LEARNING TREE DIAGRAMS IN SYNTAX: STUDENTS' DIFFICULTIES AND LEARNING STRATEGIES

Fernando De Napoli Marpaung[1],
[1]Sekolah Tinggi Keguruan dan Ilmu Pendidikan Al Maksum, Indonesia,
✉ (e-mail) fernandodenapolimarpaung@stkipalmaksum.ac.id

Supriadi[2],
[2]Sekolah Tinggi Keguruan dan Ilmu Pendidikan Al Maksum, Indonesia,
✉ (e-mail) supriadi@stkipalmaksum.ac.id

Resti Citra Dewi[3]
[3]Universitas Negeri Medan, Indonesia,
✉ (e-mail) resticitradewi@unimed.ac.id

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ABSTRACT

This study examined the difficulties students experience when learning syntactic tree diagrams, the strategies they use to manage these difficulties, their perceptions of the effectiveness of these strategies, and their suggestions for improving instruction. Using a descriptive qualitative design backed by quantitative features, data were collected via a standardized questionnaire from 31 fifth-semester students of the English Education Study Program in Indonesia who had completed a syntax course. The findings show that students primarily struggle with identifying phrase types (Mean: 3.68) and understanding complex sentence structures (Mean: 3.52), as well as applying theoretical concepts to diagram construction (Mean: 3.42). To address these challenges, students rely on a range of strategies, with digital tools—particularly artificial intelligence platforms like ChatGPT and Gemini (Mean: 4.06)—and educational video resources (Mean: 3.74) emerging as the most frequently used and most helpful. While AI provides immediate, step-by-step procedural support, students emphasized that its effectiveness is maximized when combined with collaborative approaches such as peer discussion and direct consultation with lecturers. The study concludes that learning syntactic tree diagrams involves significant conceptual demands, and students benefit most from instructional methods that incorporate visual scaffolding and interactive resources. Future research should employ experimental designs to compare AI-assisted instruction with traditional methods and investigate the impact of digital literacy on students' mastery of syntactic analysis.

Keywords: Syntax; Tree_Diagram; Strategy

INTRODUCTION

In the teaching of languages, especially Syntax, tree diagrams are crucial for the visualization of sentence structures and for demonstrating the hierarchical links between linguistic aspects. These diagrams help learners to see the grammatical

patterns and better understand the syntactic functions (McClumpha & Grote, 2016). Therefore, the ability to draw tree diagrams is very important for the students of English Education to understand the laws of phrase structure, grammatical categories, and sentence patterns. Despite their importance, tree diagrams remain a significant challenge for many students. Academically, syntactic analysis demands that students apply abstract theoretical notions precisely. Furthermore, prospective educators must be able to explain grammatical structures in a simple and systematic manner in practice (Culicover et al., 2017).

However, several studies have revealed that students struggle to overcome persistent cognitive, linguistic, and pedagogical challenges when learning syntax, especially when drawing tree diagrams (Chen, 2024). In previous research, students sometimes had difficulty understanding branches or lines, the relationship between elements of a word and a phrase (endocentric structure), and the correct placement of phrases in grammar learning, according to Heryono (2018). Additionally, students have different understandings of syntactic norms depending on their learning style. Abdullah et al. (2023) stated that excessive reliance on images or visuals in learning can prevent students with diverse learning styles from understanding the content. To address this, the use of tree diagrams in communicative activities and text learning can make syntax learning more understandable, relevant, and interesting (Abdullah et al., 2023; Syarif, 2017).

