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A Corpus-based Evaluation of Syntactic Complexity Measures as Indices of Advanced English Text Comprehension in EAP Textbooks and Academic Research Papers

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Abstract

This study investigates the syntactic complexity of reading comprehension texts in English for Academic Purposes (EAP) textbooks and academic research papers. By comparing these two text types, the research aims to identify the challenges EAP learners may face in transitioning from simplified instructional materials to complex scholarly texts. A corpus-based approach was employed to analyze the syntactic parameters of 30 EAP textbook passages and 30 research paper discussion sections across three disciplines (Psychology, Accounting, and Pharmacy). The L2SCA tool was used to assess 14 syntactic measures, including sentence length, clause complexity, and lexical density. The findings reveal significant differences in syntactic complexity between EAP textbooks and academic research papers. EAP textbooks generally exhibit simpler syntactic structures, shorter sentences, and a lower structural density compared to scholarly articles. These disparities may hinder EAP learners' ability to comprehend and effectively engage with academic research. The study's results emphasize the need for more discipline-specific EAP materials and tailored language instruction to address the unique syntactic challenges encountered in academic reading. By understanding the syntactic complexities of scholarly texts, educators can better prepare learners for the demands of academic discourse.

Keywords: Corpus, EAP textbooks, Reading texts, Research papers, Syntactic complexity

1. The Role of Syntactic Complexity in EAP Textbooks and Academic Research Papers

Reading comprehension is one of the central points of academic success, particularly in higher education, where much of the learning process is mediated through written texts (Hyland & Rodrigo, 2007). Academic reading requires students not only to understand but also to critically evaluate and synthesize information from complex materials. This skill is particularly challenging for learners of English for Academic Purposes (EAP), who face specific obstacles when navigating the intricate language and structures of scholarly texts (Grabe, 2008). Developing strong academic literacy skills is essential for these learners to succeed in such an environment (Biber & Gray, 2010).

A primary challenge for EAP learners is the transition from simplified instructional materials, such as textbooks, to authentic academic research papers. EAP textbooks are typically designed to scaffold learning by simplifying syntax to enhance accessibility (Flowerdew, 2005). However, academic research papers employ much more complex syntactic structures, including extended noun phrases, subordinate clauses, and passive constructions. These features convey nuanced and detailed arguments, creating a significant gap in text complexity (Biber et al., 2011). This disparity can hinder learners' ability to engage with academic texts effectively, highlighting the need for targeted instructional strategies to address these linguistic challenges (Arya et al., 2011).

Syntactic complexity refers to the grammatical sophistication of sentence structures in a text, which plays a crucial role in determining reading difficulty (Lu, 2011). Texts with intricate grammatical constructions require advanced cognitive and linguistic skills to process. For many EAP learners, these complexities present substantial barriers to comprehension, emphasizing the need for instructional materials that better prepare students for academic reading challenges (Chen & Meurers, 2018).

Despite the acknowledged significance of syntactic complexity, research comparing the syntactic features of EAP textbooks and academic research papers is relatively sparse. This gap limits our understanding of how well EAP materials align with the complexities of authentic

academic texts (Jin et al., 2020). Addressing this gap is crucial for developing EAP curricula that bridge the divide between simplified learning materials and the linguistic demands of scholarly texts, thereby supporting learners in their transition to advanced academic literacy (Biber et al., 2011; Martinussen & Mackenzie, 2015).

This study aims to investigate the differences in syntactic complexity between EAP textbooks and academic research papers. By identifying key syntactic features such as sentence length, clause variety, and overall sentence complexity, the research seeks to provide insights that can guide the development of more effective EAP instructional materials. Ultimately, this study aims to enhance the alignment between EAP curricula and the linguistic demands of academic scholarship, equipping learners with the tools they need for academic success.

2. Literature Review

2.1. Multidimensional Factors Influencing Reading Comprehension: Insights into Texts and Learners

Reading comprehension is a complex process that involves the dynamic interaction of reader- and text-related factors, working together to facilitate the construction of meaning. Reader-related elements, such as linguistic proficiency, background knowledge, and reading strategies, interact with text-based features like syntax, vocabulary, and genre. Together, these components require learners to employ a range of cognitive and linguistic resources to navigate and interpret texts effectively (Grabe & Stoller, 2019; Koda, 2005).

Syntactic complexity emerges as a critical determinant of comprehension, particularly for EFL learners. The ability to process and engage with complex sentence structures is essential for developing advanced reading skills. However, inconsistencies in the syntactic demands of educational materials often limit learners' exposure to the types of structures that foster proficiency. This gap highlights the importance of designing materials that align with learners' evolving linguistic capacities, ensuring they are appropriately challenged (Sun, 2020).

