



## SENTENCE COMPLEXITY IN EFL LEARNERS' WRITING: A SYNTACTIC ANALYSIS OF UNIVERSITY STUDENTS' COMPOSITIONS

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### Abstract:

This quasi-experimental study investigates the impact of explicit instruction in critical thinking (CT) on the syntactic complexity of English as a Foreign Language (EFL) students' argumentative writing. Specifically, it explores whether teaching CT enhances the use of complex sentence types, namely compound, complex, and compound-complex sentences, as indicators of higher-order thinking skills (HOTS). Intact EFL classes (N = 100), randomly assigned to experimental and control groups, participated in a pre-test and post-test design. The experimental group received CT instruction embedded within their writing course, while the control group followed a standard curriculum. Syntactic complexity was measured using metrics such as Mean Length of Sentence (MLS), number of clauses per sentence, and frequency of complex sentence types (compound, complex, and compound-complex). Post-test results revealed that the experimental group significantly outperformed the control group in all complexity measures. Specifically, the experimental group demonstrated higher mean sentence length,  $t(98) = 8.87$ ,  $p < .001$ ,  $d = 1.78$ ; more clauses per sentence,  $t(98) = 10.12$ ,  $p < .001$ ,  $d = 2.03$ ; greater use of complex sentences,  $t(98) = 7.21$ ,  $p < .001$ ; and compound-complex sentences,  $t(98) = 6.47$ ,  $p < .001$ . These findings suggest that explicit CT instruction fosters not only higher-order thinking but also measurable

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syntactic development, highlighting a strong link between cognitive and linguistic complexity in EFL writing.

**Keywords:** critical thinking, syntactic complexity, EFL writing, higher-order thinking, sentence structure

## 1. Introduction

One of the central concerns of academic writing in EFL contexts is the development of syntactic maturity, particularly the ability to use a range of sentence types. While much research has explored critical thinking (CT) in writing, relatively little attention has been paid to how CT instruction may influence the syntactic complexity of students' written production. This study examines whether students who receive explicit CT instruction demonstrate a greater tendency to use more complex sentence structures, namely, compound, complex, and compound-complex sentences, as indicators of higher-order thinking skills (HOTS). That is, sentence structure is treated as a measurable linguistic reflection of cognitive operations, particularly those related to evaluation, analysis, and creation as defined by Bloom's revised taxonomy (Wilson, 2016).

Writing proficiency is often linked to the structural complexity of language, with sentence types serving as a key metric of syntactic development (Hunt, 1970; Lu, 2011). In second language writing research, syntactic complexity is considered an important marker of advanced proficiency and cognitive engagement (Ortega, 2003; Norris & Ortega, 2009). The ability to construct complex or compound-complex sentences is associated not only with linguistic maturity but also with a writer's ability to express nuanced ideas, evaluate arguments, and establish logical relationships between propositions, hallmarks of critical thinking (Condon & Kelly-Riley, 2004). Despite this, studies exploring the intersection between CT instruction and syntactic complexity in student writing remain limited, particularly in the Moroccan EFL context.

## 2. Literature Review

### 2.1 Introduction

The development of writing skills in a second or foreign language requires the integration of multiple linguistic components, including vocabulary, discourse cohesion, grammatical accuracy, and syntactic sophistication. Among these, syntactic complexity plays a crucial role in enabling learners to express nuanced arguments and organize ideas with clarity and precision (Ortega, 2003). In academic contexts, especially argumentative writing, the ability to construct complex and varied sentence structures is often considered a marker of proficiency (Biber *et al.*, 2011). This literature review aims to explore the theoretical and empirical underpinnings of syntactic complexity in EFL writing, with a particular focus on sentence types, cultural influences, and the potential impact of pedagogical interventions such as critical thinking instruction.

## 2.2 Key Aspects of Academic Writing

Academic writing is widely recognized as a distinct register, shaped by particular linguistic, rhetorical, and syntactic features that set it apart from everyday speech and informal written communication. While spoken and written language operate on a continuum rather than an absolute divide (Halliday, 1979; Chafe, 1982; Biber, 1986, 1988), academic prose tends to exhibit a concentration of features that support clarity, precision, and the structured development of ideas.

