

# Syntactic Complexity in Children's Digital Story Texts Across BOOKR Class Levels

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**ABSTRACT :** *This study investigates the progression of syntactic complexity in children's story texts from the BOOKR Class digital reading application across nine graded levels. Using a quantitative approach, syntactic complexity was measured through sixteen indicators grouped into four dimensions: Subordination, Length of Production, Coordination, and Nominalization. Descriptive statistics, one-way ANOVA, and Games–Howell post hoc tests were employed to examine differences across levels. The results reveal statistically significant variation in all indicators, indicating a systematic and cumulative increase in syntactic complexity as reading levels advance. While adjacent levels often show non-significant differences, substantial contrasts emerge between distant levels, reflecting a gradual and developmentally appropriate progression. Minor non-linear fluctuations further suggest dynamic redistribution of syntactic features rather than regression. Overall, the findings provide empirical evidence that BOOKR Class implements a linguistically principled leveling system and demonstrate the usefulness of syntactic complexity measures for evaluating graded digital reading materials designed for young language learners.*

**KEYWORDS** – BOOKR Class, Children's literature, Digital story texts, Graded reading materials, Syntactic complexity

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## I. INTRODUCTION

The ability to comprehend texts of increasing linguistic complexity is fundamental to children's language development, particularly in second language (L2) learning contexts. Syntactic complexity plays a crucial role in determining text difficulty and shaping reading comprehension, as it influences how grammatical information is processed and integrated during reading (Ortega, 2003). For young learners, exposure to syntactic structures that are appropriately calibrated to their developmental stage can support linguistic growth, whereas texts that are syntactically misaligned may hinder comprehension and reduce learning effectiveness (Beers & Nagy, 2009).

In response to this need, digital reading platforms increasingly employ graded text systems to scaffold learners' language development. BOOKR Class is a digital storybook platform designed for children and early adolescents, organizing narrative texts into nine reading levels broadly aligned with the Common European Framework of Reference for Languages. The platform assumes that syntactic complexity increases progressively across levels in line with learners' proficiency. Previous research on children's narrative texts suggests that written stories typically expose learners to more complex syntactic structures than spoken child-directed input, particularly through longer sentences and clause expansion (Montag, 2019). However, the presence of complex

structures alone does not guarantee that they are distributed in a systematic and developmentally appropriate manner across graded levels.

A substantial body of research has proposed quantitative frameworks for measuring syntactic complexity in written texts. Lu (2010) demonstrated that syntactic complexity can be reliably operationalized through multiple structural indicators, including clause density and unit length. Building on this work, Xu (2023) introduced a multidimensional model that integrates clause-based elaboration and phrase-level density to capture a more comprehensive picture of syntactic complexity. Studies on children's language development further indicate that syntactic complexity tends to increase with age and proficiency, particularly through expanded clause relations and denser grammatical constructions (Košutar et al., 2022). At the same time, research on learner language suggests that syntactic development is not always strictly linear, as temporary plateaus or fluctuations may occur during transitional stages (Wang, 2022).

Despite these advances, existing studies have primarily focused on learner-produced texts or traditional print materials. Empirical research examining syntactic complexity as an inherent design feature of graded digital reading materials remains limited. In particular, no prior study has systematically analyzed how syntactic complexity is distributed across the nine reading levels of BOOKR Class. As a result, it remains unclear whether the platform's leveling system reflects a cumulative and pedagogically meaningful progression of syntactic difficulty or merely assumes alignment with proficiency standards.

The purpose of this study is to quantitatively examine syntactic complexity across the nine BOOKR Class reading levels by analyzing sixteen indicators grouped into four dimensions: Subordination, Length of Production, Coordination, and Nominalization. Using descriptive statistics and one-way ANOVA supported by the Games–Howell post hoc test, this study investigates whether syntactic complexity differs significantly across levels and whether the observed progression reflects gradual, cumulative development rather than abrupt change.

This study contributes to the literature in three ways. First, it provides the first comprehensive syntactic complexity profile of BOOKR Class story texts, offering empirical evidence on how syntactic structures are distributed across graded digital reading levels. Second, it extends syntactic complexity research to the underexplored domain of children's digital storybooks, thereby bridging research on linguistic complexity and educational technology. Third, by quantitatively validating syntactic progression across levels, the study informs the design and evaluation of graded reading materials for young L2 learners.

