which increased to 88.86 on the post-test, while the average pretest score for students using PowerPoint only increased from 72.71 to 74.71. The t-test analysis produced a significant value (2-tailed) of $0.000 < 0.05$, thus proving that the use of AI is more effective in improving Arabic language learning outcomes than conventional media. Based on previous research, this study focused more on validating the accuracy of analysis using AI with conceptual theory analysis.

METHOD

This research was conducted using a qualitative approach with a descriptive method. According to Moleong (2010:6), the qualitative descriptive method is defined as a research effort that aims to comprehensively understand the phenomena experienced by the subjects, producing descriptive data in the form of words, both written and spoken. Data collection used documentation techniques. The data consisted of tasks analyzing sentence structure and effective sentences in syntax learning in meetings 6 and 7. In these tasks, students were asked to analyze sentences and correct ineffective sentences to make them effective. Then, the documented data is grouped based on problems and analyzed based on theoretical concepts. The task data is the result of analysis through AI. For this reason, the data will be compared to test the accuracy of the analysis.

RESULT AND DISUSSION

Students studying Indonesian syntax are taught in depth about the structure and patterns of sentences and how they are formed. Basically, students are provided with interactive learning, but the presence of AI as a form of technology that can help solve problems is inevitable. Almost all of the tasks carried out by students, especially those studying Indonesian language and literature, rely on AI as a solution for analyzing sentence patterns. The use of AI in this context serves to automatically recognize the main elements that form a sentence, such as the subject, predicate, object, complement, and modifier. However, the success of the AI system cannot be separated from a thorough understanding of the rules of Indonesian

syntax, which are unique and often different from other languages. Without in-depth knowledge of sentence patterns and their structural variations, the capabilities of AI will be limited and prone to misinterpretation. Therefore, sentence-based trials were designed to assess the accuracy and reliability of AI in parsing syntactic structures, thereby determining its effectiveness in supporting linguistic learning and research. A total of 60 sentence examples from two classes of students studying syntax were used. The data was obtained from sentence pattern analysis assignments. The following is the data analysis results:

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Table 1. Data Analysis Summary

No	Sentence	AI Result	Conceptual Analysis	Description
1	*Mahasiswa Pendidikan Bahasa Indonesia mengikuti debat dalam rangka meramaikan dies natalis UNP.*	S-P-O-K (75%)	S-P-O-Pel	AI is not yet able to accurately identify and distinguish between attributive and complement clauses.
2	*Dosen dan Mahasiswa berpergian dalam rangka kuliah lapangan.*	S-P-O-K (75%)	S-P-O-Pel	AI is not yet able to accurately identify and distinguish between attributive and complement clauses.
3	*Sejumlah karya tulis artikel telah dipublikasi oleh mahasiswa itu.*	S-P-O (95%)	S-P-O	AI is accurate in determining S and O
4	*Mahasiswa telah mengirimkan tugas kepada dosen tentang penulisan artikel.*	S-P-O-K (80%)	S-P-O-Pel-K	AI can almost identify complements
5	*Kita harus menolong orang yang mendapatkan kesulitan.*	S-P-O (80%)	S-P-O-K	AI does not yet understand how to distinguish between context and objects.
6	*Seluruh mahasiswa diminta untuk ikut serta dalam lomba Festival Sastra Mursal yang ke-9.*	S-P-Pel (75%)	S-P-K	AI is not yet able to accurately identify and distinguish between attributive and

				complement clauses.
7	*Banyak Sastrawan telah menciptakan karya yang memperoleh penghargaan.*	S-P-O-Pel (90%)	S-P-O-Pel	AI is accurate in determining complements

Based on the analysis calculations, the number of identifications for each syntactic element is as follows:
Using the formula: $\frac{\text{(Exact identification)}}{\text{Number of analysis data}} \times 100\%$

No	*Sentence Function/Pattern*	*Total Cases*	*Correct Identification*	*Accuracy*
1	Subject	60	54	90 %
2	Predicate	60	54	90 %
3	Object	60	50	80%
4	Complement	60	35	75%
5	Adverbial	60	35	75%

Based on data analysis, it is understood that sentence pattern analysis is not entirely accurate through the use of AI. Accuracy only covers general aspects, but if the commands given to the AI are different, the answers will also be different. In fact, the AI analysis used by students in sentence pattern analysis assignments highlights that sentence analysis must be understood in depth from each element. Students need to use theoretical references from various sources to validly test the data to be analyzed and then test it using AI.

According to Chaer (2019), objects are mandatory elements for transitive verbs that require the presence of nouns or noun phrases to complement the meaning of the predicate. In some cases, AI is able to identify objects well, such as in the sentence A number of articles have been published by the student, which is analyzed correctly with the S-P-O pattern. However, in other sentences such as We must help people who are in difficulty, AI misinterprets the relative clause who are in difficulty as an adverbial, when in fact the clause is a noun modifier in the function of an object. This error shows the limitations of AI in distinguishing between the core object and the modifier attached to the object.

