



Main or Subordinate? An Exploratory Diagnosis of Clausal Hierarchy Confusion Among Thai EFL Undergraduates

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Received 01/12/2025	ABSTRACT Diagnostic exploration of syntactic analytical competencies in complex sentence analysis remains underexplored in EFL settings despite its importance to academic language proficiency. In this study, a diagnosis of the clause analysis proficiency of 200 Thai EFL undergraduates was conducted, using a purpose-designed clause analysis assessment (CAA) grounded in Burton-Roberts’s (2022) abbreviated clausal analysis (ACA) framework. The participants were administered the CAA and individually produced 1,400 sentence diagrams that were analyzed for procedural and conceptual error patterns using descriptive statistics and error frequency analysis. The average proficiency was found to be moderate ($M = 18.2/35$, $SD = 4.8$). Two patterns of errors were identified: (a) procedural errors related mainly to segmenting sentences into clauses (61.0%) and (b) a conceptual bottleneck involving main–subordinate clause confusion, accounting for 28.0% of clause-type misidentifications. This suggests that the participants
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	faced not only surface-level procedural difficulty but also a systematic misrepresentation of the hierarchical structure of complex sentences. Therefore, in EFL syntax instruction, hierarchical clause awareness should be prioritized before moving on to sentence diagramming. Visual-syntactic scaffolding is also recommended to build learners' conceptual understanding of main-subordinate clause relationships. Keywords: abbreviated clausal analysis (ACA), clausal hierarchy, diagnostic study, EFL learners, syntactic complexity
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Introduction

The ability to parse and analyze complex sentence structures is a well-documented challenge for adult EFL learners, particularly for those who are in academic or professional contexts where engagement with syntactically elaborate text is a routine demand (Biber et al., 2011; Uccelli et al., 2015). In EFL instructional contexts, a complex sentence is broadly understood as a main finite clause and one or more well-formed dependent, subordinate clauses. Learners of English often find these embedded structures challenging since they require parsing a main clause together with a number of subordinate clauses. The present study adopts Burton-Roberts's abbreviated clausal analysis (ACA) (Burton-Roberts, 2022), within which a complex sentence is defined as "a sentence composed of a sentential structure as a constituent" (p. 166).

The ACA method employs a visual representation of sentence structure using triangle notation. Each triangle represents a finite (tensed) clause. While the topmost triangle, which hosts the matrix, is labeled as S1 or main clause (MC), subsequent triangles positioned to the left or right of the main clause triangle, depending on their position in the sentence, refer to subordinate clauses, which depend on the main clause for meaning. For example, a sentence with a main clause followed by an adverbial clause would be represented by a topmost triangle for the main clause and a subsequent triangle positioned lower to the right for the adverbial clause.

Syntactic complexity refers to the "variety and sophistication degree of grammatical structures" found in language production (Yang et al., 2022, p. 401). An important aspect of syntactic complexity that has received considerable attention in studies is subordination, which refers to the possibility of constructing clauses inside other clauses and expressing various logical relations (condition, cause, concession, etc.). However, for many EFL

students, the development of syntactic maturity, i.e., the ability to write hierarchically well-formed sentences that nest complex clausal constructions, is a daunting task. In the absence of syntactic maturity, the following issues commonly occur. The first involves simple syntactic structuring, wherein students overly depend on main clauses and basic coordination (“*I woke up, and I skipped breakfast. So I went to school faster.*”). The second problem is related to constructing ill-formed complex sentences, which may entail errors such as misplaced subordinate clauses or fragmented structures (Crossley & McNamara, 2014). Both issues indicate an underlying fragility in learners’ syntactic knowledge.

Although several studies have successfully tracked the developmental paths and types of errors in L2 writing (Kampookaew, 2020; Lu, 2011), these have largely been restricted to written production processes. This could be a gap in terms of grasping learners’ analytical comprehension skills: learners’ capacities to break down and correctly interpret their complex sentences. This study addresses this gap by shifting the lens from production to comprehension processes by investigating the difficulties that Thai EFL students experience while attempting to analyze complex sentence constructions. The research explores the competencies and challenges of 200 Thai EFL undergraduates in analyzing the syntactic structure of complex sentences. The participants, all enrolled in an English syntax course, served as the focal point for assessing the application of this specific syntactic framework.

Focusing on a diagnostic test developed from Burton-Roberts’s (2022) ACA framework, this study poses: What are typical students’ error patterns regarding clause analysis tasks, and what do these error patterns suggest regarding students’ syntactic enlightenment?

Literature Review

Burton-Roberts’s (2022) Abbreviated Clausal Analysis (ACA)

The ACA framework proposed by Burton-Roberts is a syntactic model based on constituency, categories, and functions. It holds that the categorization of a constituent and the functional assignment of that constituent can be performed independently: one does not follow the other. In other words, a complex sentence comprises a matrix clause within which one or more subordinate clauses are embedded, each functioning as a grammatical constituent, e.g., subject, complement, or adjunct, of the clause that immediately dominates it. Structural category and grammatical function are treated as two independent analytical dimensions: what a clause formally is is determined separately from what role it performs. Applying the ACA to

a complex sentence, as stated previously, begins with the triangle notation of each clause in the sentence (S1, S2, S3...) followed by the determination of its function.

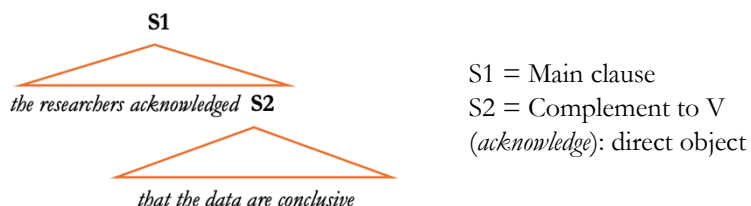
Under this approach, the major types of subordinate clauses are as follows:

- Complementizer-introduced clauses marked by *that* and *whether*, e.g., “The researchers acknowledged *that* the data are conclusive.” “The review board must decide *whether* the protocol has been breached.”
- Adverbial clauses, e.g., “I have considerable respect for their ideas *although* I don’t agree with them.”
- *Wh*-clauses divided into subordinate interrogatives (indirect questions introduced by *who*, *what*, *where*, *when*, *why*, and *how*) and relative clauses (introduced by *who*, *which*, *whose*, and *that*), e.g., “The team of scientists explained *why* the model had been put forward.” “The paper, *which* received a low citation count, was awarded the best paper published in the journal.”

