

## Syntactic Complexity and Lexical Complexity in Argumentative Writing: Variation by Proficiency

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**Abstract:** This study explores how syntactic complexity and lexical complexity vary in argumentative essays written by L2 learners of English at B2 and C1 CEFR proficiency levels. We approach both syntactic complexity and lexical complexity from a multi-dimensional perspective, examining syntactic complexity at different levels (i.e., global, clausal, and phrasal) and including the three lexical dimensions as diversity, density, and sophistication. Undergraduate students (n=42) studying English Language Teaching at a private university in Turkey voluntarily participated in this study and completed an argumentative essay writing task. We manually coded their essays for syntactic complexity structures and used the automated analyzer developed by Lu (2012) for lexical complexity features. We calculated descriptive statistics separately for the lower-level and higher-level groups and investigated the syntactic complexity variation among the two groups using the nonparametric Mann-Whitney U test. Our results indicated significant variation among the two proficiency levels in three syntactic structures (finite complement clauses controlled by nouns, words before the main verb, and passives), while there was no significant difference between the groups in lexical complexity. These findings contribute to the understanding of the connection between linguistic features and L2 writing proficiency levels.

### Anahtar Sözcükler:

Söz dizimsel karmaşıklık, sözcüksel karmaşıklık, ikinci dilde yazma, tartışmacı metin, düzeye göre fark

### İngilizce Öğrencilerinin Tartışmacı Metinlerindeki Söz Dizimsel ve Sözcüksel Karmaşıklık: Düzeye Göre Fark

**Özet:** Bu çalışmada, İngilizce öğrencilerinin tartışmacı metinlerindeki sözdizimsel ve sözcüksel karmaşıklığın öğrenci düzeylerine göre nasıl farklılık gösterdiği incelenmektedir. Sözdizimsel karmaşıklığı cümle, tümce ve öbek düzeylerinde inceleyerek, sözcüksel karmaşıklığı da çeşitlilik, yoğunluk ve karmaşıklık boyutları ile ele alarak, her iki karmaşıklık türüne de çok boyutlu bir perspektiften yaklaşılmaktadır. Çalışmanın katılımcılarını Türkiye'deki bir üniversitenin İngilizce Öğretmenliği programında öğrenim gören, Avrupa Dilleri Ortak Çerçeve Programına göre B2 ve C1 düzeylerinden olan toplam 42 lisans öğrencisi oluşturmaktadır. Katılımcılar bu çalışmaya gönüllü olarak katılmış ve çalışma kapsamında tartışmacı kompozisyon yazmışlardır. Söz dizimsel karmaşıklık yapıları manuel olarak kodlanırken, sözcüksel karmaşıklıkları Lu (2012) tarafından geliştirilen otomatik program ile kodlanmıştır. Her iki grup için tanımlayıcı istatistikler ayrı ayrı hesaplanmış ve iki grup arasındaki farkı görmek için Mann-Whitney U testi kullanılmıştır. Sonuçlar iki düzey arasında üç sözdizimsel yapıda istatistiksel olarak önemli farklılıklar gösterirken, sözcük karmaşıklığında gruplar arasında anlamlı bir fark bulunmamıştır. Çalışmanın sonuçları dilbilimsel özellikler ile ikinci dil yazma düzeyi arasındaki bağlantının anlaşılmasına katkıda bulunmaktadır.

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## 1. Introduction

Students do not arrive at university already equipped with the skills required to handle the writing demands of the academic world. Conceptualized as complex, writing is one of the primary challenges shared by L2 learners of English (Kamasak, Sahan, & Rose, 2021) because academic concepts and the complex ideas and relations in academic disciplines need to be expressed through complex structures in writing (Nasseri, 2021). The development of this complex skill has been a primary interest in L2 writing research. Our understanding of how academic writing skills develop, in particular syntactic development, is enhanced by analyses of the syntactic features in texts written by learners with different levels of proficiency, through either longitudinal or cross-sectional observations (e.g., Bulté & Housen, 2014; Khushik & Hunta, 2020; Kim, 2014; Lu, 2011; Martínez, 2018; Mazgutova & Kormos, 2015). One commonly accepted assumption is that complex writing skills progress through three levels, starting with coordination structures (beginning levels), continuing with subordination structures (intermediate levels), and ending with phrasal structures (advanced levels) (Norris & Ortega, 2009).

A central point of discussion in syntactic complexity investigations has been what measures to use. The T-unit analysis developed by Hunt (1965) guided initial length-based attempts at investigating syntactic complexity. While large-grained, length-based indices are important in measuring global complexity and continue to be a part of the current complexity research, finer-grained indices addressing the specific types of elaboration in writing (e.g., phrasal complexity) also need to be involved, acknowledging the multi-dimensional nature of syntactic complexity (Ortega, 2003; Wolfe-Quintero, Inagaki, & Kim, 1998).