In addition to pedagogical factors, the first language (L1) plays an important role in the difficulties experienced by students. Structural differences between Indonesian and English can cause confusion for EFL learners when analyzing sentences (Uktolseja et al., 2019). Winarta and Rahmanu (2020) also noted that many errors occur in the form of misunderstanding sentence structure and inappropriate clause placement. These findings suggest that problems stem not only from syntax theory itself but are also heavily influenced by the students' linguistic background. Moreover, the teaching process significantly influences these outcomes (Embick, 2023). Learning is more effective when lecturers use a variety of approaches, such as visual explanations, real-world texts, and comparisons between different language structures (Ada & Chukwuokoro, 2024; Syahiza, 2023). Conversely, when instruction only emphasizes abstract theory without guided practice, students tend to repeat mistakes and lose confidence

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(Tahang et al., 2019; Marpaung et al., 2025).

Research on syntactic challenges is still growing (Nangle et al., 2024), but few studies specifically address the cognitive processes involved in constructing tree diagrams among EFL learners in Indonesia. Han (2024) reports, "most studies focus on common grammatical errors rather than the analytical process of diagram construction." Furthermore, less focus is given to students' own approaches and views on improving teaching methods (Ojea, 2024). To bridge this gap, this study aims to analyze the tree diagram learning process by determining the difficulties students face and the strategies they use to overcome them. This research is expected to contribute to the development of more effective and student-centered syntax teaching techniques by addressing these underlying difficulties among EFL students in Indonesia.

REVIEW OF RELATED LITERATURES

2.1. English Syntax

Syntax is an important subfield of linguistics which analyzes the structure and organization of words in sentences (Weissweiler et al., 2022). Syntax is not only concerned with the linear order of words but also the hierarchical structure that governs sentence formation (Carnie, 2013 in Nuriyanti, 2022). Sentences are not simply sequences of words but structured representations that follow basic grammatical principles.

While traditional grammar often focuses on prescriptive rules of word order, generative grammar as proposed by Chomsky (1965) shifts the focus toward the internal mental system that allows speakers to generate an infinite set of sentences. This distinction is crucial; whereas descriptive syntax observes how language is used, generative syntax seeks to model the underlying competence of the speaker (Proctor et al., 2020). Here the syntax is regarded as a conceptual system which generates the structures of sentences on the basis of a set of formal principles. The theory has resulted in structural representations such as phrase structure rules and transformations which are critical in the analysis of syntax (Bochari, 2025).Syntax in English language learning is important to build learners' grammatical competence. As Radford (2009) states, learners who have an idea of the syntactic structure can comprehend the meaning of the phrase and make grammatically correct utterances (Ruixi, 2024). Yet, for EFL learners, this process is not merely about

learning rules but about navigating the structural dissonance between their native language and English, which often leads to cognitive overload during analysis. Syntax is often seen by many English as a Foreign Language (EFL) learners as abstract and difficult, due to its foundation in formal rules and symbolic representations. This challenge is intensified when learners need to study phrase constructions that are beyond the surface grammar.

Teaching of English syntax Students are expected to identify syntactic categories such as noun phrases (NP), verb phrases (VP), and clauses, as well as comprehend their functional links within a sentence (Evans, 2020). According to Fromkin, Rodman and Hyams (2014), syntax learning consists of recognizing patterns, applying rules and understanding the hierarchical relations between pieces of a sentence (Ali et al., 2023). These skills are crucial for advanced language analysis, particularly in courses like Syntax or Grammar.

2.2. Tree Diagram in Syntax

One of the discussion in syntax is the tree diagram, which is used to illustrate the structure of a phrase, clause, and sentence (Maylinda et al., 2025). These diagrams serve as a bridge between abstract theory and visual representation, allowing students to map hierarchical relations that are not visible in linear text. Despite their utility, the pedagogical effectiveness of tree diagrams is often debated; while they provide clarity for visual learners, they can introduce a secondary layer of complexity—procedural demands—where students must master the 'mechanics' of drawing alongside the 'logic' of syntax. This diagram explains how syntactic parts are interconnected in a branching format. The tree diagram shows that the sentence structure is hierarchical, containing parts of speech(Fei et al., 2020).