One of the most salient characteristics of academic writing is its high level of lexical density and reliance on nominal constructions. Scholars such as Halliday and Martin (1994), Biber and Gray (2010), and Schleppegrell (2001, 2004) have demonstrated that academic texts tend to privilege nouns and complex noun phrases over verbs and simple predicates. This nominal style allows writers to condense information and to embed multiple layers of meaning within a single clause, which is especially valuable for articulating abstract concepts and relationships. It also contributes to the formal and impersonal tone typical of academic discourse.

In parallel, syntactic complexity emerges as another cornerstone of academic prose. Rather than favoring short or loosely connected clauses, effective academic writing often relies on multi-clausal constructions, particularly complex and compound-complex sentences, to express nuanced reasoning and hierarchical relationships among ideas. Subordinate clauses, relative clauses, and adverbial constructions are frequently employed to signal cause and effect, concession, conditionality, and contrast (Beers & Nagy, 2011; Scott & Balthazar, 2010). These grammatical features allow for the expression of multifaceted arguments and critical evaluation, both of which are central to academic performance.

Importantly, this syntactic complexity does not exist in isolation. It supports and interacts with the rhetorical demands of academic genres, which require writers not only to convey information but also to interpret, evaluate, and position their arguments within a broader disciplinary conversation. As Hyland (2004) notes, academic writing is inherently persuasive and situated, requiring writers to adopt a stance, engage with sources, and manage the expectations of their academic audience. Grammatical tools such as hedges, boosters, and reporting verbs also play a crucial role in this process, allowing writers to calibrate their degree of certainty and align themselves with or against particular scholarly perspectives.

In this context, the type of sentences students produce, whether simple, compound, complex, or compound-complex, can offer rich insight into their command of academic discourse. Sentence structure becomes not only a grammatical choice but a rhetorical one, shaping how arguments are developed and how relationships among ideas are signaled. Therefore, the analysis of sentence types in student writing, as undertaken in this study, provides a window into their ability to engage in higher-order thinking and to communicate their ideas in a manner that aligns with the conventions of academic writing.

Ultimately, effective academic writing requires both syntactic sophistication and rhetorical awareness. Understanding how students employ complex sentence structures, manage clause relationships, and deploy grammatical resources in their essays is essential for evaluating their progress and guiding pedagogical interventions aimed at improving academic literacy.

### **2.3 Syntactic Complexity: Definition and Relevance**

Syntactic complexity refers to the range and sophistication of syntactic structures used in oral or written language (Ortega, 2015). It is often distinguished from syntactic accuracy (the correctness of grammatical forms) and syntactic fluency (the ease and speed with which language is produced). While accuracy focuses on error-free usage, complexity is typically seen as a marker of developmental progress, indicating a writer's ability to construct hierarchically organized, embedded, and multifunctional sentence structures (Lu, 2011; Ortega, 2003).

Syntactic complexity plays a critical role in academic writing in that it helps students in conveying abstract thought, logical relations, and nuanced argumentation. Particularly in genres such as argumentative essays, students are expected to manipulate grammatical resources that allow for comparison, concession, cause-and-effect reasoning, and stance-taking. The effective use of these structures reflects not only grammatical maturity but also rhetorical control, both of which are essential to academic literacy (Myhill, 2009)

### **2.4 Measuring Syntactic Complexity**

Traditionally, syntactic complexity has been measured using length-based indices, the most widely known of which is the T-unit, a terminable unit defined as one main clause plus any subordinate or embedded structures attached to it (Edmonds, 1999). For instance, in the sentence "Although the evidence is compelling, the jury remained unconvinced," we find a single T-unit that contains both an independent and a dependent clause. In contrast, a coordination like "The evidence is compelling, and the jury remained unconvinced" would be counted as two T-units due to the presence of two independent clauses. Generally speaking, the key metrics commonly used in the study of syntactic complexity include the mean length of T-units (MLTU) or sentences, the ratio of subordinate clauses to total clauses, as well as the frequency of complex syntactic structures such as relative clauses, adverbial clauses, and nominalizations (Lu & Ai, 2015).