Several studies have been conducted with a multi-dimensional operationalization of syntactic complexity (e.g., Biber, Gray, & Poonpon, 2011; Casal & Lee, 2019; Lu, 2011; Yang, Lu, & Weigle, 2015). However, there are aspects of complexity that are underrepresented in current complexity research. Passive voice, for example, is cognitively more complex than active voice and requires greater mental effort for processing and thus is considered to be an indicator of complexity in writing (Housen, Pierrard, & Van Daele, 2005; Kameen, 1979). Some previous research studies confirmed that higher-level L2 writing demonstrates more incidences of passives (e.g., Ferris, 1994). In addition, modals have also been reported to be a characteristic of more advanced level writing (Berninger, Nagy, & Beers, 2011).

Incorporating the underrepresented aspects of complexity, this study aims to contribute to knowledge on how complexity varies by L2 proficiency. It also aims to look into how lexical complexity relates to L2 proficiency. As Johnson (2017) argues, lexical complexity measures should be added to syntactic complexity measures in order to assess the potential of lexical complexity as a driver of the development of syntactic complexity. Lexical complexity is also a multi-dimensional construct with three dimensions: diversity, density, and sophistication (Lu, 2012). However, according to Johnson's (2017) meta-analysis, studies on lexical complexity commonly include diversity measures, but lexical density measures are rare in existing research. Addressing these gaps and aims, this study specifically investigates if there is any proficiency-related variation among syntactic complexity and lexical complexity features used in argumentative essays of L2 learners of English.

## 1.1. Syntactic Complexity

Syntactic complexity “refers to the range of forms that surface in language production and the degree of sophistication of such forms” (Ortega, 2003, p. 492). One of the most debated issues in syntactic complexity research is the question of operationalization, i.e., how to measure it. Traditional approaches to syntactic complexity measurement are often informed by the T-unit analysis developed by Hunt (1965) and include large-grained, length-based indices. Some studies have demonstrated T-unit length to be an indicator of improved or more advanced writing skills (e.g., Bulté & Housen, 2014; Casanave, 1994; Lu, 2011; Wolfe–Quintero et al., 1998). For example, comparing three proficiency levels as native speaking level, nonnative high, and nonnative low, Ai and Lu (2013) found out that there was a significant increase in T-unit length from the nonnative low to the nonnative high and the native group. Yang et al. (2015) revealed that T-unit length significantly predicted writing scores, meaning that essays that included longer T-units were considered higher quality and received higher scores. However, this measure is ineffective in specifying the nature of the difference in elaboration. The two learner sentences below, which both have nine words in total, illustrate the inadequacy of such one length-based measure. From a traditional perspective, would the same mean length of T-unit that they share indicate that they are syntactically the same in terms of complexity?

- a- People cannot use information if they cannot understand it. (Clausal complexity)
- b- The latter idea ignores the humanistic quality of students. (Phrasal complexity)

Thanks to technological advances such as corpus applications or natural language processing, recent scholarship has expanded beyond these traditional approaches and has developed indices that can reveal finer-grained differences in syntactic structures (Lu, 2011; Kyle, 2016). Based on a multi-dimensional operationalization, syntactic complexity investigations now include different indices at different levels such as clausal and phrasal (e.g., non-finite relative clauses, noun-complement clauses, premodifying nouns, prepositional phrases as postmodifiers, etc.) (e.g., Mancilla, Polat, & Akcay, 2017; Martínez, 2018; Nasser, 2021; Parkinson & Musgrave, 2014; Staples & Reppen, 2016). Lu’s (2011) framework addresses five dimensions as “length of production unit, amount of subordination, amount of coordination, degree of phrasal sophistication, and overall sentence complexity,” (pp. 43-44) with different measures in each dimension. In this model, one measure includes several syntactic structures such as complex nominals, which comprises “nouns plus adjective, possessives, prepositional phrases, relative clauses, participles, or appositives, nominal clauses, and gerunds and infinitives in subject position” (Lu, 2010). Another framework which provides a more specific classification of syntactic structures in line with five developmental stages was developed by Biber et al. (2011). That framework is adopted in this study with the aim of gaining and providing a more specific understanding of learners’ writing.

A multi-dimensional operationalization is also necessary to account for the developmental progression of complexity since beginning levels are characterized with coordination indexes, intermediate levels with subordination, and advanced levels with phrasal complexity (Norris & Ortega, 2009). At the beginning levels, students’ writing manifests a higher number of sentences and T-units, shorter sentences and T-units, finite forms, and a lot of coordination structures (Ortega, 2003; Wolfe-Quintero et al., 1998). At the intermediate level, subordination is a more distinctive feature of their writing, and at the advanced level, their writing is characterized by phrasal elaboration, nominalization, nonfinite forms, longer

clauses, and a lower number of T-units and sentences (Biber & Gray, 2013; Bulté & Housen, 2014).

While structure-based measures are at the center of the majority of syntactic complexity research, grammatical features such as passives or modals as indicators of complexity are underused. In addition to nominalization or noun phrase complexity, passive constructions also characterize academic writing (Biber, 1988; Frase, Faletti, Ginther, & Grant, 1999). Ferris (1994), who compared the syntactic features in compositions written by ESL students from two proficiency levels, found out that students from the higher-proficiency group used a greater number of passives. Grant and Ginther (2000) examined the differences in L2 learners' essays written at three proficiency levels and found out that as the proficiency level of L2 writers increased, they incorporated more passives. In addition to passive constructions, modals were also observed to be more frequent in the advanced grade levels of L2 writers (Berninger et al., 2011). In Saricaoglu's (2019) study, L2 learners considered sentences that included modals to be more complex than those which did not. Considering these findings, this study covers a wider range of grammatical features when investigating complexity differences in texts written by learners with different levels of proficiency.