In Grammar we employ tree diagrams which were suggested by Noam Chomsky, to explicitly represent deep and surface structures. These diagrams are mostly based on the phrase structure rules that describe how syntactic categories such as Sentences (S), Noun Phrases (NP), and Verb Phrases (VP) are formed (Bai et al., 2021). Tree diagrams may be used as a recipe for learning grammatical systems.

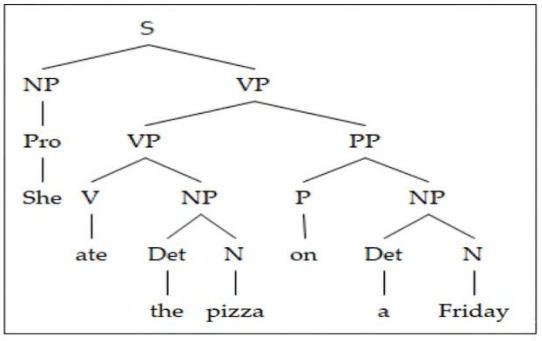

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Figure 1. An example tree Diagram

Students can learn from tree diagrams to understand abstract syntactic principles (Lee et al., 2025). According to Fromkin, Rodman and Hyams (2014), the use of tree diagrams to visually represent sentence structure improves students' analytical skills, especially, in recognizing the relations between parts (Karjo, 2024). Also, building tree diagrams takes critical thinking, as students need to decide the proper structure depending on the syntax rules.

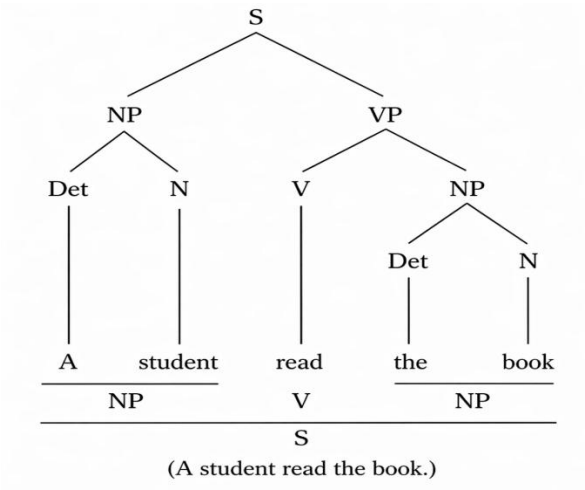

Figure 2. Noun pharase and Verb Pharase in Tree Diagram

Several studies suggest that students have major challenges in learning to use tree diagrams despite their instructional benefits. Specifically, students often struggle with 'attachment ambiguity,' where the relationship between a modifier and its head is not clearly understood, leading to incorrect branching. This suggests that the problem is not just a lack of theoretical knowledge, but a failure in 'visualizing' hierarchical dominance and parent-child connections within the diagram. These challenges include difficulty of syntactic category identification, inaccuracies in determining phrase structures and confusion in consistent application of phrase structure principles. Moreover, kids have difficulties grasping abstract ideas such as dominance, parent-child connections and hierarchical levels in the diagram.

The Problems in creating tree diagrams are generally related to a lack of understanding of basic phrase structure. Serliah Nur and Muthiah (2020) observed that students who lack a grasp of syntactic categories and functions tend to create incorrect diagrams. Students need to understand the correct structure of tree diagrams according to English writing rules.

2.3. Learning Strategies and Digital Tools in Syntax Education

Learning syntax isn't just about memorizing definitions, but also about solving problems within a grammar. Fortunately, recent advances in educational technology have provided creative

approaches to minimize the intrinsic challenges of syntactic analysis (Hanson-Smith, 2018). Computer-Assisted Language Learning (CALL) and Artificial Intelligence (AI) platforms such as ChatGPT, Gemini, and Deepseek have been shown to help some students solve problems. Previous studies have shown that students with visual learning styles can benefit greatly from the use of interactive multimedia and Computer-Assisted Learning Materials (CALM) because they allow for more dynamic interaction with language learning and linguistic rules (Syahiza, 2023). By offering real-time examples tailored to specific student queries, AI tools function as a supplementary bridge that reduces the cognitive load required to internalize complex phrase structure principles (Mara K, 2023).