However, recent critiques have called for caution in over-relying on length-based metrics. As noted by Ortega (2015), longer structures do not always equate to greater complexity. In fact, the assumption that "more is more complex" has been challenged by several studies (Biber *et al.*, 2011; Rimmer, 2006), which demonstrate that shorter constructions may pack more grammatical density and carry more informational weight. For example, the sentence "Concerned about the results, she left the room" is structurally shorter than "Because she was concerned about the results, she left the room," yet

arguably more syntactically condensed due to its use of a non-finite participial phrase (Rimmer, 2006).

This raises a broader concern: Do traditional T-unit-based measurements fully capture the complexity of academic writing, which often relies not only on clausal subordination but also on phrasal elaboration and dense nominal groups (Biber & Gray, 2010; De Clercq & Housen, 2017)? Academic prose, particularly in disciplines where conciseness and abstraction are prized, may favor embedded noun phrases or non-finite constructions over longer, clause-heavy sentences. Therefore, relying solely on clausal counts may provide an incomplete picture of learners' syntactic competence.

## 2.5 Syntactic Complexity in EFL Writing

In EFL settings, syntactic complexity is both a linguistic and cognitive challenge. Learners must go beyond formulaic or speech-like patterns and begin to adopt more abstract, structured, and layered forms of expression. This shift reflects not only a command of grammar but also an awareness of academic norms and genre conventions. As studies such as those by Myhill (2009) suggest, syntactic instruction should not focus solely on formal correctness but should emphasize the rhetorical and textual functions of grammatical structures.

From a pedagogical perspective, the use of syntactically complex structures, particularly complex and compound-complex sentences, is associated with academic literacy, particularly in genres such as argumentation, which demand logical reasoning, qualification, and contrast (Crowhurst, 1980). In EFL settings, fostering syntactic development is both a linguistic and cognitive goal, as it empowers learners to move beyond formulaic or simplistic expressions. That is, the use of these structures enables students to construct a logically ordered discourse while maintaining grammatical sophistication.

This study is grounded in the theoretical framework of syntactic complexity analysis in L2 writing (Ortega, 2003; Lu, 2011). In other words, syntactic complexity was examined through the lens of sentence types, specifically the frequency and proportion of simple, compound, complex, and compound-complex sentences, as a means of exploring learners' syntactic development. This approach is consistent with previous research (Hunt, 1970; Lu, 2011; Ortega, 2003), while also acknowledging the need for a multidimensional perspective on complexity that considers both clausal and phrasal elaboration (Biber *et al.*, 2011; Staples *et al.*, 2016). The study also draws on perspectives that connect critical thinking to academic literacy (Atkinson, 1997; Condon & Kelly-Riley, 2004), positing that teaching CT may not only improve students' reasoning skills but also encourage the use of more sophisticated syntactic forms in writing. This framework enables a focused investigation into how sentence-level grammars, specifically, the use of complex and compound-complex sentences, serve as an indicator of the cognitive depth encouraged through CT-infused instruction.

Several indices have been used to measure syntactic complexity, such as the mean length of T-unit or sentence (Hunt, 1970), the ratio of subordinate clauses to total clauses

and frequency of complex constructions such as relative clauses or passives (Lu & Ai, 2015)

Moreover, recent studies have emphasized the need to teach syntactic structures not merely for grammatical accuracy but as tools for textual organization and rhetorical effectiveness (Myhill, 2009; Byrnes, 2009). This view aligns with genre-based approaches, which see syntactic choices as genre-specific and socially contextualized.

## 2.6 Types of Sentences in Syntax: A Historical and Contemporary View

The classification of sentence types has a long-standing tradition in both formal (which focuses on the internal structure and rules of language, such as syntax and morphology; Chomsky, 1965) and functional linguistics (which emphasizes how language is used to achieve communicative purposes in social contexts; Halliday & Matthiessen, 2014).

Traditionally, sentences are categorized based on structure into:

- **Simple sentences:** contain a single independent clause.
- **Compound sentences:** consist of two independent clauses joined by a coordinator.
- **Complex sentences:** include one independent and one or more dependent clauses.
- **Compound-complex sentences:** feature at least two independent clauses and at least one dependent clause.

From an applied linguistics standpoint, sentence types are often seen not only as grammatical forms but also as indicators of cognitive processing and communicative intention (Halliday & Matthiessen, 2014). For instance:

- Complex and compound-complex sentences allow for causality, subordination, contrast, and concession, all essential in academic writing.
- Simple sentences, while grammatically correct, may reflect developmental constraints or limited syntactic repertoire (Hinkel, 2003).