The remainder of this paper is organized as follows. The next section presents the methodological framework used in the study. The results section reports descriptive statistics, ANOVA findings, and post hoc comparisons. The discussion interprets the findings in relation to syntactic progression in graded texts, followed by a conclusion outlining implications and directions for future research.

## **II. METHOD AND THEORY**

### **2.1 Method**

This study employed a quantitative research design to examine syntactic complexity across nine graded reading levels in the BOOKR Class digital storybook platform. A quantitative approach was selected because the study aims to measure linguistic features numerically and to compare patterns of syntactic complexity across multiple predefined groups in a systematic manner (Creswell, 2004; Creswell, 2014). A total of 45 storybooks five from each level (Levels 1–9) were selected using purposive sampling, which allows researchers to deliberately select data sources that are most relevant to the research objectives and analytical requirements (Creswell, 2004).

The purposive sampling was guided by three criteria. First, the selected storybooks contain complete narrative texts that provide sufficient syntactic material for quantitative analysis. Second, each storybook is clearly classified into a specific BOOKR Class level, ensuring consistency and comparability across levels. Third, the selected storybooks are representative of the typical linguistic characteristics of their respective levels in terms of sentence structure, narrative organization, and grammatical patterns. Selecting multiple storybooks from each level was intended to minimize the influence of individual text variation and to capture a more stable syntactic

profile of each level (Creswell, 2014). All texts were collected through screenshot documentation within the BOOKR Class application and manually transcribed for analysis due to platform restrictions on text export.

Syntactic complexity was measured using sixteen indicators adapted from Xu's (2023) multidimensional framework, categorized into four dimensions: Subordination, Length of Production, Coordination, and Nominalization. Each sentence, clause, and T-unit was manually identified and coded to ensure accurate calculation of the quantitative measures.

Data analysis was conducted in two stages. First, descriptive statistics were used to describe distributional patterns of syntactic complexity across levels. Second, a one-way ANOVA was employed to examine whether statistically significant differences existed among the nine levels. Because Levene's Test indicated that the assumption of homogeneity of variances was violated for most indicators, the Games–Howell post hoc test was applied to identify pairwise differences between levels. All statistical analyses were conducted using SPSS to ensure consistency and replicability.

## **2.2 Theory**

This study adopts a structural and quantitative perspective on syntactic complexity grounded primarily in Hunt's (1965) foundational concept of the T-unit and Xu's (2023) multidimensional model of syntactic complexity. Hunt defines the T-unit as the minimal independent clause together with all subordinate clauses attached to it and argues that increases in T-unit length, frequency, and internal structure reflect developmental gains in syntactic maturity. Because the T-unit captures both clause expansion and phrasal growth, it remains one of the most widely used units for measuring written syntactic proficiency and forms the basis of the present analysis.

Building on this foundation, the study employs Xu's (2023) comprehensive framework, which operationalizes syntactic complexity through four dimensions and sixteen indicators: (1) Subordination, capturing the use of dependent clauses and clausal embedding; (2) Length of Production, measuring the size and density of sentences, T-units, and clauses; (3) Coordination, reflecting horizontal structural expansion through coordinated phrases and clauses; and (4) Nominalization, representing phrasal complexity through the use of complex noun phrases. This model integrates both clause-based and phrase-based complexity, enabling a fine-grained analysis of how syntactic difficulty develops across text levels.

To interpret the structural mechanisms underlying the quantitative patterns identified by Xu's indicators, this study draws on Biber and Gray's (2016) distinction between clausal elaboration and phrasal compression. Clausal elaboration refers to increases in complexity achieved through the addition of coordinated and subordinated clauses, whereas phrasal compression involves the packaging of information into dense phrasal structures, particularly complex noun phrases and nominalizations. Biber and Gray argue that syntactic development often involves a shift from clause-based elaboration toward greater phrasal compression at more advanced levels, providing a useful interpretive lens for explaining how complexity increases across graded texts.