## 1.2. Syntactic Complexity and L2 Proficiency

How written syntactic features relate to L2 proficiency has long been a topic of interest for writing researchers. The underlying assumption is that more complex syntactic structures within a written text can indicate more advanced-level writing skills (Crossley, 2020; Larsen-Freeman, 1978). It is important to keep in mind, however, that the relationship between syntactic complexity and L2 proficiency is dependent upon contextual factors such as genre (narrative versus argumentative), mode of communication (synchronous versus asynchronous), and discourse (spoken versus written) (Mancilla et al., 2017; Pallotti, 2009). This means that a narrative oral task or a synchronous online discussion might elicit low-level syntactic features (subordination or coordination) even from highly proficient language users. Thus, when L2 proficiency is concerned, the developmental levels and the associated syntactic complexity features need to be considered specific to the context. The focus of this study is written argumentative writing, and hence the assumption of "the more complex, the higher" holds in the present study.

Studies dealing with the relationship between syntactic complexity and L2 proficiency can be classified into two as longitudinal studies focusing on the change in written syntactic complexity features over a certain period of time, i.e., from the beginning to the end of a course, over a semester, etc., and cross-sectional studies comparing written syntactic complexity features of students from different proficiency levels. Bulté and Housen (2014) examined the syntactic complexity changes in the writings of English L2 learners over a course. They observed a significant increase in the length of phrases, clauses, sentences, and T-units and also a non-significant increase in clause coordination, but not subordination. In another longitudinal growth study, Crossley and McNamara (2014) assessed syntactic development in L2 writers' descriptive essays at the end of a writing course. By the end of the semester, L2 writers' essays demonstrated a decrease in the number of clauses and verb phrases and an increase in the number of words before the main verb, in the frequencies of negation, and in the length of noun phrases. Mazgutova and Kormos (2015) compared the syntactic characteristics of argumentative essays written by L2 learners from two different proficiency levels (C1 and B2 CEFR) at the beginning and at the end of a one-month intensive EAP course. At the end of the course, there was a reduction in the T-unit length

and clausal embedding and an increase in noun phrase complexity of the higher-proficiency group. The increase in noun phrase complexity was also observed for the lower-proficiency group, but the amount of clausal embedding did not change.

In a cross-sectional study investigating which syntactic features best distinguished three L2 writing proficiency levels (basic, intermediate, advanced), Kim (2014) identified mean length of T-unit, complex T-unit ratio, and complex nominals per T-unit to be the strongest predictors of L2 writing proficiency levels. Martínez (2018) examined differences in syntactic complexity among secondary education L2 writers from low intermediate (third year) and intermediate (fourth year) proficiency levels. She found a significantly greater frequency of coordination and subordination and a higher mean length of noun phrases in the writings of the intermediate level students than in those of the low intermediate students. Khushik and Hunta (2020) investigated whether syntactic complexity measures distinguished between Common European Framework of Reference (CEFR) levels in argumentative writing of EFL learners from A1, A2, and B1 levels. It was found that sentence length, subordination, and phrasal sophistication and density indices separated the CEFR levels, but coordination indices did not.

### **1.3 Lexical Complexity**

Lexical complexity refers to the range and sophistication of vocabulary produced in spoken or written language (Wolfe-Quintero et al., 1998). Similar to syntactic complexity, lexical complexity is also a multi-dimensional construct with three main dimensions as lexical diversity (also referred to as lexical variation or lexical range), lexical density, and lexical sophistication (Lu, 2012). L2 writing development is associated with these three lexical dimensions as more unique words, more content words, or more infrequent words in a learner's text serve as an indicator of higher text quality and/or higher proficiency (Friginal, Li, & Weigle, 2014; Kormos, 2011; Read, 2000; Wolfe-Quintero et al., 1998; Yoon & Polio, 2017; Zenker & Kyle, 2021).

Lexical diversity is operationalized as the proportion of different words to the number of total words in a text (Lu, 2012). Lexical diversity is typically measured through type-token ratio (TTR), i.e., “the ratio of the number of word types to the total number of word tokens in a text” (Lu, 2014, p. 4). However, it is subject to criticism because it is affected by sample size. Instead, transformations of TTR which are not affected by sample size are preferred, such as “mean segmental TTR” or “corrected TTR” (Lu, 2012). Lexical density is operationalized as the proportion of lexical/content words to the total number of words (both lexical/content and grammatical/functional) (Ure, 1971). Lexical sophistication is operationalized as the proportion of infrequent/advanced words to the total number of words (Read, 2000).