In light of Burton-Roberts’s (2022) ACA, the first example can be analyzed using the triangle notation as follows:

Figure 1

ACA of Sentence



In the example, the *that*-clause introduced by the complementizer *that* and labelled S2 is structurally subordinate to and embedded within S1, with its grammatical function assigned independently as the second step of the ACA procedure. This two-step treatment, identifying the clause category before assigning grammatical function, directly motivates the use of the *that*-clause as the analytical term of choice in this study. Unlike a noun clause, which derives its label from its function and thereby conflates the two dimensions, the ACA keeps the *that*-clause analytically separate: the *that*-clause is a functionally neutral category that is formally defined. It identifies the

clause by its structural position in the larger construction (e.g., direct object or extraposed subject within a complex sentence) and is treated as analytically independent of the structural category itself. This separation of category from function, laid out in Burton-Roberts's (2022) framework, is the primary theoretical evidence for preferring *that*-clause over noun clause as the term in this study.

Measurement and the Challenge of Syntactic Complexity

Previous research on syntactic complexity in L2 writing was dominated by measures based on clause length or subordination ratio in learner texts. For instance, Lu (2011) validated 14 complexity indices ranging from measures of sentence length to rates of subordination, contributing to the establishment of clause-level subordination as an important index of development. The measurement of syntactic complexity through structure counts enabled large-scale comparisons and remains widely used today.

However, there are limitations associated with the practice of counting structures. According to Norris and Ortega (2009), the counts obtained did not correspond to the researchers' claims. Therefore, they suggested analyzing complexity, accuracy, and fluency as interdependent factors rather than three separate indices. The aforementioned limitation is relevant for the present study in that if production indices have trouble measuring writing development, they will be even less likely to accurately diagnose the level of syntactic knowledge, such as distinguishing between a main and a subordinate clause or identifying the syntactic function of a relative clause.

Crossley and McNamara (2014) revealed experimentally that more sentence complexity did not guarantee better writing skills. They tracked the development of 57 learners and discovered that the learners exhibited increases in their syntactic productivity; however, such growth did not lead to better-quality writing or improved syntactic analysis.

Moreover, there is an insight regarding syntactic complexity not being unitary. Biber and Gray (2010) showed that academic texts depend strongly on complex noun phrases, not merely on clause subordination. Moreover, Biber et al. (2011) suggest a developmental route in which learners initially acquire finite complement clauses (for oral discourse), then non-finite clauses, and finally, clause nesting within complex noun phrases (for written discourse). This implies the need to test the ability to distinguish between different types of clauses, i.e., adverbial, relative, and complement clauses, separately. Corpus-based research demonstrates that learners with higher proficiency wrote more such clauses, but whether they were aware of their functions in a sentence remains inconclusive.

It is obvious that production studies have revealed many important details about learners' development in terms of their output, but they could not answer another crucial question: Can a learner analyze the hierarchical structure of a complex sentence? This is exactly the problem addressed by the current study. By employing Burton-Roberts's (2022) ACA framework, the researcher directly probes what learners comprehend – not just what they happen to produce.

Error Patterns in EFL Writing

With respect to the discrepancy between complexity and quality, growing evidence from error analysis studies suggests that constructing complex sentences remains problematic among EFL learners. Ha (2022), for example, investigated syntactic complexity across different writing topics within the same genre and found that different topics led to different levels of syntactic complexity. Higher-rated essays had more complex phrasal structures and larger constituent units. Ultimately, the study concluded that the nature of these “topic effects” must be pondered to ensure more accurate and equitable evaluations of EFL language proficiency.

Studies on error patterns also pose persistent problems regarding complex sentences. Descriptive studies conducted among Thai EFL students have shown recurring problems with clause formation, such as misuse of logical connectors (Dankittikul & Laohawiriyanon, 2018) and overall grammatical misuse in academic paragraphs (Chintaradeja, 2020; Kampookaew, 2020). In addition, other research studies, such as that of Boonyarattanasoontorn (2017), who examined Thai students' writing difficulties and their use of writing strategies, confirmed that syntactic difficulties in written output were indeed widespread. Observations of EFL university students revealed that repeated misuse of subordination results in ill-formed complex sentences (Princess & Syarif, 2021). Such productive levels have shown metalinguistic fragility of clause relationships and are purposely neglected since learning tasks prioritize communication rather than grammatical discussion, according to Guey (2016).

What is more, the role of learners' first language (L1) is also a crucial factor that influences learners' handling of complex English sentence structures. Phimsawat's (2013) study on EFL students among Thais posits that both phonological features and writing alphabets unique to the Thai language significantly impact EFL students' spelling and writing proficiency. This result indicates that differences in sentence structure between Thai and English might also impact EFL students' perception and analytical handling of complex sentence structure.

Moving Toward a Diagnostic, Comprehension-Based Approach

While existing literature reveals an account of learners' errors in writing and their strategies, it does not adequately explain why such errors persist as a result of the interaction between comprehension and syntax analysis. The need for more in-depth research seems in line with Yang et al.'s (2022) appeal for an examination of how visual syntactic modeling can contribute to the development of learners' awareness of clause structure. Some have examined learners' engagement with authentic texts (Andriani & Bram, 2021; Muarif & Indarti, 2022); others have called for corpus-based or lexical approaches to influence classroom teaching (Boulton & Cobb, 2017; Hughes, 2010; Hill, 2000 advocated a shift from grammar to collocation). Still, few studies have addressed visual modeling as a diagnostic or developmental tool for clause-level comprehension errors. The present study intends to fill this gap by applying the ACA method not only in class but also in the context of diagnosing comprehension-based syntactic analysis. More precisely, it will examine whether learners face difficulties in analyzing complex sentences, identifying the type of subordinate clauses and their hierarchical structure. Comprehension-based syntactic analysis in this study refers to the ability of learners to break down a complex sentence into its well-formed clausal constituents, determine their types and functions, and illustrate their hierarchical structure visually by means of triangle notation.

Methodology

Research Design

This research was carried out within a diagnostic case study framework employing a convergent mixed-methods design (Creswell & Plano Clark, 2017). Quantitative and qualitative data were collected simultaneously, yet analyzed independently, and then combined to build a complete picture of the syntactic analytical skills of a group of EFL students. The research was conducted in an attempt to assess error rates on a quantitative level while, at the same time, diagnosing the conceptual and procedural roots of those errors through qualitative, pattern-based analysis. It was for these reasons that the ACA method was utilized in its role not only as the object of assessment, but as the primary diagnostic tool. This combination of quantitative data based on error frequency and qualitative data based on error pattern was consistent with the goal of a convergent approach. The result would be a more refined diagnosis than either part alone would give.