Together, Hunt's concept of the T-unit and Xu's multidimensional metrics constitute the core theoretical framework of this study, while Biber and Gray's model serves as an interpretive perspective for explaining the mechanisms through which syntactic complexity develops across BOOKR Class levels.

## **III. RESULT AND DISCUSSION**

### **3.1 Result**

This section presents the results of the syntactic complexity analysis of children's story texts across the nine BOOKR Class reading levels. The findings are organized according to the four major dimensions of syntactic complexity, Subordination, Length of Production, Coordination, and Nominals along with their corresponding indicators. Descriptive statistics are first used to illustrate overall patterns and developmental progression across levels, followed by inferential analyses to determine whether these differences are statistically significant. The discussion then relates the quantitative results to relevant theoretical perspectives, highlighting how the observed progression aligns with expected linguistic development in young English learners and with established research on syntactic complexity. Together, the results and discussion provide a comprehensive interpretation of how

BOOKR Class structures its leveled texts and the extent to which these levels reflect a coherent progression in linguistic difficulty.

### 3.1.1 Descriptive Analysis

Descriptive analysis shows that syntactic complexity in BOOKR Class texts increases consistently from Level 1 to Level 9 across all measured dimensions.

**Tabel 1.1**  
**Result of Descriptive Analysis**

Dimensi	Indikator	Level								
		1	2	3	4	5	6	7	8	9
Subordination	C/T	1.02	0.98	0.98	1.07	1.19	1.44	1.32	1.31	1.36
	DC/C	0.04	0.01	0.03	0.07	0.16	0.25	0.20	0.24	0.25
	DC/T	0.04	0.01	0.03	0.08	0.20	0.40	0.27	0.32	0.35
	CT/T	0.04	0.01	0.03	0.07	0.18	0.29	0.25	0.31	0.31
	VP/T	1.07	0.95	1.01	1.23	1.38	1.82	1.55	1.73	1.68
Length of Production	MLS	4.28	4.40	5.43	7.34	8.83	10.92	12.57	11.70	13.34
	MLT	4.95	4.79	5.77	7.06	8.26	9.91	10.09	10.58	12.34
	MLC	4.83	4.91	5.92	6.63	6.92	7.09	7.70	8.07	9.14
	T/S	0.86	0.92	0.94	1.04	1.07	1.09	1.24	1.10	1.08
	C/S	0.89	0.90	0.92	1.11	1.27	1.58	1.64	1.44	1.47
Coordination	CP	0.80	2.40	6.60	11.80	9.60	12.80	20.20	18.00	30.80
	CP/T	0.06	0.07	0.11	0.18	0.15	0.27	0.26	0.26	0.35
	CP/C	0.06	0.07	0.11	0.17	0.13	0.20	0.20	0.20	0.26
Nominalization	CN	4.80	6.20	15.40	22.40	39.00	29.60	57.00	56.40	94.60
	CN/T	0.25	0.17	0.28	0.34	0.61	0.64	0.70	0.85	1.09
	CN/C	0.23	0.17	0.29	0.32	0.51	0.47	0.53	0.64	0.81

In the subordination dimension, the ratio of dependent clauses per T-unit (DC/T) rises from 0.04 at Level 1 to 0.34 at Level 9. A similar pattern appears in dependent clauses per clause (DC/C), which increases from only 0.03 at Level 1 to 0.25 at Level 9. The indicator clauses per T-unit (C/T) also grows from 1.01 at Level 1 to 1.44 at Level 9, indicating an increase in the number of clauses contained within a single syntactic unit. Complexity becomes even more apparent through complex T-units per T-unit (CT/T), which increase from 0.04 to 0.31. Additionally, verb phrases per T-unit (VP/T) rise from 1.06 to 1.81, reflecting increasingly complex and information-dense predication structures. These findings indicate that the role of subordination in meaning construction expands substantially at the higher levels.

In the length of production dimension, a significant expansion occurs across various syntactic units. The mean length of sentence (MLS) increases from 4.27 words per sentence at Level 1 to 13.34 words at Level 9. The mean length of T-unit (MLT) also develops from 4.94 to 12.33 words, indicating the addition of more syntactic elements within the main clause. The mean length of clause (MLC) follows a similar trend, increasing from 4.82 to 9.14 words per clause. In addition, T-units per sentence (T/S) grow from 0.86 to 1.23, while clauses per sentence (C/S) rise from approximately 0.88–0.92 at Levels 1–3 to more than 1.60 at Levels 6–7. Overall, this dimension demonstrates quantitative increases in length, density, and the number of grammatical units that make up each sentence.