However, despite these exciting technological advances, a significant research gap remains regarding how EFL students specifically utilize these tools to navigate the procedural complexities of tree diagram construction (Schicchi & Giovanni, 2020). While existing literature has extensively explored automated syntax assessment and common grammatical error detection, there is still limited empirical evidence on how interactive AI assistance influences the actual cognitive thought processes of students when mapping hierarchical structures. Most current research tends to focus on the accuracy of the final output rather than the students' adaptive methods or their perceptions of technology-driven instructional shifts. Therefore, this study aims to fill this gap by exploring the intersection of traditional syntactic analysis and modern digital strategy use, investigating whether these tools truly enhance conceptual mastery or merely serve as a procedural shortcut.

Ultimately, the choice of these learning strategies reflects how students actively manage their own cognitive resources when facing academic hurdles. Rather than being passive recipients of syntax theory, students act as adaptive problem-solvers who consciously select tools, whether through peer collaboration or digital platforms to regulate their learning pace and breakdown complex tasks. Investigating these self-regulated behaviors is crucial because a strategy's success depends not just on the technology itself, but on how intentionally students use it to bridge the gap between abstract grammar rules and actual tree diagram construction.

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METHODS

The study used a descriptive qualitative design backed by quantitative features to find out the problems and learning strategies of the fifth-semester students of the English Education Study Program in making syntactic tree diagrams. The qualitative and quantitative methodologies were suitable since the research needed both an in-depth understanding of students' learning experiences and measurable trends that enhance the interpretative validity of the findings (Wijaya, 2018). The descriptive qualitative technique provided an opportunity to study students' perceptions in their natural academic context , while the quantitative component provided organized evidence on the frequency and perceived effectiveness of particular strategies employed.

A total of 31 undergraduate students from the fifth-semester English Education Program in an Indonesian higher education institution participated in this study. The sampling process was a purposive sampling technique. The selection of this sampling technique had a scientific justification because only those students who had attended the Syntax course and had experience in constructing the tree diagrams could contribute relevant and correct information. The research context was the Syntax course that introduces the phrase structure rules and the analysis of the sentence. The unit of analysis is the individual students who have practiced in building syntactic trees in their learning (Sugiyono, 2018). While the study is exploratory, the sample size represented the entire eligible cohort, providing complete coverage of the group.

Data were obtained using a standardized questionnaire which was administered via an internet platform (Google Forms). The instrument consisted of two parts: closed-ended items and open-ended questions. The closed-ended portion consisted of five-point Likert-scale items assessing students' perceived difficulties and the usage of several learning approaches. To ensure the instrument's rigor, it underwent both content validity and reliability checks. Before data collection, the questionnaire was reviewed by two Syntax academics to guarantee clarity and alignment with research aims ,

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and a pilot test was conducted to ensure the questions were consistently understood. The open-ended questions requested students to elaborate on their learning difficulties, the solutions they found most useful, and give recommendations for enhancing instructional approaches.

The data analysis was carried out in two phases. First, quantitative data from the closed-ended items were analyzed using descriptive statistics, such as frequencies, percentages, and mean scores. These statistical approaches were appropriate to find out the pattern and the relative severity of the issues students faced. Second, qualitative responses from open-ended questions were examined through content analysis. In this phase, coding categories were developed inductively by identifying significant concepts and recurring keywords from the replies, which were then grouped into broader thematic patterns related to students' issues and strategies . To increase the credibility of the analysis, coding was undertaken by two researchers independently and any disagreements were discussed until consensus was obtained.

Ethical issues were considered. All individuals were informed of the research purpose and participation was voluntary. The questionnaire did not capture any personal identifiers, thereby making it anonymous and respecting students' privacy. Such ethical practices, combined with the systematic data analysis, allowed the study to investigate the difficulties and perspectives of students holistically, ensuring that future researchers would be able to reproduce the study using the same approach.