Similarly, lexical richness, which encompasses vocabulary diversity and sophistication, plays a pivotal role in reading comprehension. While lexical richness can present challenges to learners, it also deepens engagement and supports comprehension when balanced effectively.

Ensuring this balance allows texts to remain accessible while maintaining the intellectual rigor necessary for the development of advanced reading abilities (Nation, 2006)

Despite these insights, many educational textbooks and assessment materials exhibit inconsistencies in text complexity, which can hinder their overall effectiveness. Addressing these shortcomings requires refinements in material design, supported by automated systems for evaluating and optimizing text complexity. Such tools offer significant potential for improving linguistic cohesion, ensuring fair assessments, and fostering more consistent learning outcomes (Bogaerds-Hazenberg et al., 2022; Kupriyanov et al., 2022). By balancing syntactic, lexical, and readability considerations, educators and material developers can create resources that effectively meet learners' needs while promoting meaningful and successful reading comprehension.

2.2. EFL Countries, Reading Comprehension and Grammatical Complexity Challenges

In EFL countries, reading comprehension is particularly important as it is a primary way for students to learn English. However, many students struggle with reading comprehension which is influenced by both syntactic complexity of the texts and grammatical knowledge of the students. Readers' grammatical proficiency is essential for facilitating comprehension, while limited syntactic awareness often creates significant barriers (Tarlani-Aliabadi et al., 2022). To address these challenges, pedagogical strategies must explicitly target syntactic understanding, equipping learners with the skills to navigate complex sentence structures effectively (Ahmed & Ahmed, 2023). However, text-related factors frequently undermine these efforts. Insufficient syntactic practice in textbooks were found in the literature which can negatively affect students' ability to build strong comprehension skills (Alenezi, 2016; Mousavi et al., 2021). This challenge becomes even more pronounced in advanced academic texts, where high levels of syntactic density and structural complexity require explicit instructional focus (Grabe & Stoller, 2019). Despite these insights, research has largely overlooked the inconsistencies between the syntactic features of EAP textbooks and authentic academic texts, highlighting a critical gap that requires further investigation.

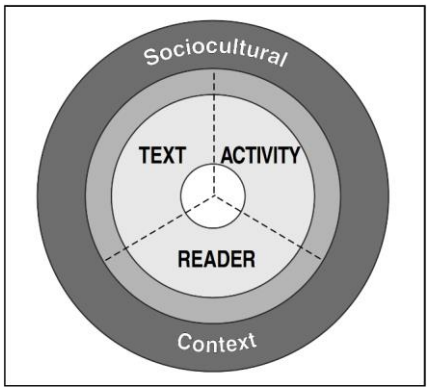
2.3 Theoretical Framework

According to the RAND Reading Group (2002), the reading comprehension process can be conceptualized through a heuristic approach involving three core elements: the reading activity,

the text, and the reader. These elements operate within a broad social and cultural context, where diverse learning theories and practices interact dynamically. The reader contributes knowledge, experience, and cognitive capacities to understand texts. Variations in individual characteristics, both inter-individual and intra-individual, influence comprehension outcomes (RAND, 2002).

Figure 1

Heuristic for reading comprehension (source: adopted from RAND Group, 2002, p. xiv).



Regarding the text element, the Construction-Integration Model(Kintsch, 1988) posits that readers' cognitive strategies and the textual features they engage with impact comprehension. This model introduces two guiding frameworks: the text model, which involves processing explicit textual information, and the situation model, which integrates background knowledge to derive meaning. To comprehend texts, learners must access word meanings, activate relevant prior knowledge, and construct both textual and situational models. Consequently, text complexity, including syntactic features, can introduce challenges in the reading process.

Reading Comprehension Process

Reading comprehension is a multifaceted process requiring the integration of linguistic, cognitive, and contextual elements to build coherent representations of text. The interplay among word meanings, syntactic structures, and background knowledge enables both literal understanding and inferential reasoning. Foundational models, such as the Text Base Reading Model (van Dijk & Kintsch, 1983) and the Construction-Integration Model (Kintsch, 1988), emphasize this integrative approach, underscoring the importance of connecting explicit textual information with implicit meanings derived from prior knowledge.

Successful comprehension depends on balancing lower-level skills, such as word recognition, with higher-order cognitive tasks, including inferencing and model building. Automatizing basic processes like decoding and syntactic integration in mind is critical, as it frees cognitive resources for more complex tasks (Perfetti, 1985) However, syntactic complexity presents significant challenges for EFL learners, where advanced grammatical processing in the mind is essential for integrating textual information into coherent mental models.