In the coordination dimension, all three indicators show notable increases. The simple count of coordinate phrases (CP) rises sharply from 0.80 at Level 1 to 30.80 at Level 9, a substantial surge indicating the increasingly prominent use of coordination at higher levels. The ratio of CP per clause (CP/C) increases steadily from 0.05 to 0.26, while CP per T-unit (CP/T) grows from 0.06 to 0.35. These increases demonstrate that coordination is used more frequently as a syntactic elaboration strategy to expand information horizontally.

In the nominalization dimension, the increase is the most significant of all. The number of complex nominals (CN) rises dramatically from 4.80 at Level 1 to 94.60 at Level 9. At the ratio level, complex nominals per T-unit (CN/T) increase from 0.24 to 1.08, while complex nominals per clause (CN/C) grow from 0.23 to 0.80. This sharp rise reflects the development of denser and more layered nominal phrase structures, including the use of attributive modifiers, prepositional phrases, participial modifiers, and embedded noun phrases. These changes strongly indicate a shift from clause-based elaboration toward phrasal compression, a hallmark of advanced syntactic proficiency.

Overall, the four dimensions display clear and systematic numerical increases across all indicators. Lower levels are dominated by simple structures with minimal clausal expansion, while higher levels feature more layered clauses, richer coordination, and substantially more complex nominal phrases. This developmental pattern provides strong evidence that BOOKR Class employs a syntactic progression that aligns with increasing reading difficulty and the expected cognitive-linguistic growth of its readers.

### 3.1.2 Homogeneity of Variance Test (Levene's Test)

Levene's Test was used to examine whether the variance of each syntactic complexity indicator was equal across the nine BOOKR Class levels. The results show that several indicators meet the assumption of homogeneity, while most indicators violate it, indicating that their variances differ significantly across levels.

**Table 1.2**  
**Result of Homogeneity of Variance Test**

Dimension	Indicator	Sig.	Variance Assumption
Length of Production	MLS	.042	Not homogeneous
	MLT	.044	Not homogeneous
	MLC	.051	Homogeneous
	C/S	.021	Not homogeneous
	T/S	.133	Homogeneous
Subordination	VP/T	.042	Not homogeneous
	C/T	.003	Not homogeneous
	DC/C	.018	Not homogeneous
	DC/T	.002	Not homogeneous
	CT/T	.003	Not homogeneous
Coordination	CP/T	.003	Not homogeneous
	CP/C	.048	Not homogeneous
	CP	.118	Homogeneous
Nominalization	CN/T	.006	Not homogeneous
	CN/C	.031	Not homogeneous
	CN	.015	Not homogeneous

Indicators that meet the homogeneity assumption ( $p > .05$ ) include CP (coordinate phrases) ( $p = .118$ ), MLC (mean length of clause) ( $p = .051$  for mean), T/S (T-units per sentence) ( $p = .133$ ), and CP/C (coordinate phrases per clause) ( $p = .048$  for mean but  $> .05$  for median and trimmed mean), suggesting relatively similar variance patterns across levels for these measures.

However, the majority of indicators violate the assumption of homogeneity, particularly when assessed using the "Based on Mean" value. These include the indicators for nominal complexity (CN,  $p = .015$ ; CN/T,  $p = .006$ ; CN/C,  $p = .031$ ), sentence and T-unit length (MLS,  $p = .042$ ; MLT,  $p = .044$ ), coordination density (CP/T,  $p = .003$ ), and all subordination measures (C/T,  $p = .003$ ; DC/C,  $p = .018$ ; DC/T,  $p = .002$ ; CT/T,  $p = .003$ ). In these cases, the significant p-values indicate that the variances differ significantly among levels, meaning the assumption of equal variances required for standard ANOVA post hoc tests is not satisfied.