### **1.4 Lexical Complexity and L2 Proficiency**

Because lexicon is an integral component of written language and an indicator of language proficiency, lexical complexity has had an important place in writing assessment and research. To capture proficiency level differences, Grant and Ginther (2000) compared essays written at three proficiency levels for type-token ratio and average word length. They found out that both lexical complexity features increased steadily as the proficiency level increased. Essays of more proficient writers included longer and more varied words. Cumming et al. (2006) measured average word length and type-token ratio in essays from three ESL levels and found average word length to be affected by proficiency level, although with a small effect

size. According to the TTR results, there were significant differences between Levels 3-4 and Levels 3-5, but no significant differences between Levels 4-5 (Cumming et al., 2006). In a study on how children's use of written vocabulary throughout school years, Durrant and Brenchley (2019) revealed that use of low-frequency words overall did not differ across year-groups, while specific lexical parts of speech were different: "the mean frequencies of verbs and adjectives significantly decreased with age while the mean frequency of nouns significantly increased" (pp. 1950-1951).

## **1.5 The Present Study**

Given the extant literature base, the present study aims to add to the existing complexity literature by examining how syntactic complexity and lexical complexity vary by proficiency. It proceeds from a multi-dimensional perspective of both syntactic complexity, including global, clausal, and phrasal measures and lexical complexity, including lexical diversity, lexical density, and lexical sophistication. The following research questions guided this inquiry:

1. To what extent does syntactic complexity in L2 learners' argumentative writing vary by proficiency?
2. To what extent does lexical complexity in L2 learners' argumentative writing vary by proficiency?

## **2. Method**

### **2.1. Research Design**

This study employs a quantitative research design in investigating variation among the written syntactic and lexical complexity features of L2 learners of English at two proficiency levels (lower and higher). This study was conducted as part of a bigger research investigation on syntactic complexity. Ethical approval was granted from the Human Subjects Ethics Committee of the university where the participants studied and one of the researchers worked at the time of the project application.

### **2.2. Participants**

The participants of this study were 42 undergraduate students enrolled in the English Language and Teaching (ELT) program at a private university with an English-medium of instruction in Turkey. Participants (n=26 female and 16 male) were recruited through an email inviting volunteers to the study. Half of the participants were 2<sup>nd</sup>-year students (lower level), while the other half were 3<sup>rd</sup>-year students (higher level). Turkish was the first language of all participants, and the average number of their ages was 21. According to the language proficiency standards of the ELT program, the participants in the lower level could be defined as "independent users of the language" (B2 level on the CEFR scale) and the participants in the higher level could be defined as "proficient users of the language" (C1 level on the CEFR scale).

### **2.3. Data Collection**

Data for this study were collected through an argumentative writing task. All the participants took a compulsory academic writing course in their first year as a part of their departmental curriculum, thus had background knowledge and prior experience of writing an argumentative essay. Participants were asked to write an essay about whether they agreed or disagreed with the following statement: "It is more important for students to understand

ideas and concepts than it is for them to learn facts.” The prompt was chosen from a TOEFL iBT practice test available free online (Educational Testing Service, 2019). Following the independent writing task procedures of TOEFL as a high-stakes international test, they were asked to write a minimum of 300 words in 30 minutes. Participants completed the writing task on a Google form using a computer in the first researcher’s office. They all participated in the research voluntarily, signing an informed consent form, and were financially compensated for the time they spent on the writing task. In total, 42 argumentative essays were collected (12,172 number of words).

#### 2.4. Data Coding and Analysis

Participants’ essays were first manually coded for syntactic complexity based on 17 structures. Table 1 displays the list of the structures employed in the coding and coded examples from the learner data. The structures were chosen in a way to assess complexity at different levels as global complexity (T-unit length), clausal complexity (verbal, adverbial, relative, adjectival, nominal, passives, modals), and phrasal complexity (prepositional and nominal). Words before the main verb were coded as part of the noun phrase complexity, thus only words within the subject position were coded while other words before the main verb were not. For example, the number of words before the main verb was coded as seven for the following learner sentence excluding the first three words: “In other words, memorizing the facts they need in exams seems easier to them.”

For all the syntactic structures targeted, T-unit was employed as the unit of analysis because it is “the shortest allowable grammatical unit punctuated at the sentence level” (Crossley, 2020, p. 421) and is the most common unit of analysis in L2 writing research. A total of 836 T-units were coded; 379 T-units (5,320 words) from the lower level and 457 T-units (6,852 words) from the higher level.

Table 1.

*Syntactic structures and coded examples from the learner data*

Structure	Examples
1. Words per T-unit	<ul style="list-style-type: none"> <li>– <u>People do not try to change the facts that they already learned.</u> (12 words)</li> <li>– <u>Students cannot improve themselves because of this situation.</u> (8 words) <u>and it won’t be of any use.</u> (6 words)</li> </ul>
2. Finite complement clauses controlled by verbs	<ul style="list-style-type: none"> <li>– People need to <u>understand what</u> they learn.</li> <li>– It is <u>clarified that</u> learning is not enough.</li> </ul>
3. Finite adverbial clauses	<ul style="list-style-type: none"> <li>– <u>While some try to capture the base of information</u> others tend to memorize and try to keep that information forever.</li> <li>– I believe that ideas and concepts are particularly important in students’ education life <u>because it prepares students to the real life.</u></li> </ul>
4. Finite relative clauses	<ul style="list-style-type: none"> <li>– Facts are <u>things that can be changed.</u></li> <li>– Students need study skills <u>which are useful and beneficial to learn facts, to understand or ideas and concepts better.</u></li> </ul>
5. Finite complement clauses controlled by adjectives	<ul style="list-style-type: none"> <li>– It is <u>apparent that</u> people cannot use information.</li> <li>– It is <u>certain that the more a class is active,</u> it is <u>more likely that the students will learn somehow better than just text-book reading.</u></li> </ul>