In EFL contexts, input materials such as textbooks play a crucial role in developing the linguistic systems required for academic reading. Yet, studies indicate that these materials often fail to align with the syntactic and lexical demands of advanced academic texts (Fender, 2001) This misalignment can hinder learners' ability to process and integrate complex grammatical structures effectively. Addressing this gap requires instructional materials that mirror the linguistic features of target academic contexts, equipping learners to navigate complex texts and enhancing their overall language proficiency(Grabe, 2008). Accordingly, the current study poses the following questions:

1) How syntactically complex are the advanced-level comprehension texts practiced within EAP textbook materials?

2) How syntactically complex are advanced-level comprehension texts within respective academic research papers?

3) How differently/similarly is the advanced reading comprehension operationalized among these two types of sources (EAP textbook materials and advanced academic research papers)?

3. Methodology

3.1. Design and Context of the Study

The present study employs a corpus-based quantitative research design to examine the syntactic complexity and readability of advanced reading comprehension texts, specifically sourced from educational EAP textbooks and academic research papers in three distinct academic disciplines: Psychology, Accounting, and Pharmacy. Each EAP textbook was paired with research papers from the same discipline to ensure consistency and comparability across the corpora. Using the L2 Syntactic Complexity Analyzer (L2SCA) as the analytical tool, the study quantitatively evaluates key syntactic dimensions to uncover patterns and differences in linguistic structures

across these genres of EFL learner input. Statistical analyses, particularly MANOVA, are applied to assess how these syntactic features vary, providing a framework for identifying meaningful relationships and contrasts.

3.2. Instruments

The primary instruments used in this study were text document data and a linguistic analysis tool, the L2 Syntactic Complexity Analyzer (L2SCA). Six corpora of advanced reading texts were compiled from three academic disciplines: Psychology (EAP textbooks and research papers), Accounting (EAP textbooks and research papers), and Pharmacy (EAP textbooks and research papers). These texts were analyzed using the L2SCA to evaluate syntactic complexity.

SAMT, a prominent publisher of English for Academic Purposes (EAP) textbooks in Iran, provided the materials for this study. The aim was to assess the syntactic complexity of SAMT's EAP reading materials and compare them to that of academic research papers. EAP textbooks from SAMT were selected, each containing at least 10 units with reading passages relevant to academic disciplines. Three textbooks, serving as primary resources for "Specialized English" courses in the targeted fields (Psychology, Accounting, and Pharmacy), were chosen (SAMT, 2024a, 2024b, 2024c). Ten texts were extracted from each textbook, resulting in 30 texts, compiled into three separate EAP textbook corpora (see Appendix A).

To provide a comparison, 10 research papers from Scopus-indexed journals were selected for each academic discipline, forming the second set of corpora. These research papers were chosen based on Scopus subject areas, which include 26 main categories with various subcategories. A total of 30 research papers—10 from each field—were compiled into three separate academic research text corpora.

To ensure comparability and enhance the validity of the syntactic complexity analysis, only the discussion sections of the research papers were included. These sections are recognized for their focus on interpreting findings and advancing knowledge claims, critical aims of research articles (Basturkmen, 2009; Le & Harrington, 2015). Unlike EAP textbook passages, research papers contain significantly more content. Focusing on discussion sections helped maintain balance and ensured a reliable comparison between corpora. Detailed information on the journals

and research papers is provided in Appendix B. And, more information on linguistic analysis tools used to compare the corpora are covered in the “Data Analysis” section.

3.4. Data Collection Procedure

The process of compiling the corpora for this study was carefully aligned with its research objectives. As McEnery and Brookes (2022) explain, corpora can be classified as either general or specialized. General corpora encompass a broad spectrum of language data, whereas specialized corpora focus on specific genres or varieties of language. For this study, specialized corpora were developed by selecting advanced reading comprehension texts from EAP textbooks and academic research papers, ensuring their relevance to the study's emphasis on EFL learner input.

In preparing the reading comprehension passages for syntactic complexity analysis, the researchers undertook several steps to ensure validity. This included formatting the text in plain text, ensuring proper punctuation, removing extraneous information, and addressing word separation issues. These measures were crucial for creating a corpus compatible with the L2SCA tool's requirements.

Authenticity, a key consideration in corpus design, involves including language data that reflects real-world usage with minimal researcher interference (McEnery & Wilson, 2001). To maintain authenticity, this study utilized random EAP textbooks and academic research papers, which EFL learners commonly encounter in academic contexts. The EAP textbooks, published by the SAMT Association, are widely used in Iran for various academic disciplines. Although not internationally renowned, these textbooks are integral to university English courses in the region. Their inclusion ensured that the texts reflected materials EFL learners typically engage with, reinforcing the study’s focus on real-world learner input.

Representativeness was another crucial criterion, ensuring the language data reflected the variability within the target genre(Biber, 1993). To achieve this, the study included a diverse selection of advanced reading texts from three academic disciplines—Psychology, Accounting, and Pharmacy. These texts, commonly encountered by EFL learners, form a significant portion of their academic language input. Sampling from multiple disciplines enhanced the corpora's representativeness, thereby supporting the validity of the syntactic complexity analyses.