Participants and Sampling

The study employed a purposive sample of 200 Thai EFL undergraduate students enrolled in a compulsory English syntax course at a state-funded autonomous university in Thailand. Purposive sampling was adopted on the grounds that participants were required to have received systematic instruction in syntactic analysis prior to the assessment, a criterion that this course specifically satisfied. All participants were native Thai speakers assessed at lower-intermediate English proficiency (CEFR A2–B1), as determined by university placement examinations and prior semester grades. Ages ranged predominantly from 19 to 20 years ($M = 19.5$, $SD = 0.8$). While the single-institution design limits broad generalizability, the findings may reasonably inform syntactic instruction in comparable Thai EFL undergraduate contexts where students share similar proficiency and instructional backgrounds. Participation was voluntary and all data were anonymized prior to analysis to ensure confidentiality.

Instrument and Materials

The primary instrument was a clause analysis assessment (CAA) aimed at diagnostically eliciting participants' fundamental points of failure regarding their syntactic processing mechanisms during attempts to decompose complex sentences. Out of the seven sentences, three authentic sentences were taken from foreign news media and a peer-reviewed journal (Elamroussi, 2023; Marshall et al., 2021; Tano et al., 2023). The criteria for sentence selection are illustrated by the following:

- (a) the presence of at least a finite subordinate clause, which serves as an embedded grammatical constituent, functioning either as the subject, the complement, or the postmodifier within a larger constituent.
- (b) the inclusion of at least two structurally distinct clause types.
- (c) the set of sentences as a whole covering a variety of clause type combinations, such as *that*-clauses, relative clauses, *wh*-complement clauses, and adverbial clauses.
- (d) the use of two main source types, i.e., authentic sentences from published sources and pedagogical sentences adapted from the course textbook, enabling qualitative comparison of error patterns across sources.

As for authentic sentences, participants were exposed to genuine syntactic complexity evidenced in news journalistic texts and in one academic article. The three sentences were:

1. “Although forecasters have said this weekend’s storms won’t bring as much rain as last week’s rainfall that wreaked havoc on New York City’s

roads, some flood watches are in effect Saturday in those same hard-hit areas.” (Elamroussi, 2023)

2. “Now research suggests that myopericarditis which is an umbrella term that encompasses myocarditis and pericarditis is not uncommon after Covid jabs.” (Tano et al., 2023)

3. “As Covid vaccination programs began around the world it emerged that some young men subsequently developed a type of inflammation of the heart muscle called ‘myopericarditis.’” (Marshall et al., 2021)

Regarding pedagogical sentences, these four sentences illustrate some explicitly taught syntax patterns in the syllabus (Burton-Roberts, 2022):

1. “I never understood how the theory worked until I read your book.”

2. “If you are wondering if Max is turning up tomorrow, the general rumor is that, since he is getting married, he won’t be in for the rest of the month.”

3. “Patience is not a characteristic we associate with Bryan, who lacks the ability to wait.”

4. “He sold that house which had been designed by himself at a huge profit.”

Each individual was then required to analyze the seven complex sentences. The imbalance in numbers from two major different types of sources reflects a deliberate methodological choice because authentic texts usually have multi-layered embedding, non-canonical structures, and a higher density of subordinate clauses, providing a stimulating context for error detection.

A preliminary sentence analysis indicated that each authentic sentence had two or more finite clauses compared to the average number of clauses in a pedagogical sentence. This meant that three authentic sentences sufficed for an adequate complexity analysis. Four pedagogical sentences were used, although they were less complicated, since their inclusion would ensure coverage of the structures explicitly taught according to the syllabus.

Data Analysis

To begin with, descriptive statistics (mean and standard deviations) were calculated on the basis of CAA overall scores as an indicator of participant performance (N = 200). The performance was evaluated by using deductive criteria (a maximum of five points per sentence: two points for correct identification of clausal boundary, two points for correct identification of type and function of clauses, and one point for correct ACA triangle positioning), yielding a total possible score of 35 points. Frequencies

and proportions of errors were calculated across 1,400 sentence diagrams, with 95% confidence intervals computed using the Wilson score method.

Regarding coding reliability, a random subsample of 20% of participants ($N = 40$) was selected via random number generation in SPSS (version 28), producing 280 ACA diagrams for inter-rater reliability analysis, consistent with accepted guidelines of 15-25% of total data (Lombard et al., 2002). This sample was analyzed using Cohen's Kappa test, showing substantial inter-rater agreement ($K = .89$), with any discrepancies resolved by discussion.

The qualitative part of the study included classifying clause errors into a purpose-designed taxonomy. For content validity, the error taxonomy and the clause analysis assessment (CAA) were rated and validated through expert peer review, using a 15-item relevance scale ($+1$ = relevant; 0 = unable to assess; -1 = not relevant). The items comprised the seven CAA sentences (representativeness), two instruction components (clarity), and six error categories (representativeness and exhaustiveness). Item-level CVI (I-CVI) was computed as the proportion of raters assigning $+1$ to each item. Item-level CVI (I-CVI) was 1.0 for 14 items, indicating full inter-rater agreement. One item of the instruction components received an I-CVI of 0.5 , reflecting rater disagreement on clarity, below the recommended threshold of 0.78 for two-rater designs (Polit & Beck, 2006), and was subsequently revised based on expert feedback. The scale-level CVI (S-CVI/Ave) was 0.97 , higher than the recommended threshold of 0.90 (Polit & Beck, 2006), confirming strong content validity.

The taxonomy comprises two primary categories. First, "clause type misidentification" captures those structural errors that happen prior to diagramming, more specifically, errors associated with main versus subordinate confusion, finite versus non-finite confusion, and phrase versus clause confusion. Second, "ACA diagram errors" include those types of errors that occur when constructing a diagram, namely, sentence segmentation errors, clause misplacement, and clause function mislabeling. Although clause function mislabeling is a conceptual process, it is considered an ACA diagram error since it takes place at a later stage of analysis; that is, the participants identify clauses structurally, but they label their functions inaccurately in their diagrams. Thus, two types of errors differ with regard to the stage of analysis they occur in, apart from the procedural-conceptual dimension. Since the ACA diagram subcategories of errors are not mutually exclusive, their proportions are calculated separately on the basis of 1,400 diagrams generated in the study.