Given that most indicators show unequal variances, this study follows established statistical guidelines by applying the Games–Howell post hoc test, which is specifically recommended for comparisons when variances

are unequal and group sizes differ. The use of Games–Howell ensures accurate identification of pairwise differences without violating ANOVA assumptions.

### 3.1.3 ANOVA Result

The ANOVA results reveal strong and statistically significant differences across all subordination indicators among the nine BOOKR Class levels.

**Table 1.3**  
**Result of ANOVA Test**

Dimension	Indicator	F (8, 36)	Sig. (p)	Interpretation
Coordination	CP	9.220	< .001	Significant
	CP/T	4.694	< .001	Significant
	CP/C	3.312	< .006	Significant
Nominalization	CN	22.194	< .001	Significant
	CN/T	13.722	< .001	Significant
	CN/C	8.732	< .001	Significant
Length of Production	MLS	21.084	< .001	Significant
	MLT	24.546	< .001	Significant
	MLC	8.263	< .001	Significant
	T/S	9.448	< .001	Significant
	C/S	11.761	< .001	Significant
Subordination	VP/T	13.709	< .001	Significant
	C/T	9.721	< .001	Significant
	DC/C	13.023	< .001	Significant
	DC/T	7.989	< .001	Significant
	CT/T	12.104	< .001	Significant

The measure clauses per T-unit (C/T) shows a significant effect,  $F(8,36) = 9.721$ ,  $p < .001$ , indicating that higher-level texts contain more clauses within each T-unit. The ratio of dependent clauses per clause (DC/C) also differs significantly,  $F(8,36) = 13.023$ ,  $p < .001$ , confirming that subordinate clauses increase systematically as the reading level rises. Similarly, dependent clauses per T-unit (DC/T) demonstrates a significant difference,  $F(8,36) = 7.989$ ,  $p < .001$ , reflecting greater embedding of subordinate structures in the higher levels. In addition, complex T-units per T-unit (CT/T) shows significant variation,  $F(8,36) = 12.104$ ,  $p < .001$ , indicating that more T-units contain at least one dependent clause as levels progress. Even verb phrases per T-unit (VP/T) differs significantly across levels,  $F(8,36) = 13.709$ ,  $p < .001$ , suggesting increased predication complexity in more advanced texts. Together, these results demonstrate a consistent rise in subordination from Level 1 to Level 9, marking a clear shift from simple clause structures toward more layered and embedded constructions.

All indicators related to the length of linguistic units show highly significant differences across levels. Mean length of sentence (MLS) increases significantly, as indicated by ANOVA,  $F(8,36) = 21.084$ ,  $p < .001$ , showing that sentences at higher levels contain considerably more words. Mean length of T-unit (MLT) demonstrates an even stronger effect,  $F(8,36) = 24.546$ ,  $p < .001$ , suggesting that T-units become more expanded and structurally dense at advanced levels. The measure mean length of clause (MLC) also varies significantly,  $F(8,36) = 8.263$ ,  $p < .001$ , reflecting that clauses become longer and more information-rich. Furthermore, significant differences are found in T-units per sentence (T/S),  $F(8,36) = 9.448$ ,  $p < .001$ , and clauses per sentence (C/S),  $F(8,36) = 11.761$ ,  $p < .001$ , indicating that sentences increasingly contain multiple T-units and clauses as the levels progress. These findings collectively demonstrate substantial growth in structural length and syntactic density across the BOOKR Class levels.

The coordination dimension also shows statistically significant variation across all indicators. Coordinate phrases (CP) differs significantly among levels,  $F(8,36) = 9.220$ ,  $p < .001$ , indicating a marked increase in the use of coordinate structures at higher levels. The ratio CP per T-unit (CP/T) shows a significant effect,  $F(8,36) =$



4.694,  $p = .001$ , confirming that coordinate phrases are used more frequently to expand T-unit structure in advanced texts. Likewise, CP per clause (CP/C) exhibits significant variation,  $F(8,36) = 3.312$ ,  $p = .006$ , demonstrating that clauses in upper levels contain more coordinated elements. These combined results indicate that coordination constitutes an increasingly important strategy for syntactic elaboration as text complexity rises, contributing to broader horizontal expansion of clauses and sentences in higher-level BOOKR materials.