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6. Finite complement clauses controlled by nouns	<ul style="list-style-type: none"> <li>- That does not change <u>the fact that</u> they usually try to learn facts.</li> <li>- They have no <u>idea what it is</u>.</li> </ul>
7. Prepositional phrases as adverbials	<ul style="list-style-type: none"> <li>- The process of learning something usually happens <u>in schools</u>.</li> <li>- Students, for instance, try to obtain every kind of information <u>through the internet</u>.</li> </ul>
8. Nonfinite complement clauses controlled by verbs	<ul style="list-style-type: none"> <li>- The real meaning that a text <u>wants to give</u> the audience.</li> <li>- They should <u>make students think</u> on facts rather than <u>make them memorize</u> things.</li> </ul>
9. Nonfinite adverbial clauses	<ul style="list-style-type: none"> <li>- <u>Rather than being curious and open minded</u>, they will be standard and close minded people in their future life.</li> <li>- <u>When young</u>, we didn't know how to cook.</li> </ul>
10. Nonfinite relative clauses	<ul style="list-style-type: none"> <li>- I would focus on <u>the idea laying behind this art</u>.</li> <li>- You automatically understand <u>ideas and concepts related to it</u>.</li> </ul>
11. Nonfinite complement clauses controlled by adjectives	<ul style="list-style-type: none"> <li>- Whenever a student learns a wrong fact about the subject, it is <u>very hard to correct that mistaken fact</u>.</li> <li>- It is <u>great to know something completely</u>.</li> </ul>
12. Nonfinite complement clauses controlled by prepositions	<ul style="list-style-type: none"> <li>- The most crucial <u>part of writing</u> a literary review</li> <li>- Showing them they <u>way of finding</u> the right path on their own.</li> </ul>
13. Nonfinite complement clauses controlled by nouns	<ul style="list-style-type: none"> <li>- The most necessary <u>thing to be a good or successful person</u> is understanding the ideas and concepts.</li> <li>- Because only by learning and memorizing those salt facts we have <u>a potential to vanish our creativity</u>.</li> </ul>
14. Prepositional phrases as postmodifiers in the noun phrase	<ul style="list-style-type: none"> <li>- A student can learn <u>all the grammar rules in English</u>.</li> <li>- It is so important to learn <u>the reason behind facts</u>.</li> </ul>
15. Words before the main verb	<ul style="list-style-type: none"> <li>- <u>Grammar</u> is an important issue.</li> <li>- <u>The main responsibility for teachers</u> is that they learn different ideas.</li> </ul>
16. Passives	<ul style="list-style-type: none"> <li>- Some ideas <u>can be perceived</u> very good at the beginning.</li> <li>- Students need to learn knowledge or information which <u>can be used</u> in daily life.</li> </ul>
17. Modals	<ul style="list-style-type: none"> <li>- One <u>should</u> learn facts with its concepts.</li> <li>- We <u>would</u> want to see their own perspectives and ideas.</li> </ul>

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The coded data were then analyzed, calculating frequencies of the structures per text. Table 2 presents how the syntactic complexity measures were operationalized. Operationalizations were based on prior operationalizations of each measure in syntactic complexity research (Biber et al., 2011; Lu, 2011). Means, standard deviations, and confidence intervals were calculated separately for the lower and higher levels. As no normal distribution was found, the analysis of whether there was any syntactic complexity variation among the two proficiency levels was performed using the nonparametric Mann-Whitney U test.



The accuracy of the coding was established through an analysis of discordance between the codes of both authors who independently coded a random sample of 125 T-units (15%). The initial inter-coder agreement was 88%. Disagreements were resolved by discussion between the two authors. After total consensus was reached, the second author coded the rest of the data.

Table 2.