Results

The results of the 1,400 ACA diagram analyses reveal the participants' level of syntactic analytical skills to be of moderate ability as they scored an average of 18.2 (standard deviation of 4.8) out of a possible 35 points on the CAA. The distribution of the errors committed by the participants is shown in Table 1.

Table 1

Prevalence of ACA Error Categories (N = 200 Participants; 1,400 Sentence Analyses)

Major error category	Subcategory	Frequency (n)	Percentage (%)	95% CI (%)
1. Clause type mis-identification	1.1 Main <i>vs.</i> subordinate confusion	392	28.0	[25.7, 30.4]
	1.2 Finite <i>vs.</i> non-finite confusion	126	9.0	[7.6, 10.5]
	1.3 Phrase <i>vs.</i> clause confusion	84	6.0	[4.8, 7.3]
2. ACA diagram errors (<i>non-mutually exclusive</i>)	2.1 Sentence segmentation errors	854	61.0	[58.4, 63.6]
	2.2 Clause function mislabeling	476	34.0	[31.5, 36.5]
	2.3 Clause misplacement	406	29.0	[26.6, 31.4]

Note. The total frequency of ACA diagram errors (sum of rows 2.1-2.3) is 1,736, which exceeds the total number of sentence analyses (1,400) because multiple sub-errors could occur within a single sentence. Percentages for each subtype are calculated independently against the total of 1,400 sentence analyses and are therefore non-additive.

With regard to the reliability of statistical estimates, the confidence intervals were narrow across all error categories, reflecting the large analytic base of 1,400 sentence diagrams. Both the clause type misidentification rate (43.0%, 95% CI [40.4, 45.6]) and the sentence segmentation error rate (61.0%, 95% CI [58.4, 63.6]) yielded a half-width of ± 2.6 percentage points. This indicates that the observed error rates represent precise and stable estimates within this sample.

Within “clause type misidentification,” the distribution of subtypes revealed a well-defined hierarchical structure of conceptual complexity. Main versus subordinate confusion was by far the most prevalent subtype, (28.0%, 95% CI [25.7, 30.4]), more than three times the rate of finite versus non-finite confusion (9.0%, 95% CI [7.6, 10.5]) and nearly five times that of phrase versus clause confusion (6.0%, 95% CI [4.8, 7.3]).

With respect to “ACA diagram errors,” the sum of subtype percentages exceeded 100%, an expected outcome given that these error types were coded as non-mutually exclusive, meaning a single sentence diagram could simultaneously contain more than one diagram error type. For instance, a participant’s diagram could exhibit both a sentence segmentation error and a clause misplacement within the same analysis. Subtype percentages are therefore independently calculated against the base of 1,400 sentence diagrams and are non-additive. Sentence segmentation errors were the most prevalent subtype (61.0%, 95% CI [58.4, 63.6]), nearly double the rate of clause function mislabeling (34.0%, 95% CI [31.5, 36.5]) and more than double that of clause misplacement (29.0%, 95% CI [26.6, 31.4]).

Next, a detailed analysis of qualitative analysis of the seven sentences and participants’ error types is presented.

Sentence 1: “Although forecasters have said this weekend’s storm won’t bring as much rain as last week’s rainfall that wreaked havoc on New York City’s roads, some flood watches are in effect Saturday in those same hard-hit areas.”

Figure 2

ACA of Sentence 1

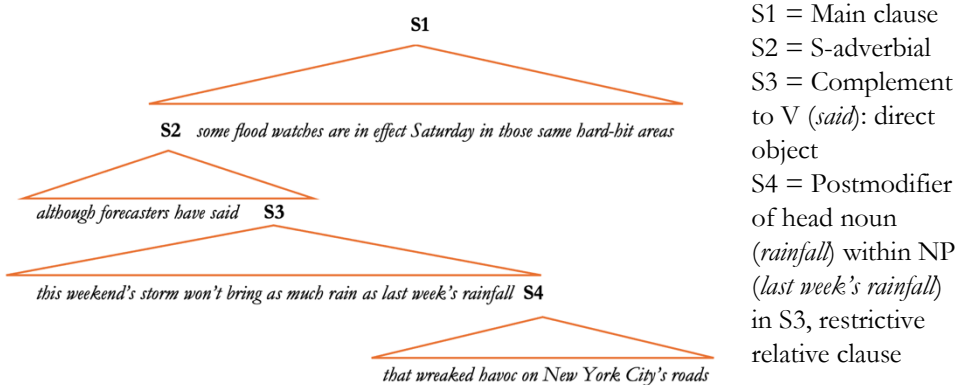


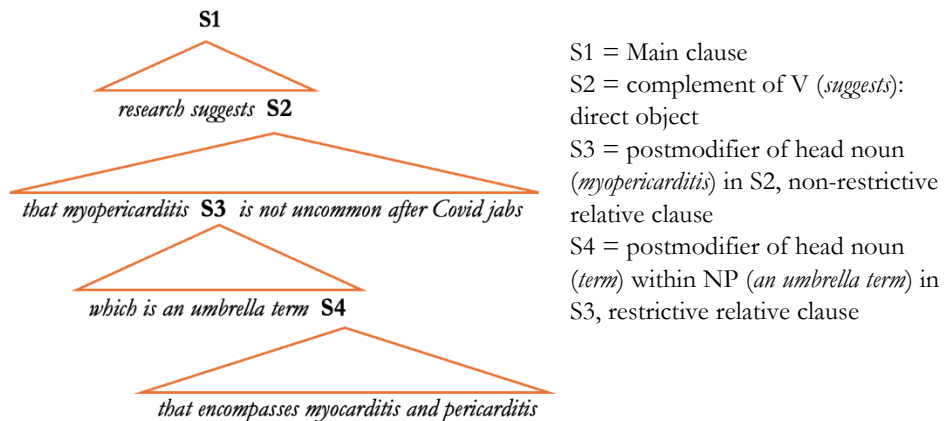
Table 2*Examples of Error Classification of Sentence 1*

No.	Error category	Subcategory	Common participant errors
1	Clause type misidentification	Main <i>vs.</i> subordinate confusion	Promoting either S2 or S3 as the MC, stranding S1 elsewhere at a subordinate position
2	ACA diagram error	Clause misplacement	Placing the S2 clause triangle to the right of the MC
			Arranging all the clauses in accordance with the sentence's linear order
		Sentence segmentation errors	Combining S1 and S3 into a single clause triangle
			Combining S3 and S4 into a single clause triangle
			S1 & S4 clause triangles missing
		Function mislabeling	Treating S4 as a complement of the noun " <i>rainfall</i> "

Sentence 1 elicited errors across both taxonomy categories. Under “clause type misidentification,” participants frequently promoted S2 or S3 to main clause status, displacing S1 to a subordinate position, a direct instance of main versus subordinate confusion.