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RESULTS AND DISCUSSION

Students' Difficulties in Learning Tree Diagrams

The specific challenges experienced by students in mastering syntactic tree diagrams are categorized into conceptual hurdles, practical application issues, and external factors. As shown in Table 1, quantitative data indicates that the most significant obstacles are identifying phrase types (Mean: 3.68) and understanding the hierarchical sentence structure (Mean: 3.52) . These results suggest a fundamental struggle in distinguishing grammatical components and arranging them according to their syntactic functions.

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The relationship between syntax theory and its application in tree diagrams (mean 3.42) was also a major issue, indicating a gap between conceptual understanding and practical application. This challenge was also related to the limited study time (mean 3.42) given to tree diagrams and students' lack of skills in creating such diagrams. The clarity of lecturers' explanations and the abstract nature of the material were also cited as obstacles, but students considered these two issues slightly less problematic than the difficulty in distinguishing phrase types and applying theory to diagrams.

Table: 1 Students' difficulties

No	Difficulty Statement	Mean Score
1	I feel confused distinguishing phrase types (NP, VP, PP) when creating a tree diagram.	3.68
2	I find it difficult to understand sentence structure in tree diagrams.	3.52
3	I struggle to connect syntactic theory with its application in tree diagrams.	3.42
4	The time given to learn tree diagrams is not enough for me to fully understand it.	3.42
5	I lack sufficient practice in constructing tree diagrams.	3.35
6	The lecturer's explanation about tree diagrams is still hard for me to understand.	3.26
7	Tree diagram material is too abstract and complicated for me.	3.03

Based on the data in Table 1, the primary difficulty lies in the conceptual transition from abstract rules to visual mapping. Students reported that identifying part-of-speech functions and following complex branching patterns are particularly taxing. This difficulty in identifying phrase types often stems from 'attachment ambiguity,' where students struggle to determine which head a specific modifier belongs to—a finding that aligns with Heryono (2018) regarding the misunderstanding of endocentric structures. Furthermore, the gap between theoretical knowledge and practical skill (Mean: 3.42) indicates that while students may recognize rules in isolation, they fail to operationalize them during diagram construction. This "procedural demand" is exacerbated by limited study time and a lack of intensive practice. Such findings are consistent with Tahang et al. (2019), who noted that without guided and repetitive practice,

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students often lose confidence and repeat structural errors . Lastly, external factors such as the abstract nature of the material and the clarity of instructional delivery also play a role, though they are perceived as slightly less problematic than the core conceptual challenges.

Strategies Students Use to Address Those Difficulties

Students employ a diverse range of strategies to overcome these challenges, with a notable shift toward technology-integrated and collaborative methods. As illustrated in Table 2, the most frequently utilized and highly-rated approach is leveraging Artificial Intelligence (AI) platforms, which achieved the highest mean score of 4.06. Quantitative data revealed that using AI tools like ChatGPT, Gemini, and similar applications was the most frequently used and most helpful option. This was reflected in the average agreement score of 4.06 on a scale of 5, with 5 indicating the highest level of agreement. In fact, 12 of 31 students strongly agreed (scoring 5) with this strategy. Watching learning videos on YouTube and discussing with friends were also widely used strategies, with an average agreement score of 3.74 for each. For example, 20 of 31 respondents gave the use of YouTube videos a 4. Asking lecturers directly when experiencing difficulties also showed a fairly high level of agreement, with an average score of 3.71. Meanwhile, less frequently used strategies included rereading lecture notes, seeking additional references, and creating summaries or concept maps, with average scores of 3.68, 3.58, and 3.58, respectively.