Furthermore, the concept of complement is different from that of object because it cannot be passivized and has a close relationship with a specific predicate. For example, in the sentence All students are asked to participate in the 9th Mursal Literary Festival competition, the element to participate should be regarded as a complement to the predicate asked. However, AI interprets this element as a modifier. This error shows that AI is not yet able to accurately distinguish between mandatory syntactic functions (complements) and optional functions (modifiers). The difference in the identification of complements and modifiers is also apparent

in the sentence Students have sent assignments to lecturers about writing articles. According to Chaer's theory, the element to the lecturer can be understood as a place of destination, while about writing articles tends to be closer to the function of a complement because it expands the meaning of the predicate submitting the assignment. AI shows uncertainty by placing some of these elements as complements and some as modifiers, indicating that the system is not yet fully capable of capturing the nuances of function described in traditional syntactic theory. Then, in the sentence Lecturers and students traveled for a field study, AI placed the sentence pattern as S-P-O-K, even though the element for a field study is more accurately understood as a purpose modifier, not an object or complement. According to Chaer, adverbials have a more flexible position because they are not always required in sentence structure. This misclassification shows that AI often relies on linear word order patterns, thereby obscuring the difference between core and additional functions.

Overall, the results of this analysis confirm Chaer's view that syntactic analysis requires a deep understanding of the function of each element, not just based on surface form. AI can indeed be a tool to facilitate the recognition of basic patterns, but theoretical understanding must still be used as a foundation. Therefore, students should not rely solely on AI output, but must compare it with the syntactic theory proposed by Chaer in order to make sentence analysis more valid and accurate.

Table 3. Challenges and Solutions in AI-Based Syntactic Analysis

No	Challenge	Explanation	Solution
1	Error in Identifying Complement and Adverbial	In sentences such as *"Mahasiswa Pendidikan Bahasa Indonesia mengikuti debat dalam rangka meramaikan dies natalis UNP"* or *"Dosen dan Mahasiswa berpergian dalam rangka kuliah lapangan"*, AI identifies the pattern as S-P-O-K (75%), whereas the correct conceptual analysis is S-P-O-Complement. This indicates that AI is still inaccurate in distinguishing between adverbial and complement.	Train AI with more varied data related to complements (pseudo objects, clauses, purpose phrases) and adverbials, as well as strengthening AI's conceptual understanding so that the relation among sentence elements is more accurate with clear and repetitive instructions.
2	Error in Differentiating Object and Restrictive Modifier	In the sentence *"Kita harus menolong orang yang mendapatkan kesulitan"*, AI reads the pattern as S-P-O (80%), whereas conceptually there is a Restrictive Modifier. This shows that AI has	Incorporate more training data containing restrictive clauses and compound sentences, as well as integrate rule-based checking to differentiate

		limitations in understanding the concept of modifier, particularly restrictive ones, such as appositive modifiers.	object functions from modifiers.
3	Error in Identifying Complement	In the sentence *"Mahasiswa telah mengirimkan tugas kepada dosen tentang penulisan artikel"*, AI reads S-P-O-K (80%), whereas the correct conceptual analysis should be S-P-O-Complement-K. AI is almost correct but fails to fully recognize the complement function.	Provide more varied examples so that AI can distinguish between core arguments (subject, object) and complements.
4	Error in Identifying Adverbial and Complement	In the sentence *"Seluruh mahasiswa diminta untuk ikut serta dalam lomba Festival Sastra Mursal yang ke-9"*, AI detects S-P-K (75%), whereas the correct conceptual analysis is S-P-Complement. This indicates AI's bias in treating almost all additional phrases as adverbials.	Add training data containing sentences with long nominal phrases functioning as complements so AI can learn more accurate distributional patterns.
5	Identification of Complex Phrase Objects	In the sentence *"Sejumlah karya tulis artikel telah dipublikasi oleh mahasiswa itu"*, AI is fairly accurate (95%), but difficulties may arise with variations of complex object phrases.	Train AI with complex nominal phrases so that it can consistently differentiate the object core from its attributes.
6	Accuracy in Identifying Complement	In the sentence *"Banyak sastrawan telah menciptakan karya yang memperoleh penghargaan"*, AI is correct (90%) in identifying the complement. However, limitations still exist when the complement is in the form of a longer clause.	Employ deep learning approaches that are capable of handling longer contexts to maintain consistency in recognizing complements.

Based on the solutions provided, it was identified that the biggest challenge for AI intelligence in performing sentence analysis is its inability to consistently distinguish between the roles of complements, objects, and modifiers, especially when all three are present in the form of phrases or clauses with complex structures. For example, the system often miscategorizes complements as adverbials or

objects, and also has difficulty detecting adverbials that serve to limit the meaning of a noun. Although AI sometimes shows good accuracy in analyzing simpler structures such as nested objects or basic complements, its accuracy decreases when faced with sentences with longer and more varied constructions. To overcome these weaknesses, several strategic steps are needed, such as: training on commands containing basic concepts with more sentence examples from various structures, combining with rule-based methods to clarify the differences between ambiguous grammatical functions, and applying deep learning models that are more sensitive to context because AI is still not optimal in recognizing the same concept with different things.

CONCLUSION

Based on the results of the study, it can be concluded that AI can essentially help analyze sentences in the field of syntactic analysis. However, there are still many inaccuracies that can be used as a reference to always evaluate the findings after AI provides the results. Avoid copying fully without conceptual validation to obtain valid results. This is reflected in several errors in syntactic function analysis that require critical attention. Conceptual validation is an important part so that the output is not merely mechanical but also has a solid scientific basis. Therefore, the use of AI in sentence analysis should be positioned as a supporting tool that requires continuous evaluation, not as the sole determinant of truth in syntactic studies. One of the benefits of using AI refers to model development in learning, both in the field of syntactic linguistics and other fields.

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