In “ACA diagram errors,” all three subcategories were present. Clause misplacement was prevalent when S2 was positioned right to the main clause. Moreover, all four triangle clauses were aligned linearly with S2 becoming a main clause. This represented the flat processing tendency documented across the dataset. Sentence segmentation errors occurred when two clauses were combined into one. Finally, function mislabeling occurred in S4 because it was erroneously labeled as a noun complement of *rainfall*.

Sentence 2: “Now research suggests that myopericarditis which is an umbrella term that encompasses myocarditis and pericarditis is not uncommon after Covid jabs.”

Figure 3*ACA of Sentence 2***Table 3***Examples of Error Classification of Sentence 2*

No.	Error category	Subcategory	Common participant errors
1	Clause type misidentification	Main vs. subordinate confusion	Promoting S2 as the MC, stranding S1 elsewhere at a subordinate position
2	ACA diagram error	Clause misplacement Sentence segmentation errors	Detaching the S4 clause triangle from the whole ACA Combining S4 and the VP part of S2 “ <i>is not uncommon after Covid jabs</i> ” into a single triangle Combining S1 and S2 into a single clause triangle Combining S2 and S3 into a single clause triangle Combining S3 and S4 into a single clause triangle Combining the NP part of S4 “ <i>myocarditis and pericarditis</i> ” and the VP part of S2 “ <i>is not uncommon after Covid jabs</i> ” into a single clause triangle Misplaced adverbial “ <i>after Covid jabs</i> ” attached to the MC Over-segmentation: “ <i>Now research suggests/ that myopericarditis/ which is an umbrella term/ that encompasses/ myocarditis</i> ”

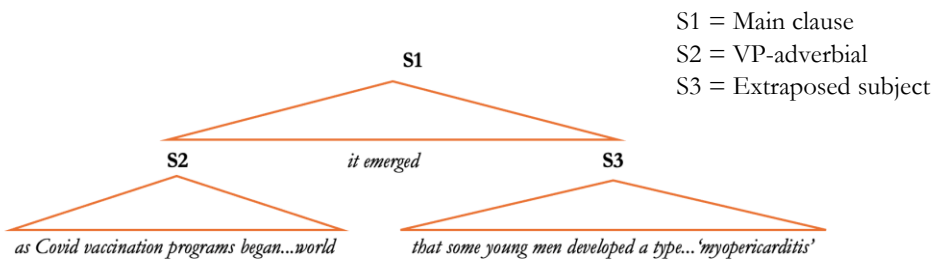
	<i>and pericarditis is not uncommon/ after Covid jabs”</i>
Function	Treating S3 as a VP-adverbial or
mislabeling	predicative complement
	Treating S4 as a noun complement
	clause

Sentence 2 generated a relatively wide variety of errors across the dataset, reflecting its four-level embedding depth. Under “clause type misidentification,” participants promoted S2 to main clause status, displacing S1, again representing the predominant main versus subordinate confusion.

Under “ACA diagram errors,” sentence segmentation errors were one of the most varied subcategories. The most frequent pattern was collapsing adjacent clause pairs into single triangles. This reflected difficulty tracking clause boundaries across multiple embedding levels. Two further error patterns were notable: the VP constituent of S2 (*is not uncommon after Covid jabs*) was merged with either S4 or the NP *myocarditis and pericarditis*, indicating that participants parsed by linear word strings rather than hierarchical structure. Additionally, the adverbial *after Covid jabs* was misattached to the main clause rather than retained within S2. At the opposite extreme, over-segmentation produced up to six units, which confirmed the absence of any fundamental clause boundary principles. Clause misplacement was highlighted primarily by S4 being entirely detached from the ACA diagram and unconnected to its head noun *term* within S3.

Function mislabeling was performed with regard to relative clauses. S3 was most mislabeled as a VP-adverbial or a predicative complement, showing that participants failed to recognize S3 as a modifier of N *myopericarditis*. As for S4, it was most frequently confused with a noun complement clause since both constructions share similar surface form in postnominal position and are distinguished only by the presence of a syntactic gap.

Sentence 3: “As Covid vaccination programs began around the world it emerged that some young men subsequently developed a type of inflammation of the heart muscle called ‘myopericarditis.’”

Figure 4*ACA of Sentence 3***Table 4***Examples of Error Classification of Sentence 3*

No.	Error category	Subcategory	Common participant errors
1	Clause type misidentification	Main <i>vs.</i> subordinate confusion	Promoting S2 as the MC, stranding S1 elsewhere at a subordinate position
		Finite <i>vs.</i> non-finite confusion	Treating “called ‘myopericarditis’” as finite
2	ACA diagram error	Sentence segmentation errors	Combining S1 and S2 into a single clause triangle Combining S1 and S3 into a single clause triangle Over-segmentation: “As Covid vaccination programs began around the world/it emerged that/some young men subsequently developed a type of inflammation/of the heart muscle called ‘myopericarditis’” Over-segmentation: “As Covid vaccination programs began around the world it emerged/that some young men subsequently developed/a type of inflammation of the heart/ muscle called ‘myopericarditis’”
		Clause misplacement	Placing S2 underneath S3, extraposited subject
		Function mislabeling	Treating S3 as an object or modifier Treating S2 as the subject of the MC
			Reduced relative clause misidentification by treating “called

Sentence 3 proved the most analytically challenging, primarily due to its extraposed subject construction. Because the verb *emerge* cannot take a clausal subject directly, dummy *it* occupies the canonical subject position while the *that*-clause S3 is extraposed to end-position. This is a sentence structure redesign that consistently misled participants. For instance, S3 was mislabeled as a direct object or modifier, while the role of dummy *it* was not recognized as an anticipatory subject. The fronted adverbial S2 compounded this difficulty. Under linear processing, participants frequently identified it as the main clause or as an illogical subordinate to *it emerged*, producing a structurally incoherent hierarchy.

In addition to confusion regarding sentence structure, another type of ambiguity was observed in finite versus non-finite form distinction. The reduced relative clause *called 'myopericarditis,'* as a non-finite passive participial postmodifier of the noun *inflammation* in S3, was extracted out of S3, then misinterpreted it as an independent triangle, thus committing over-segmentation errors.