Based on open-ended student responses, it appears that visual aids such as YouTube video tutorials and the use of AI like ChatGPT significantly assisted them in understanding the material. Many students found that hands-on exercises, such as drawing tree diagrams step by step and clearly labeling each branch, made the learning process easier. Some also noted that dividing the diagram into steps and using specific colors or markings helped them better understand the structure. This suggests that students are more comfortable with interactive, visual, and step-by-step learning methods when learning tree diagrams.

Table: 2 Students' Strategy

No	Strategy Statement	Mean Score

1	I ask AI (ChatGPT, Gemini, Deepseek, etc.) to understand tree diagrams.	4.06
2	I use educational YouTube videos to understand tree diagrams.	3.74
3	I discuss the tree diagram topic with my peers to enhance understanding.	3.74
4	I ask the lecturer directly when I face difficulties.	3.71
5	I re-read my lecture notes to better grasp tree diagram concepts.	3.68
6	I look for additional references such as e-books or journals related to syntax.	3.58
7	I create summaries or concept maps to visualize the structure of tree diagrams.	3.58
8	I practice drawing tree diagrams from random sentences I encounter daily.	3.39

The data show dominance of AI tools like ChatGPT and Gemini suggests that students prioritize "on-demand" assistance that provides immediate, step-by-step explanations tailored to their specific queries. This practical benefit often outweighs traditional methods, such as reviewing lecture notes (mean 3.68), because AI can decompose complex branching into smaller, more manageable "chunks". Furthermore, visual-audio resources via YouTube and peer discussions (both mean 3.74) serve as critical supplements, offering the multimodal support that students with diverse learning styles require.

Students Perceived The Effectiveness of The Strategies

Students rated the strategies they used to overcome barriers to learning tree diagrams as having varying degrees of usefulness, but most found the use of digital tools and collaborative approaches to be the most useful.

The evaluation of these strategies reveals that digital tools and interactive methods are perceived as the most effective in mastering syntactic analysis. Students reported that dividing the diagram construction process into sequential steps often guided by AI or video tutorials significantly lowered the "mental load" associated with binary branching and phrase structure rules. While autonomous practice (mean 3.39) is recognized as a necessary component, students noted it is significantly less effective when conducted without structured feedback or expert exemplars. This highlights a crucial pedagogical insight: technology does not replace the educator but rather acts as a supplementary bridge. Effectiveness is maximized when AI-generated insights are validated through lecturer consultation (mean 3.71) and peer interaction, ensuring that the student's mastery of abstract syntax theory is both accurate and operational.

Recommendations for Teaching Strategy

Students provided numerous suggestions to the lecturer to help them better understand the concept of tree diagrams in the classroom. These suggestions generally identified three main themes: the use of more visual and practical teaching methods, the provision of more exercises and examples, and the implementation of more interactive and collaborative learning methods.

One of the most important suggestions was the use of clearer and more practical learning methods. Many students stated that real-world examples from everyday sentences should be used more frequently because this makes the material more relevant and easier to understand, reflecting the language used in everyday life. Students highlighted the need to provide the material in a simple, straightforward, and visually engaging manner. They proposed to employ visual aids like diagrams, animations and even colour-coded branches in tree diagrams to make it easier to understand. Many students also said the content should be presented slowly and progressively, beginning with the most basic concepts and progressing to more complicated instances. Extra activities and examples were also important. Students specifically asked for more practice problems and examples as they believed that hands on experience was highly useful in better grasping the content.

In addition, they hoped that instructors would make sure that pupils had a solid understanding of the basic principles before going on to more challenging topics. Students also proposed more interesting, group-based learning approaches, such as working together and discussion between students to explain concepts to each other and clear up confusion together. A suggestion that was often made was to employ interactive exercises, in which students may either individually or in couples make tree diagrams. Some students also requested that professors address typical faults in the construction of tree diagrams.

Most recommendations were positive and constructive while one reply indicated that there was no genuine difficulty with the lecturer's explanations, all the content was easy enough to understand. Sometimes the pupils were not focused and did not listen while the presenter explained. This shows that the learning problems of some pupils are more related to issues of concentration than to the teaching approach. But most

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respondents felt that the learning of tree diagrams should be more visual, more practical, interactive and more practice-oriented.