The nominalization dimension presents the strongest differences among all dimensions examined. Complex nominal (CN) shows a highly significant effect,  $F(8,36) = 22.194$ ,  $p < .001$ , reflecting a dramatic rise in the use of information-dense noun phrases at higher levels. Similarly, complex nominals per T-unit (CN/T) varies significantly,  $F(8,36) = 13.722$ ,  $p < .001$ , indicating increasing nominal density within each syntactic unit. The ratio complex nominals per clause (CN/C) also differs significantly,  $F(8,36) = 8.732$ ,  $p < .001$ , suggesting that clauses at advanced levels contain more layered noun phrase structures, including modifiers, prepositional phrases, and embedded nominals. These findings demonstrate that the BOOKR Class texts evolve toward greater phrasal compression, a hallmark of advanced syntactic development in which information is increasingly packaged within complex noun phrases rather than through additional clauses. This dimension exhibits the sharpest growth, signaling its major role in shaping syntactic difficulty across levels.

### 3.1.4 Games–Howell Post Hoc Results

The Games–Howell post hoc results indicate that statistically significant differences in subordination emerge primarily between lower and higher BOOKR Class levels. For dependent clauses per T-unit (DC/T), Level 1 differs significantly from Level 8 ( $MD = -0.26$ ,  $p = .039$ ) and Level 9 ( $MD = -0.30$ ,  $p = .001$ ), demonstrating a substantial increase in subordinate clause use at advanced levels. A similar pattern is observed for clauses per T-unit (C/T), where Level 1 differs significantly from Level 8 ( $p = .046$ ) and Level 9 ( $p = .001$ ). The indicator dependent clauses per clause (DC/C) shows significant differences between Level 1 and Level 7 ( $MD = -0.18$ ,  $p = .034$ ), Level 8 ( $MD = -0.21$ ,  $p = .007$ ), and Level 9 ( $MD = -0.27$ ,  $p < .001$ ), indicating that subordination becomes prominent starting at Level 7. In addition, complex T-units per T-unit (CT/T) and verb phrases per T-unit (VP/T) show significant contrasts between Level 1 and the highest levels, particularly for VP/T (Level 1 vs. Level 8:  $MD = -0.67$ ,  $p = .025$ ; Level 1 vs. Level 9:  $MD = -0.61$ ,  $p = .023$ ). Collectively, these results demonstrate a gradual but statistically robust shift toward hierarchically embedded clause structures at higher proficiency levels.

In the length of production dimension, the Games–Howell test reveals consistent and significant differences between Level 1 and the middle-to-upper levels. For *mean length of sentence* (MLS), Level 1 differs significantly from Level 4 ( $MD = -3.06$ ,  $p = .047$ ), Level 6 ( $MD = -6.65$ ,  $p = .034$ ), and Level 9 ( $MD = -9.07$ ,  $p = .002$ ), indicating a clear increase in sentence length across levels. This pattern is reinforced by *mean length of T-unit* (MLT), where Level 1 differs significantly from Level 7 ( $MD = -5.14$ ,  $p = .001$ ), Level 8 ( $MD = -5.63$ ,  $p = .011$ ), and Level 9 ( $MD = -7.39$ ,  $p = .002$ ). For *mean length of clause* (MLC), significant differences emerge between Level 1 and Level 5 ( $MD = -2.09$ ,  $p = .041$ ) and become stronger at higher levels, particularly Level 8 ( $MD = -3.24$ ,  $p = .002$ ). Additionally, *clauses per sentence* (C/S) shows that Level 1 differs significantly from Level 7 ( $MD = -0.75$ ,  $p = .026$ ) and Level 9 ( $MD = -0.58$ ,  $p = .002$ ). These numerical patterns confirm that higher levels are characterized by longer and structurally denser sentences containing more clauses and T-units.

The coordination dimension shows a non-linear but pronounced increase at higher levels. For *coordinate phrases* (CP), Level 7 differs significantly from Level 1 ( $MD = 19.40$ ,  $p = .008$ ) and Level 2 ( $MD = 17.80$ ,  $p = .011$ ), while the largest contrast occurs between Level 9 and Level 1 ( $MD = 30.00$ ,  $p = .049$ ). These results indicate that coordination becomes substantially more frequent at advanced levels. The ratios *CP per T-unit* (CP/T) and *CP per clause* (CP/C) also show significant differences mainly between lower and higher levels, suggesting that coordination is increasingly embedded within clauses and T-units rather than occurring as isolated structures. Overall, the numerical evidence confirms that coordination functions as a key syntactic strategy for horizontal expansion of meaning at Levels 7–9.