Variations in the process of segmentation could be seen as well: S1 and S2 were merged and so were S1 and S3. Over-segmentation errors included such divisions as *that*-complementizer. Clause misplacement demonstrated as S2 positioned underneath S3 rather than adjoined to S1. This reflected a failure to recognize the adverbial clause as modifying the main clause. Function mislabeling yielded different patterns. For instance, S3 was treated as a direct object or modifier rather than an extraposed subject. S2 was mislabeled as a grammatical subject of the main clause, likely facilitated by its fronted position.

Sentence 4: "I never understood how the theory worked until I read your book."

Figure 5

ACA of Sentence 4

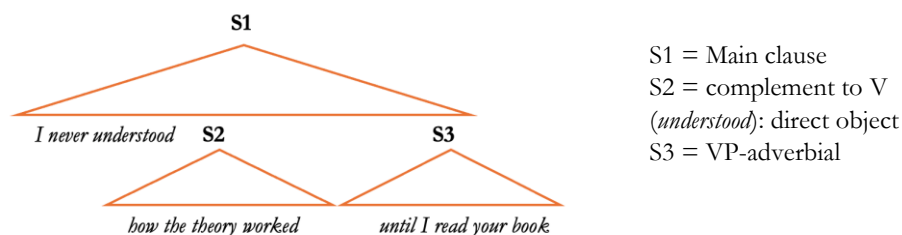


Table 5*Examples of Error Classification of Sentence 4*

No.	Error category	Subcategory	Common participant errors
1	ACA diagram error	Sentence segmentation errors	Clause merging by treating S3 as part of S2, the interrogative clause
		Clause misplacement	Placing S3, the VP-adverbial leftmost Flattening structure by ignoring the embedding structure
		Function mislabeling	Treating S2, interrogative clause, as adverbial/modifier Treating adverbial as a complement and vice versa

Errors in Sentence 4 were only found under “ACA diagram errors.” Sentence segmentation failures included merging S3 with S2, treating the former as part of the interrogative complement rather than as a separate VP-adverbial of S1. In addition, clause misplacement was found when S3 was positioned leftmost, replacing S2 in the diagram. Such a position of S3 in the diagram not only created a clause placement error, but also caused a diagrammatic obstruction, syntactically known as “adjunct island obstruction,” between the transitive verb *understood* and its obligatory object S2. That is, the adjunct adverbial structurally interrupted the verb-complement dependency, thereby causing distortion in the ACA representation.

Also, participants systematically failed to differentiate the hierarchical syntactic relationships correctly. This occurred through inappropriate single-level placement of the clauses together where the existence of the clause dependency had been completely neglected.

There are two patterns of errors under function mislabeling: first, S2 was treated as an adverbial or a modifier rather than as a direct object complement of *understood*; second, S3 was mislabeled as a complement, with the adverbial-complement distinction inverted. The error reflected difficulty distinguishing argument from adjunct positions within the main clause.

Sentence 5: “If you are wondering if Max is turning up tomorrow, the general rumor is that, since he is getting married, he won’t be in for the rest of the month.”

Figure 6

ACA of Sentence 5

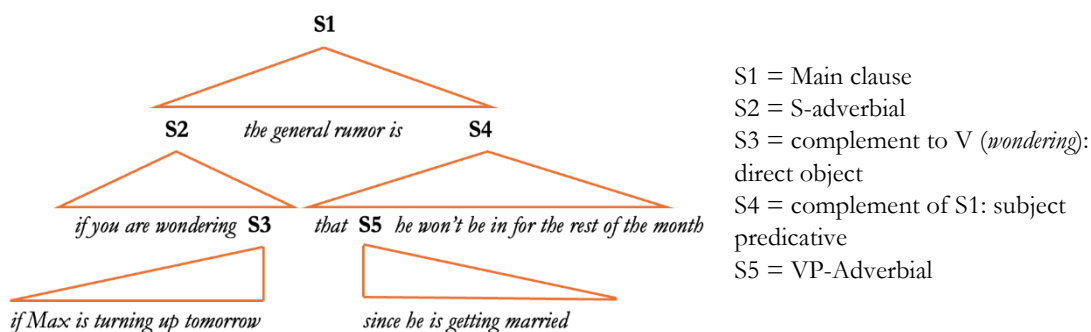


Table 6

Examples of Error Classification of Sentence 5

No.	Error category	Subcategory	Common participant errors
1	Clause type misidentification	Main <i>vs.</i> subordinate confusion	Promoting either S2 or S4 as the MC, stranding S1 elsewhere at a subordinate position
2	ACA diagram error	Sentence segmentation errors	Combining S1 and S2 into a single clause triangle Combining S2 and S3 into a single triangle Combining S4 and S5 into a single clause triangle
		Clause misplacement	Flattening structure by ignoring embedded structure Placing S4 underneath S2 or S5 Detaching S4 and S5 clause triangles from the whole ACA
		Function mislabeling	Treating adverbial as a complement and vice versa

The ACA analysis follows Burton-Roberts (2022), p. 188. In Sentence 5, a relatively broad error range occurred, reflecting its multiple embedding depth. Under clause type misidentification, participants promoted either the fronted conditional S2 or the predicative *that*-clause S4 to the main clause status, displacing S1, again reflecting main-versus-subordinate confusion under linear processing.

Under “ACA diagram errors,” segmentation failures took different forms. That is, adjacent clause pairs were collapsed into single triangles, reflecting difficulty tracking clause boundaries across multiple embedding levels. Clause misplacement was also present. The overall embedding

structure was flattened into a linear arrangement. Besides, S4 was positioned underneath S2 or S5 rather than as a predicative complement of S1. Additionally, S4 and S5 triangles were detached entirely from the diagram, left unconnected to the matrix structure. It was also found in function mislabeling that adverbial and complement functions were inverted. Lastly, participants failed to distinguish between the modification scope of the S-adverbial and the VP-adverbial.

Sentence 6: “Patience is not a characteristic we associate with Bryan, who lacks the ability to wait.”