*Measures of syntactic complexity and operationalizations*

Measure	Operationalization
1. Words per T-unit	Number of words divided by number of T- units per text
2. Finite complement clauses - verbs per T-unit	Number of finite complement clauses controlled by verbs divided by number of T- units per text
3. Finite adverbial clauses per T-unit	Number of finite adverbial clauses divided by number of T- units per text
4. Finite relative clauses per T-unit	Number of finite relative clauses divided by number of T- units per text
5. Finite complement clauses - adjectives per T-unit	Number of finite complement clauses controlled by adjectives divided by number of T- units per text
6. Finite complement clauses - nouns per T-unit	Number of finite complement clauses controlled by nouns divided by number of T- units per text
7. Prepositional phrases as adverbials per T-unit	Number of prepositional phrases as adverbials divided by number of T- units per text
8. Nonfinite complement clauses - verbs per T-unit	Number of nonfinite complement clauses controlled by verbs divided by number of T- units per text
9. Nonfinite adverbial clauses per T-unit	Number of nonfinite adverbial clauses divided by number of T- units per text
10. Nonfinite relative clauses per T-unit	Number of nonfinite relative clauses divided by number of T- units per text
11. Nonfinite complement clauses - adjectives per T-unit	Number of nonfinite complement clauses controlled by adjectives divided by number of T- units per text
12. Nonfinite complement clauses - prepositions per T-unit	Number of nonfinite complement clauses controlled by prepositions divided by number of T- units per text
13. Nonfinite complement clauses - nouns per T-unit	Number of nonfinite complement clauses controlled by nouns divided by number of T- units per text
14. Prepositional phrases as postmodifiers in the noun phrase per T-unit	Number of prepositional phrases as postmodifiers in the noun phrase divided by number of T- units per text
15. Words before the main verb	Number of words before the main verb divided by number of T- units per text
16. Passives	Number of passives divided by number of T- units per text
17. Modals	Number of modals divided by number of T- units per text

Lexical complexity was assessed automatically using the Lexical Complexity Analyzer (LCA) developed by Lu (2012). LCA has only one measure for lexical density but a number of different measures for lexical diversity and lexical sophistication. One measure was chosen for each of these dimensions: the measure of corrected type-token ratio (CTTR) for lexical diversity and the measure of lexical sophistication (LS1). CTTR was chosen over the other lexical diversity measures because it was one of the three transformed TTR measures that performed the best in previous research (Lu, 2012).

### 3. Findings

Table 3 provides an overview of the descriptive findings for the syntactic features used in argumentative essays written by learners from the lower- and higher-level groups. The Mann-Whitney U test results showed significant differences between the groups in three of the syntactic measures explored: finite complement clauses controlled by nouns, words before the main verb, and passives.

Table 3.

*Descriptive findings for syntactic complexity measures*

Measures	Lower Level			Higher Level		
	M	SD	95% CI	M	SD	95% CI
Words per T-unit	14.44	2.90	13.12-15.76	15.57	3.50	13.98-17.16
Finite complement clauses - verbs	0.19	0.15	0.12-0.26	0.16	0.11	0.11-0.21
Finite adverbial clauses	0.31	0.16	0.24-0.38	0.27	0.17	0.19-0.35
Finite relative clauses	0.04	0.07	0.01-0.07	0.06	0.12	0.00-0.11
Finite complement clauses - adjectives	0.00	.00	0.00-0.00	0.01	0.02	0.00-0.02
Finite complement clauses - nouns	0.00	0.01	0.00-0.01	0.02	0.03	0.00-0.03
Prepositional phrases as adverbials	0.65	0.24	0.54-0.76	0.66	0.23	0.56-0.77
Nonfinite complement clauses - verbs	0.24	0.19	0.15-0.32	0.23	0.23	0.12-0.34
Nonfinite adverbial clauses	0.14	0.11	0.09-0.19	0.12	0.10	0.08-0.17
Nonfinite relative clauses	0.04	0.07	0.01-0.07	0.06	0.12	0.00-0.11
Nonfinite complement clauses - adjectives	0.08	0.08	0.04-0.12	0.14	0.12	0.09-0.19
Nonfinite complement clauses - nouns	0.03	0.06	0.01-0.06	0.03	0.04	0.01-0.05
Nonfinite complement clauses - prepositions	0.06	0.07	0.03-0.09	0.05	0.06	0.02-0.08
Prepositional phrases as postmodifiers in the NP	0.27	0.16	0.20-0.34	0.31	0.16	0.23-0.38
Words before the main verb	2.37	0.35	2.21-2.53	2.86	0.77	2.51-3.21
Passives	0.09	0.12	0.03-0.14	0.19	0.16	0.12-0.26
Modals	0.38	0.21	0.29-0.48	0.45	0.15	0.38-0.52

As demonstrated in Table 4, argumentative essays written by higher-level learners included a significantly higher number of finite complement clauses controlled by nouns ( $U=273.50$ ,  $p<.05$ ) as well as significantly more words before the main verb ( $U=312.00$ ,  $p<.05$ ) and passive constructions ( $U=339.50$ ,  $p<.01$ ). No statistical significance was found between the two groups for the other syntactic measures examined.

Table 4.