The strongest and most consistent effects in the Games–Howell analysis are found in the nominalization dimension. For *complex nominals* (CN), Level 1 differs significantly from Level 3 ( $MD = -10.60$ ,  $p = .039$ ), Level

7 ( $MD = -52.20, p = .036$ ), Level 8 ( $MD = -51.60, p = .033$ ), and especially Level 9 ( $MD = -89.80, p = .003$ ). The ratios *complex nominals per T-unit* (CN/T) and *complex nominals per clause* (CN/C) follow the same pattern, with Level 9 consistently differing significantly from all lower and intermediate levels. The magnitude of these mean differences indicates a dramatic rise in nominal density and structural layering at advanced levels. This pattern provides strong empirical support for the concept of *phrasal compression*, whereby syntactic development at higher proficiency levels is characterized by increasingly dense and information-rich noun phrase structures.

### 3.2 Discussion

The findings of this study provide clear quantitative evidence that syntactic complexity in BOOKR Class story texts increases systematically across reading levels, as measured through the multidimensional framework proposed by Xu (2023). All four dimensions; subordination, length of production, coordination, and nominalization show statistically significant variation across levels, confirming that syntactic development in graded texts is cumulative rather than abrupt. In line with Hunt's (1965) concept of syntactic maturity, early levels are characterized by short sentences, minimal clause embedding, and simple T-unit structures, while higher levels gradually introduce longer sentences, more clauses, and structurally denser constructions.

Importantly, the descriptive patterns indicate that syntactic progression is gradual and non-linear. Several indicators show temporary decreases at intermediate levels before increasing again at higher levels, a pattern consistent with developmental redistribution rather than regression. From the perspective of Xu's (2023) framework, such fluctuations reflect shifts in how complexity is realized across dimensions, while overall syntactic load continues to increase. These small variations do not undermine the progression, as statistically significant differences emerge primarily between distant levels, indicating cumulative growth across broader developmental stages.

When interpreted through the lens of Biber and Gray's (2016) distinction between clausal elaboration and phrasal compression, the quantitative data reveal distinct strategies of complexity growth at different levels. At lower to early-intermediate levels (approximately Levels 4–6), increases in clause-based indicators such as DC/T, DC/C, C/S, and CT/T, together with rising sentence length (MLS, MLT), indicate that complexity is primarily achieved through clausal elaboration. In contrast, at higher levels particularly levels 7 to 9, nominal-based indicators (CN, CN/T, CN/C) increase sharply, while clause-based measures stabilize or grow more slowly. This pattern signals a shift toward phrasal compression, where syntactic complexity is realized through dense nominal structures rather than additional clauses. Levels 7 and 8 function as a transitional stage in which both strategies coexist, whereas Level 9 shows a clear dominance of phrasal compression, a hallmark of advanced syntactic complexity as described by Biber and Gray (2016).

Taken together, the results suggest that syntactic development in BOOKR Class texts follows a staged trajectory: early levels rely on structural simplicity, intermediate levels expand complexity through clause-based elaboration, and advanced levels increasingly compress information into complex nominal phrases. This progression is fully consistent with Hunt's (1965) developmental view of syntactic maturity, Xu's (2023) multidimensional model of syntactic complexity, and Biber and Gray's (2016) account of how complexity shifts from clausal to phrasal domains at higher proficiency levels.

## IV. CONCLUSION

This study demonstrates that syntactic complexity in BOOKR Class story texts is systematically structured across levels and can be empirically captured through multidimensional complexity measures. The findings confirm that graded digital reading materials are linguistically organized in ways that reflect cumulative syntactic development rather than abrupt structural shifts. By validating the internal consistency of syntactic progression across levels, this study highlights the value of quantitative syntactic analysis in evaluating and informing the design of leveled reading platforms for young language learners.



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