Figure 7

ACA of Sentence 6

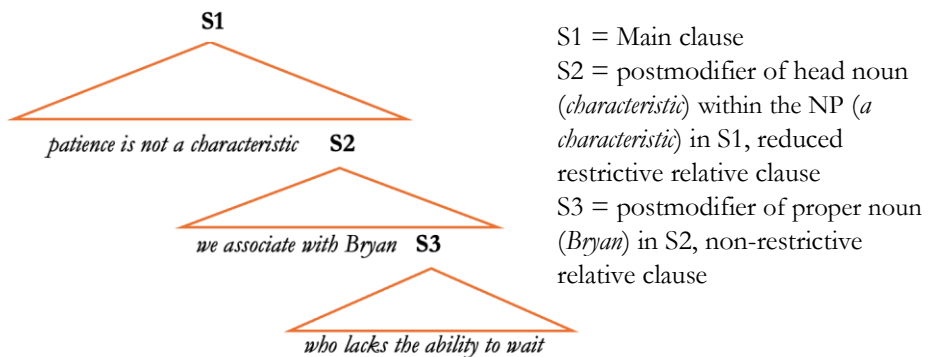


Table 7

Examples of Error Classification of Sentence 6

No.	Error category	Subcategory	Common participant errors
1	Clause type misidentification	Phrase <i>vs.</i> clause confusion	Treating S2 reduced relative clause as an NP embedded within S1
		Main <i>vs.</i> subordinate confusion	Promoting either S2 or S3 as the MC, stranding S1 elsewhere at a subordinate position
2	ACA diagram error	Sentence segmentation errors	Treating PP “ <i>with Bryan</i> ” as part of the MC
		Clause misplacement	Placing S2 to the left of the MC Placing S3 right to the left of the noun “ <i>patience</i> ,” hence its modifier Detaching clause triangles, leaving them floating elsewhere

Function mislabeling	Treating the noun modifier as a subject complement Treating relative clauses modifying nouns as VP-adverbials
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In Sentence 6, there was another type of clause-type misidentification pattern that did not occur in earlier sentences: phrase versus clause confusion. In particular, the relative clause S2, which has no overt relative pronoun, was often perceived as a subordinate noun phrase, despite the finite verb *associate*, and therefore combined with S1. On the other hand, S3 was correctly identified in most cases, thus suggesting that the presence of the relative pronoun *who* provided sufficient formal cues for clause identification while absence of the relative pronoun in S2 did not. There was also main versus subordinate confusion, with participants promoting S2 or S3 to main clause status and displacing S1.

Under “ACA diagram errors,” the prepositional phrase *with Bryan* was misincorporated into the main clause rather than retaining it inside S2. As for clause misplacement, S2 appeared to the left of the main clause while S3 was misattached to the noun *patience*. This reflected a failure to track antecedent-relative clause dependency across intervening constituents. As for function mislabeling, relative clauses were treated as subject complements. Additionally, both S2 and S3 were mislabeled as VP-adverbials, reflecting a difficulty with recognizing noun modification as a grammatical function distinct from predicate modification.

Sentence 7: “He sold that house which had been designed by himself at a huge profit.”

Figure 8

ACA of Sentence 7

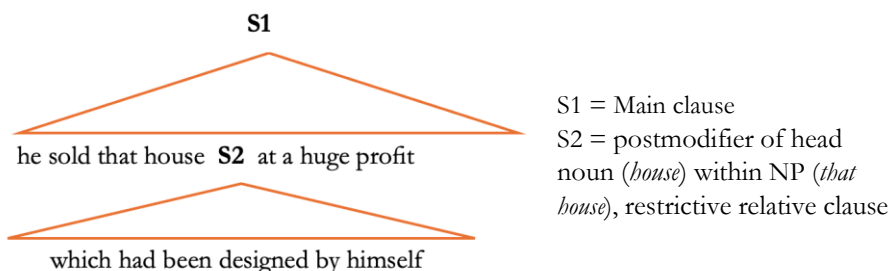


Table 8*Examples of Error Classification of Sentence 7*

No.	Error category	Subcategory	Common participant errors
1	ACA diagram error	Sentence segmentation errors	He sold that house/which had been designed/by himself/at a huge profit He sold/that house/which had been designed by himself at a huge profit He sold that house/which had been designed by himself/at a huge profit Treating the PP “<i>at a huge profit</i>” as part of S2, relative clause Treating the PP “<i>at a huge profit</i>” as part of the noun “<i>house</i>” Treating the PP “<i>at a huge profit</i>” as part of the verb “<i>sold</i>” Treating the NP “<i>that house</i>” as part of S2, relative clause, leaving the MC complementless Placing the PP “<i>at a huge profit</i>” to the left of the VP “<i>had been designed</i>,” recognized as its VP-adverbial Placing both PPs “<i>at a huge profit</i>” and “<i>by himself</i>” as part of the MC PP scramble, treating both PPs as part of the verb “<i>sold</i>”
		Function mislabeling	Treating the S2 relative clause as a VP-adverbial modifying the noun “<i>profit</i>” Treating the S2 relative clause as the extraposed subject of S1 Treating the S2 relative clause as a complement to the noun “<i>house</i>”
		Clause misplacement	Arranging all the clauses in accordance with the sentence’s linear order

Sentence 7 elicited a relatively high concentration of ACA diagram errors across all three procedural subcategories. With respect to segmentation, participants frequently failed to establish accurate clause boundaries, either incorrectly dissecting the relative clause *which had been designed by himself* from its head noun *house*, or omitting the object NP *that house* from the main clause entirely, leaving the transitive verb *sold* without its direct object in the diagram. Regarding clause function mislabeling, the relative clause, which functions as a postmodifier within the object NP, was systematically mislabeled, most commonly as a VP-adverbial and, in fewer

cases, as an extraposed subject; both misanalyses reflect a failure to recognize the clause's embedded position within the NP rather than its attachment to the VP or the matrix clause. A further error pattern involved the PP *at a huge profit*, which participants incorrectly attached to the relative clause, the noun *house*, or the verb *sold* as a separate dependent, rather than analyzing it as an adverbial within the main clause. Across all three error types, the common underlying pattern was again consistent with the linear processing tendency: participants appeared to assign constituent boundaries on the basis of surface word order, treating the sentence as a flat sequence of units rather than as a set of embedded constituents organized around the main clause.

Qualitative observation of the error patterns found in the seven sentences revealed a distinct difference. Authentic sentences (Sentences 1-3) triggered more diverse and frequent errors compared with pedagogical sentences (Sentences 4-7). Such errors in the authentic sentences were found under sentence segmentation and main versus subordinate confusion stemming from multi-level clause structures. Pedagogical sentences, however, though also yielding errors, did so less frequently, with the error types, primarily including clause misplacements or clause function mislabeling.

Discussion

The findings of this study reflect a detailed diagnostic profile of learners' syntactic analytical deficiencies within the boundaries of the current research methodology. The clause analysis assessment (CAA) allowed isolating learners' explicit syntactic analytical skills in controlled conditions. However, the CAA does not assess the extent to which these skills are realized in real reading or writing assignments. As a result, the obtained results are informative for diagnosing learners' syntactic analytical abilities, but not for their overall syntactic competencies in the language.