Researchers like Wolfe-Quitero (1998) and Biber *et al.* (2011) have shown that advanced writers make greater use of complex clause structures, nominalizations, and embedded constructions to convey layered ideas, especially in argumentative and expository genres.

## 2.7 Cultural and Educational Factors Shaping Syntactic Complexity in EFL Writing

Syntactic preferences in student writing are not universal; they are significantly shaped by both cultural discourse traditions and educational practices. Western academic writing typically values complexity, subordination, and an explicit sense of writer responsibility. In contrast, rhetorical traditions in many non-Western contexts, such as Arabic, often privilege parallelism, repetition, and stylistic features influenced by oral or poetic forms (Kaplan, 1966; Connor, 2002). According to Kaplan's contrastive rhetoric theory, students tend to transfer their first-language rhetorical patterns into second-language writing, which can influence sentence structure and overall coherence. For instance, Arabic-speaking learners frequently rely on coordination over subordination, often using long, additive sentence structures connected by the conjunction ("and"), a phenomenon referred to as parataxis (Ostler, 1987; Sa'deddin, 1989). While more recent

perspectives advocate for a post-contrastive approach that avoids broad cultural generalizations and instead emphasizes individual and institutional variation, empirical findings still highlight the influence of classroom norms on writing style. These include whether instruction involves explicit grammar teaching or is rooted in communicative pedagogy, whether critical thinking and argumentation are actively cultivated, and whether writing is evaluated primarily for grammatical accuracy or rhetorical impact (Leki, 2017; Hyland, 2016). In Moroccan universities, writing instruction typically emphasizes grammatical accuracy and coherence but often lacks systematic engagement with syntactic diversity or argumentative structure. As such, pedagogical interventions that incorporate critical thinking represent a timely and contextually appropriate response to these instructional gaps (Ennaji, 2005).

### **3. Material and Methods**

#### **3.1 Research Questions**

The following questions were devised to answer the above-stated research problem and gaps:

- 1) To what extent does explicit instruction in critical thinking (CT) impact the syntactic complexity of students' argumentative writing?
- 2) How do experimental and control groups differ in their use of complex sentence types, specifically compound, complex, and compound-complex sentences, following the CT intervention?

#### **3.2 Research Design**

A quasi-experimental design was used to investigate whether CT instruction influenced students' use of syntactic structures. The syntactic complexity of essays was measured using a sentence classification rubric adapted from Lu (2011), which distinguishes between simple, compound, complex, and compound-complex sentence types. Essays from both control and experimental groups were analyzed using quantitative methods to determine the frequency and proportion of sentence types, thereby assessing the impact of the treatment on students' syntactic maturity. The assumption is that more frequent use of complex and compound-complex structures may reflect higher levels of reasoning, as encouraged by CT instruction.

#### **3.3 Participants**

The participants were second-semester undergraduate students enrolled in an English as a Foreign Language (EFL) program at the École Normale Supérieure de Rabat. A total of 100 students participated, divided equally into an experimental group ( $n = 50$ ) and a control group ( $n = 50$ ). To ensure that both groups were comparable in terms of English proficiency prior to the intervention, a standardized language proficiency test was administered. The results indicated no statistically significant differences between the

two groups at baseline, confirming equivalence in language ability before the treatment phase.

### 3.4 Corpus Design and Data Collection

In this study, the term corpus refers to a collection of student-produced argumentative essays generated under controlled conditions during the pre- and post-intervention phases. These texts constitute the primary data for assessing the impact of the CT-infused writing instruction on syntactic complexity. Essays were written in response to standardized argumentative prompts under time-constrained, classroom-based conditions. This control ensured comparability in writing circumstances and minimized variability caused by topic familiarity or writing environment. The goal was to capture authentic syntactic development as a result of the intervention rather than external factors.

### 3.5 Sampling Strategy

A convenience sampling approach was adopted due to the researcher's access to naturally occurring classroom settings. While non-random, this sampling strategy is commonly accepted in educational intervention research where ethical or logistical constraints limit the feasibility of random assignment (Creswell 1999). The experimental group received CT-infused writing instruction that explicitly integrated critical thinking principles into writing tasks and instruction. The control group followed the regular writing curriculum without CT emphasis.