Discussion

Looking at the data in Table 1, the biggest problem faced by students is confusion in differentiating between phrase types such as NP, VP, and PP (Mean Score: 3.68). Following that, they also have difficulty understanding how to organize sentences into a hierarchical tree structure (Mean Score: 3.52). These figures explain why students often make mistakes when drawing tree diagrams. They experience a heavy mental burden because, within limited class time, they must simultaneously determine word categories and organize their branches. Visually, students often confuse where a phrase begins and ends (constituent boundaries). They also get caught up in the problem of attachment ambiguity, namely confusion about where an explanatory word should be connected. This operational difficulty is very much in line with the findings of Heryono (2018) and Marpaung et al. (2025), which show that students often repeat the same mistakes in endocentric sentence structures. Furthermore, this problem is exacerbated by the structural differences between Indonesian and English, which demonstrates that the influence of the mother tongue (L1) makes learning syntax more challenging for EFL students (Uktolseja et al., 2019; Winarta & Rahmanu, 2020).

To overcome these difficulties, the data in Table 2 shows that students are taking independent steps by utilizing technology. Asking questions on AI platforms such as ChatGPT, Gemini, or Deepseek was the most frequently used and most helpful strategy (Mean Score: 4.06). Students reported that AI was very helpful because it could break down complex sentence structures into step-by-step explanations and answer their questions instantly. Although Computer-Assisted Language Learning (CALL) theory has long supported the use of multimedia to assist students who prefer visual learning (Hanson-Smith, 2018; Syahiza, 2023), the students' actions in this study demonstrate a new trend. They are now more independent and rely on fast, on-demand digital assistance. Students preferred AI over traditional methods like reviewing lecture notes (Mean Score: 3.68) because AI saved them time searching for answers outside of class.

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However, another interesting finding from Table 2 shows that practicing on their own with random sentences outside of class was considered the least effective strategy (Mean Score: 3.39). This result indicates that practicing without knowing the correctness of the answers will only confuse and frustrate students. Through open-ended questionnaire responses, students emphasized that technology cannot completely replace the role of lecturers. AI is merely a complementary tool that must be combined with discussions with peers (Mean Score: 3.74) and asking lecturers directly (Mean Score: 3.71). This supports Weissweiler et al.'s (2022) view that technology works best as a support, not a substitute, for structured teaching guidance.

In conclusion, to become proficient in drawing tree diagrams, students need a blended learning approach: experimenting with digital assistance, then validating the results through discussions and feedback from lecturers to ensure their understanding is truly accurate.

CONCLUSIONS

This study concludes that mastering syntactic tree diagrams is a sophisticated cognitive task that presents significant challenges for students, particularly in differentiating phrase categories and applying abstract theory to hierarchical structures. While these difficulties align with traditional syntactic hurdles, this research reveals a modern shift in student behavior: a heavy reliance on digital tools, specifically AI platforms like ChatGPT and Gemini, to navigate these complexities.

This finding constitutes a primary contribution of the study, highlighting how AI provides the immediate, step-by-step scaffolding that traditional lecture notes often fail to deliver. The findings provide clear practical implications for syntax instruction. Lecturers should move beyond abstract theory by integrating multimodal teaching methods, such as color-coded visual aids, animations, and guided step-by-step demonstrations. Furthermore, educators should consider the judicious integration of AI tools within the classroom, not merely as supplements but as diagnostic aids that can support students' thinking processes outside of class.

Despite its insights, this study is limited by its small sample size and reliance on self-reported data. Future research should utilize performance-based

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tests to measure how AI-assisted learning and varying levels of digital literacy directly influence students' actual accuracy in constructing tree diagrams. Longitudinal studies are also recommended to track how these technology-driven strategies impact students' long-term syntactic competence across different institutional contexts. .

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