As far as ACA diagram errors are concerned, a clear hierarchical relation between them was evident from the obtained results. Sentence segmentation errors dominated (61.0%), being greater in frequency than clause function mislabeling (34.0%) and clause misplacement (29.0%). These numbers indicate that the critical bottleneck in ACA diagram analysis does not involve the process of diagramming per se, but the basic task of identifying clauses' boundaries. Without accurate segmenting, there is a slim chance of completing the rest of the diagramming correctly.

It is essential to preserve the difference between clause function mislabeling and clause misplacement in error taxonomy since these operations correspond to different types of problems. The former occurred more often than the latter (34.0% versus 29.0%), with non-overlapping confidence intervals confirming that this gap is not attributable to sampling

variation. Had the two error types been merged, this difference would have been lost and would have obscured this distinction and misrepresented the nature of participants' difficulties. While clause function mislabeling is associated with participants' conceptual difficulties, the clause misplacement refers to problems with the process of diagramming per se. However, in corpus analysis of syntactic errors, it is common to collapse these two error classes into one (see e.g., Lu, 2011).

One of the most theoretically important findings in this study was clause type misidentification errors. As shown earlier, the relatively low percentages of finite versus non-finite confusion (9.0%) and phrase versus clause confusion (6.0%) in comparison with main versus subordinate clause confusion (28.0%) suggest that the main conceptual bottleneck in clause comprehension is not clause recognition in general but the hierarchical relationship between clause types or, more specifically, the distinction between a matrix clause and its subordinates. Such findings extend what production-based studies have established. Princess and Syarif (2021) and Kampookaew (2020) documented systematic errors in complex sentence construction, but their surface-level error taxonomies did not identify which level of clausal hierarchy those errors reflected. The present study's diagnostic design isolates this more precisely; that is, participants can recognize clausal units generally, evidenced by the considerably lower rates of finite versus non-finite (9.0%) and phrase versus clause confusion (6.0%), but fail to represent the hierarchical dependency between matrix and subordinate clauses, a distinction that production-based error analysis cannot reveal.

In addition, an inability to identify the matrix clause will prevent EFL learners from comprehending complex sentences correctly, an important skill emphasized by Uccelli et al. (2015) in explaining the concept of academic language proficiency beyond the level of vocabulary knowledge.

One of the consequences of learners' difficulty with clause hierarchical structure identification is a preference for writing linearly structured sentences rather than complex sentences with multi-level clause structures. Boonyarattanasoontorn (2017) noted that such linear sentence structure is typical of EFL writings. One possible explanation for this finding is provided by this research since the findings indicate that participants find it difficult to analyze complex sentence structures with clauses nested within other clauses. Instead of recognizing complex sentences as hierarchical structures with subordination relations, participants may rely on linear sentence analysis strategies and consider each clause separately. It also helps to explain why the correlation between syntactic complexity and the quality of written sentences was insignificant (Crossley & McNamara, 2014).

The diagnostic resolution of the ACA framework complements corpus-based syntactic complexity measures. Where approaches such as Lu's

(2011) quantify the frequency and distribution of syntactic structures in learner production, the present framework targets a different dimension entirely by pinpointing where in the analytical process learners' understanding breaks down. Not surprisingly, the number of errors made while analyzing authentic sentences was higher than during the analysis of pedagogical sentences. Although systematic statistical verification of this observation requires further research, it can be provisionally argued that authentic sentences provide more sensitive diagnostic material for detecting syntactic analytical weaknesses than purpose-constructed pedagogical examples.

Pedagogical Implications

From the results of this study, a sequential approach to teaching can be identified. Considering that there is a misunderstanding between main and subordinate clauses that becomes the most significant barrier, it is vital to ensure that learners understand the hierarchical structure of clauses before moving on to diagrammatic procedures. The three-stage sequence of lessons is suggested as follows: first, deconstruction through guided ACA analysis by the teacher based on authentic sentences focusing on differences in the main and subordinate clauses; second, collaboration through guided group work of diagramming, which will force students to provide justifications for their analyses; third, application, i.e., ACA analysis performed individually, with explanations of each step. This sequence moves learners from procedural reproduction toward conceptual competence of hierarchical structure. As for teacher training, teachers must learn how to diagnose errors made during ACA based on whether they are related to segmentation problems or misrepresentation of subordination.

Limitations of the Study

First, one-sample nature of the study restricts generalizability beyond this Thai EFL context. Besides, the detected patterns of errors may be influenced by local instructional practices rather than universal developmental tendencies. Second, the CAA assessed performance on seven pre-selected sentences under controlled conditions, which may not fully represent learners' analytical difficulty across the broader range of authentic complex sentence structures. Third, the participants were restricted to a particular proficiency group. There is still a need for further studies to establish if the identified trends persist, decrease, or even shift among other proficiency groups and academic levels.

Conclusion and Directions for Future Research

This study offers evidence that not only is there syntactic difficulty in constructing sentences among EFL learners, but there also exists such challenges in the analysis of sentences. Based on the application of the CAA method using Burton-Roberts's (2022) ACA framework, two distinct types of syntactic difficulty were determined among 200 Thai EFL undergraduates. Procedurally, the difficulty in segmenting sentences poses a gateway problem that undermines subsequent diagramming operations. Conceptually, the higher percentage rate for confusion between main versus subordinate (28.0%) compared to that between finite and non-finite (9.0%) and phrase versus clause (6.0%) implies that the difficulty encountered is more in understanding clausal hierarchy than in recognizing clauses.

Based on the findings, directions for future studies emerge. First, replications across different institutions, different levels of proficiency, and different L1 backgrounds are needed in order to verify whether this hierarchy of errors holds outside the Thai EFL context. Second, longitudinal studies could investigate the possibility that instructions based on the ACA would result in sustained improvement in the quality of analysis as well as writing ability, which would provide much-needed cause-and-effect data regarding the proposed pedagogy. Third, in addition to these broad directions of research, the current findings identify specific areas of diagnostic interest for future study. For instance, the confusion surrounding the differences between modifiers and complements calls for further study assessing learners' capacity to distinguish grammatical function from formal structural category. This would involve focusing specifically on the difference between modifiers and complements across sentence types, probing whether learners conflate the two because of surface structural similarity, insufficient metalinguistic instruction, or both.

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