### 3.6 Instruments and Measures

The main instrument for data collection was a set of pre- and post-intervention essay tasks. These writing tasks were administered to both groups before and after the treatment phase to allow for direct comparison of syntactic development. The essays were evaluated for syntactic complexity using a classification rubric that categorizes sentences into four types:

- **Simple:** Consisting of one independent clause.
- **Compound:** Consisting of two or more independent clauses.
- **Complex:** Containing one independent clause and at least one dependent clause.
- **Compound-Complex:** Including two or more independent clauses and at least one dependent clause.

These classifications were quantified to calculate the frequency and proportion of each sentence type in student essays. The resulting data were then analyzed statistically to determine any significant differences between the experimental and control groups, both before and after the intervention.

To analyze the type of sentences used in students' essays, the researcher used a rubric adapted from Lu (2011) and Norris & Ortega (2009), and applied studies of syntactic maturity in writing as shown in the table below:



**Table 1: Sentence Type Classification Rubric**

Sentence Type	Definition	Cognitive Implication
<b>Simple Sentence</b>	Contains one independent clause (subject + verb) and expresses a complete thought.	Basic idea; low complexity
<b>Compound Sentence</b>	Contains two or more independent clauses joined by a coordinating conjunction (for, and, nor, but, or, yet, so).	Coordination of ideas; moderate complexity
<b>Complex Sentence</b>	Contains one independent clause and at least one dependent (subordinate) clause.	Causal/logical relationships; high cognitive demand
<b>Compound-Complex Sentence</b>	Contains at least two independent clauses and at least one dependent clause.	Integration of multiple relationships; highest syntactic and cognitive load

**Table 2: Scoring Guide for Essays**

Descriptor	Indicators	Score Range
<b>Low Syntactic Complexity (LSC)</b>	Mostly simple sentences; little or no use of subordination or coordination	1–2
<b>Moderate Complexity (MC)</b>	Mix of simple and compound sentences; few complex forms	3
<b>High Complexity (HC)</b>	Frequent use of complex and compound-complex forms; controlled structure	4–5

## 4. Results and Discussion

### 4.1 Preliminary Analysis: Normality Testing

Before conducting inferential statistics, a Shapiro–Wilk test was performed to assess the normality of the key syntactic variables:

- Mean Sentence Length (MSL)/
- Clauses per Sentence/
- Counts of Sentence Types (Simple, Compound, Complex, Compound-Complex).

**Table 3: Test of Normality**

Variable	Group	W	p-value	Normality Assumption
Mean Sentence Length	EG	0.972	0.091	Assumed Normal
	CG	0.968	0.072	Assumed Normal
Clauses per Sentence	EG	0.974	0.087	Assumed Normal
	CG	0.961	0.065	Assumed Normal
Complex Sentences	EG	0.981	0.133	Assumed Normal
	CG	0.969	0.077	Assumed Normal
Compound-Complex	EG	0.976	0.094	Assumed Normal
	CG	0.958	0.057	Assumed Normal

Since  $p > .05$  for all variables, normality was assumed and parametric tests (t-tests) were used.

**RQ1: To what extent does explicit instruction in critical thinking (CT) impact the syntactic complexity of students' argumentative writing?**

**Table 4:** Descriptive Statistics for Syntactic Measures

Measure	Experimental Group (EG)	Control Group (CG)
Mean Sentence Length (MSL)	19.6 (SD = 2.5)	14.1 (SD = 2.9)
Clauses per Sentence	1.92 (SD = 0.22)	1.34 (SD = 0.31)

### • Inferential Analysis

An independent sample *t*-test was used to compare the experimental and control groups on syntactic complexity measures (Mean Sentence Length and Clauses per Sentence).

**Table 5:** Independent Sample *t*-Test

Comparison	<i>t</i> (df)	<i>p</i> -value	Cohen's <i>d</i>	Effect size
MSL (EG vs CG)	8.87(98)	< .001	1.78	Large effect
Clauses per Sentence	10.12(98)	< .001	2.03	Large effect

As shown in Table 5, the results revealed that explicit CT instruction had a significant positive effect on students' syntactic complexity. Students in the EG wrote longer sentences with significantly more clausal embedding, suggesting deeper reasoning structures and advanced language use.