*Mann-Whitney U Test findings for syntactic complexity measures*

Measure	Level	Mean rank	U	Z	P
Words per T-unit	Higher	23.14	255.00	0.87	0.39
	Lower	19.86			
Finite complement clauses - verbs	Higher	20.10	191.00	-0.74	0.46
	Lower	22.90			
Finite adverbial clauses	Higher	19.36	175.50	-1.13	0.26
	Lower	23.64			
Finite relative clauses	Higher	23.86	270.00	1.25	0.21
	Lower	19.14			
Finite complement clauses - adjectives	Higher	22.50	241.50	1.43	0.15
	Lower	20.50			
Finite complement clauses - nouns	Higher	24.02	273.50	2.05	0.04
	Lower	18.98			
Prepositional phrases as adverbials	Higher	22.17	234.50	0.35	0.72
	Lower	20.83			
Nonfinite complement clauses - verbs	Higher	20.43	198.00	-0.57	0.57
	Lower	22.57			
Nonfinite adverbial clauses	Higher	20.40	197.50	-0.58	0.56
	Lower	22.60			
Nonfinite relative clauses	Higher	21.43	219.00	-0.04	0.97
	Lower	21.57			
Nonfinite complement clauses - adjectives	Higher	24.38	281.00	1.54	0.12
	Lower	18.62			
Nonfinite complement clauses - prepositions	Higher	20.83	206.50	-0.37	0.71
	Lower	22.17			
Nonfinite complement clauses - nouns	Higher	22.62	244.00	.66	0.51
	Lower	20.38			
Prepositional phrases as postmodifiers in the NP	Higher	22.40	239.50	0.48	0.63
	Lower	20.60			
Words before the main verb	Higher	25.86	312.00	2.30	0.02
	Lower	17.14			
Passives	Higher	27.10	339.50	3.02	0.003
	Lower	15.83			
Modals	Higher	24.26	278.50	1.47	0.14
	Lower	18.74			

Table 5 displays the descriptive findings for the lexical complexity measures for the lower-level and the higher-level groups. Lexical density and lexical sophistication features were almost the same in the writing of both proficiency groups, while lexical diversity was slightly higher in the essays from the higher-proficiency group. However, the Mann-Whitney U test results showed no statistical difference in any of the lexical complexity measures between the two groups (see Table 6).

Table 5.

*Descriptive findings for lexical complexity measures*

Measures	Lower Level			Higher Level		
	M	SD	95% CI	M	SD	95% CI
Lexical diversity	4.94	0.57	4.68-5.20	5.12	0.60	4.84-5.39
Lexical density	0.50	0.03	0.49-0.52	0.49	0.03	0.48-0.50
Lexical sophistication	0.13	0.06	0.10-0.16	0.13	0.04	0.12-0.15

Table 6.

*Mann-Whitney U Test findings for lexical complexity measures*

Measure	Level	Mean rank	U	Z	P
Lexical diversity	Higher	22.19	235.00	0.37	0.72
	Lower	20.81			
Lexical density	Higher	18.71	162.00	-1.49	0.14
	Lower	24.29			
Lexical sophistication	Higher	22.67	245.00	0.62	0.54
	Lower	20.33			

#### 4. Discussion and Conclusion

The present study explored proficiency-related variation among syntactic complexity and lexical complexity in L2 learners' writing. To this end, 42 argumentative essays written by learners from two proficiency levels were analyzed. The results indicate that three complexity measures significantly varied among the two proficiency levels: finite complement clauses controlled by nouns, words before the main verb, and passives. However, there was no significant difference between the groups in lexical complexity.

In reference to noun phrase complexity, our study has shown that essays that were written by learners from the higher proficiency group were characterized by a higher number of words before the main verb (noun phrases in the subject position) and complement clauses controlled by nouns (noun phrases in the subject and object position). Our finding of more words before the main verb relates to the connection between the accessibility of the main verb in a sentence and the mental effort required for processing, supporting earlier findings from syntactic complexity research (e.g., Crossley & McNamara, 2014; McNamara, Crossley, & McCarthy, 2010). Crossley and McNamara (2014) argue that "the main verb controls the arguments in the sentence and the longer it takes to access the main verb, the more complex the sentence is" (p. 70). For example, the longer subject in the first learner sentence below makes it more complex than the second one:

- 1- The most important thing that teachers can teach to their students is the ability to think for themselves.
- 2- The most important part is to expose them the native usage of the language.

Another complexity measure that discriminated the proficiency levels in our study was the number of passive constructions per T-unit. The writing of more proficient writers demonstrated significantly more passive constructions. This finding is not surprising given that passives are a common feature of academic writing, assisting writers in compressing information rather than elaborating on the performers of an action (Staples, Egbert, Biber, & Gray, 2016). Thus, more proficient or advanced learners are expected to utilize passive forms in their written texts (Hinkel, 2002). It also supports earlier findings on complexity and academic writing (Biber, 1988; Ferris, 1994; Frase et al., 1999; Grant & Ginther, 2000). For ESL or EFL learners, passives are also one of the difficult subjects in L2 grammar (Hinkel, 2002). This difficulty is due to its cognitive complexity and the mental effort required for processing (Housen et al., 2005; Kameen, 1979). It seems reasonable to conclude that syntactic complexity and cognitive complexity often go hand in hand; syntactic structures that are more complex are also cognitively more demanding to process or more difficult to learn.

Regarding complement clauses, clauses controlled by nouns are considered syntactically more complex than clauses controlled by adjectives or verbs (Biber et al., 2011). Learners are expected to learn verb or adjective-complement clauses before noun-complement clauses. The developmental progression for these structures is specified by Biber et al. (2011, pp. 30-31) as the following (examples are from Biber, Gray, Staples, and Egbert, 2020):

Finite complement clauses controlled by verbs - Stage 1-2 (e.g., “I would hope that we can have more control over them.”)

Nonfinite complement clauses controlled by verbs - Stage 3 (e.g., “I really want to fix this room up.”)

Finite complement clauses controlled by adjectives - Stage 3 (e.g., “It is evident that the virus formation is related to the cytoplasmic inclusions.”)

Nonfinite complement clauses controlled by adjectives - Stage 4 (e.g., “It was important to obtain customer feedback.”)

Complement clauses controlled by nouns - Stage 5 (e.g., “The fact that no tracer particles were found in or below the tight junction (zonula occludens) indicates that these areas are not a pathway for particles of this size in the toad bladder.”)

According to this developmental progression, among the complement clauses, noun clauses are the latest group for language learners to learn and to produce. They are placed in Stage 5, which includes the most typical complexities of academic writing. In our study, verb-complement or adjective complement clauses failed to identify significant differences between the proficiency groups, but finite complement clauses controlled by nouns were significantly associated with proficiency, with students from the higher-proficiency group using more noun-complement clauses in their essays.

In this study, we used only one measure of production length, which was the mean length of the T-unit. Complexity research has produced rather mixed results for this measure. Some studies have documented an increase in T-unit length in line with the increase in proficiency level or writing quality and/or scores (e.g., Ai & Lu, 2013; Yang et al., 2015), while in some others, T-unit as a measure of the length of production was not comparable across different proficiency levels (e.g., Mancilla et al., 2017). Our findings support the latter group of studies. Researchers (e.g., Mancilla et al., 2017) attribute the mixed results regarding T-unit to the differences in studies such as the level of the learners (e.g., graduate versus undergraduate or different CEFR levels), the writing conditions (e.g., timed versus untimed or online versus offline), or genre (e.g., narrative versus argumentative). Regarding the level of the learners, previous research has mostly compared lower CEFR levels (i.e., A1, A2, and B1) for T-unit length (e.g., Gyllstad, Granfeldt, Bernardini, & Källkvist, 2014; Verspoor, Schmid, & Xu, 2012). We wonder if the distinction may be larger between the lower levels, which is a direction for future research.

Overall, in our study, a very small number of complexity measures were found to predict L2 proficiency. This might be due to two reasons: the distinction between the language levels examined and the use of very specific syntactic measures. The adjacent CEFR levels such as B1-B2 or B2-C1 might be less different from each other in language performance than nonadjacent levels such as B1-C1 or B2-C2. Previous research has shown that some linguistic features are shared between adjacent levels, but not between nonadjacent levels (Chen & Baker, 2016). Second, in this study, we were interested in the very specific complexity differences between the groups and thus looked into specific syntactic structures rather than generic ones. For example, we did not assess learners' use of dependent clauses in general as has been done in several existing studies on syntactic complexity (e.g., Lu, 2011), but we conducted a detailed analysis addressing specific types of structures such as adverbial clauses,

adjective clauses or noun clauses. This might have affected our results since the frequency of each specific structure would be much smaller than the frequency of all structures from a group, e.g., adverbial clauses specifically versus dependent clauses all together.

Our findings provided no support for our expectation that texts written by higher proficiency learners would be lexically more diverse, dense, and sophisticated. Such a lack of predictive power of lexical complexity in proficiency was also observed in previous research (e.g., Bulté & Housen, 2014) as opposed to other studies providing counter-evidence (e.g., Cumming et al., 2006; Grant & Ginther, 2000). As an explanation for this, Paquot (2019) claims that adjacent levels such as B2-C1 or C1-C2 are not that much comparable since the language development between these levels is not lexical, but rather phraseological. This seems to apply to the participants in our study who were from the adjacent levels of B2 and C1. Regarding the parallel between syntactic complexity and lexical complexity, our findings weaken any potential of lexical complexity as a driver of the development of syntactic complexity and strengthen their potential as independent dimensions of L2 proficiency (Bulté & Housen, 2014; Johnson, 2017; Skehan, 2009).

Findings from this study are informative with regard to the explicit teaching of complexity in L2 writing classrooms. Despite the growing calls for instructional interventions for students' complexity development (e.g., Ai & Lu, 2013; Atak & Saricaoglu, 2021), no models or examples that can guide teachers' instructional planning exist. For efficacy, writing teachers' pedagogical practices should rely on research findings. While existing complexity research mostly focuses on clausal and phrasal structures, L2 teachers should also pay attention to different aspects of complexity, such as passive voice. L2 learners of English from certain L1 backgrounds, such as Turkish, find passive voice to be more difficult (Saricaoglu, 2019) and might benefit from a more explicit focus on passive constructions within the process of complexity development. Moreover, addressing syntactic development rather than lexical development might be a more realistic goal in the short-term since there is not much lexical difference between adjacent levels of development.

This study was conducted on a small sample of texts because syntactic features were hand-coded. Our results need to be interpreted taking into account this small dataset. Larger data samples will certainly be more beneficial in future research studies. Future studies could also conduct comparisons between nonadjacent CEFR levels, which will provide a more precise picture of variation in syntactic complexity by proficiency. While our analysis included a number of complexity measures, there are some indices that we could not examine, such as verb phrases, verb phrase length, or negations. To better understand complexity, future studies should incorporate as many indices as possible.

### **Note on Ethical Issues**

The authors confirm that ethical approval was obtained from TED University (Approval Date: 31/07/2018).

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