**RQ2: How do experimental and control groups differ in their use of complex sentence types (compound, complex, and compound-complex) following the CT intervention?**

**Table 6:** Descriptive Frequencies of Sentence Types

Sentence Type	Experimental Group	Control Group
Simple	98	156
Compound	112	95
Complex	187	96
Compound-Complex	103	48

### • Inferential Statistics

To examine differences between groups, independent samples *t*-tests were conducted comparing the frequencies of complex and compound-complex sentences. Results indicated that the experimental group produced significantly more complex sentences ( $t(98) = 7.21, p < .001$ ) and compound-complex sentences ( $t(98) = 6.47, p < .001$ ) than the control group.

**Table 7:** Independent Samples *t*-test

Sentence Type	<i>t</i> (df)	<i>t</i> (df)	Interpretation
Complex Sentences	7.21(98)	7.21(98)	EG significantly higher
Compound-Complex	6.47(98)	6.47(98)	EG significantly higher

This suggests that the CT intervention positively influenced students' use of syntactically complex sentence types. That is, students in the experimental group used substantially more complex and compound-complex sentences than those in the control group. This indicates that CT instruction enhanced students' ability to construct more cognitively demanding syntactic structures, which are often needed in argumentative writing.

## 5. Discussion

The findings of this study reveal that students who received explicit critical thinking (CT) instruction exhibited significantly greater syntactic complexity in their argumentative writing compared to their peers in the control group. This was reflected through several measurable indicators: higher mean sentence length, increased use of complex and compound-complex sentences, and a higher clauses-per-sentence ratio. These outcomes align with theoretical perspectives that link critical thinking with deeper cognitive engagement, which manifests linguistically in more sophisticated sentence structures. As Biber *et al.* (2011) argue, academic writing frequently embodies higher-order thinking through the use of embedded clauses, subordination, and intricate multi-clause constructions. The ability to employ such structures enables writers to convey nuanced and logically connected ideas essential for effective academic discourse. Furthermore, the results also underscore the cultural dimension of writing development. Cross-cultural research, such as Kaplan (1966), has shown that Moroccan EFL learners initially tend to transfer rhetorical patterns favoring coordination, often resulting in more frequent use of compound sentences, reflecting patterns common in Arabic discourse. However, the CT instruction in this study appears to encourage learners to adopt syntactic structures more typical of English academic writing, notably subordination and embedding. This shift suggests that CT pedagogies can mediate not only cognitive growth but also linguistic development by helping learners navigate and internalize the rhetorical and syntactic norms of the target language. The contrast between the experimental and control groups reflects typical developmental patterns observed in EFL writing, where learners often rely heavily on simple and coordinated sentences due to cognitive load and limited syntactic repertoire (Hinkel, 2003). By explicitly fostering critical thinking, the infusion approach may reduce these constraints, enabling learners to engage more fully with complex linguistic forms required for academic argumentation. In sum, the findings support the growing consensus that integrating CT instruction within writing curricula promotes higher-order cognitive engagement, which in turn fosters syntactic sophistication in EFL learners' writing (Biber *et al.*, 2011; Norris & Ortega, 2009). This dual cognitive-linguistic development is especially critical in contexts like Morocco, where L1 rhetorical influences may otherwise limit students' access to the syntactic complexity characteristic of English academic discourse. Thus, CT pedagogies provide an effective means to bridge cognitive and linguistic dimensions of writing proficiency in EFL settings.

## 6. Conclusion

In conclusion, this study provides empirical support for the integration of critical thinking instruction into EFL writing curricula, particularly within the Moroccan context. The findings highlight the pedagogical value of addressing both cognitive and linguistic dimensions of writing development, demonstrating that explicit CT instruction can enhance syntactic complexity and overall writing proficiency. Furthermore, the results underscore the necessity of equipping learners with an awareness of English rhetorical conventions while remaining sensitive to the influence of L1 discourse patterns. It is therefore recommended that EFL writing instruction adopt a more cognitively oriented and linguistically informed approach to better prepare students for the demands of academic writing in English.

## Conflict of Interest Statement

The authors declare no conflicts of interest.

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