To ensure comparability, texts within each corpus were drawn from the same academic discipline, with equal numbers of passages selected from each source. This approach facilitated valid comparisons across corpora, as texts within each discipline shared common characteristics and functions. As Hewavitharana and Vogel (2008), and Ji (2009) emphasize, comparability is critical for aligning texts in terms of content and purpose. In this study, six corpora—covering texts from three disciplines (Psychology, Accounting, and Pharmacy) and their respective research papers—each comprised 10 advanced reading passages.

3.5. Data Analysis Procedure

To address the research questions and assess advanced reading texts, a series of procedures was implemented. Initially, the textual data, comprising advanced reading passages from a selection of EAP textbooks and academic research papers, were collected to create individual corpora. Subsequently, an objective syntactic complexity analysis of the texts was conducted using the L2SCA tool. This involved feeding each corpus into the tool and analysing all syntactic measures of the texts, resulting in six analyses: three for the EAP textbooks individually and three for the research papers across the three academic disciplines. The derived results formed the foundation for subsequent comparisons. Each EAP textbook was juxtaposed with and compared to the research papers within its corresponding academic discipline, leveraging the syntactic complexity measures of the texts. The comparative results formed the basis for in-depth discussions and further analyses.

Syntactic Complexity Measures and the linguistic analysis tool

According to the previous literature, readers process the texts linearly, decoding it word by word; but as they read, they need to compile the linguistic items into a larger scale of syntactic structures(Just & Carpenter, 1987; Rayner & Pollatsek, 1996). Accordingly, the mental demands required for this operation can vary considerably on the basis of how complex the structure is (Perfetti et al., 2005). Therefore, the collected texts were analysed using all 14 measures computed by the syntactic complexity measures of L2SCA in order to make the analysis a comprehensive one which covers each of the 4 core complexity measures. Additionally, the measures are divided into 4 core groups which are called length of the production unit, amount of subordination, amount of coordination, and degree of phrasal sophistication. Table 1 presents more information on the syntactic complexity measures.

Table 1.

L2 Syntactic Complexity Measures

Category	Label	Description
Length of Production Unit	MLC	Mean length of clause
	MLS	Mean length of sentence
	MLT	Mean length of T-unit
Amount of Subordination	C/T	Number of clauses per T-unit
	CT/T	Complex T-unit ratio
	DC/C	Number of dependent clauses per clause
	DC/T	Number of dependent clauses per T-unit
Amount of Coordination	CP/C	Number of coordinate phrases per clause
	CP/T	Number of coordinate phrases per T-unit
	T/S	Number of T-units per sentence
Degree of Phrasal Sophistication	CN/C	Number of complex nominals per clause
	CN/T	Number of complex nominals per T-unit
	VP/T	Number of verb phrases per T-unit
Overall Sentence Complexity	C/S	Number of clauses per sentence

Note: Retrieved from "Automatic analysis of syntactic complexity in second language writing" by Lu (2010), International Journal of Corpus Linguistics, 15(4): 474-496. Copyright 2010 by John Benjamins Pulishing Company.

The amount of coordination is assessed through the number of coordinate phrases per clause (CP/C), number of coordinate phrases per T-unit (CP/T), and number of T-units per sentence (T/S) (Lu, 2010). These measures provide information about the level of coordination within the text. Finally, the degree of phrasal sophistication is evaluated through the number of complex nominals per clause (CN/C) (Lu, 2010) This index reflects the complexity of noun phrases, which can impact the overall processing demands on the reader. Therefore, the L2SCA was used in the current study because it offers a comprehensive framework for analyzing text complexity by examining various aspects of syntactic complexity, including length of production unit, amount of subordination, amount of coordination, and degree of phrasal sophistication. All these 14 measures were calculated to ensure a comprehensive descriptive analysis of the variance between the corpora. However, with regard to the inferential analysis of the data, a following study by Ai and Lu (2013) provided a structured framework for analyzing syntactic complexity by grouping

measures into four distinct categories: length of production units, amount of subordination, amount of coordination, and degree of phrasal sophistication. They compared texts by examining differences in the mean values of these grouped measures across multiple writing samples. This grouping allowed for a more focused and systematic analysis of syntactic patterns. The study highlighted statistically significant differences between their groups, revealing how syntactic complexity varied across proficiency levels and text types. Their groupings are reviewed in Table 2. Additionally, their study demonstrated the effectiveness of categorizing syntactic complexity measures to uncover patterns and relationships in diverse text sources. Similarly, in the current study, after calculating and alazying the descriptive data, the syntactic complexity measures were systematically grouped into four distinct categories to enable effective statistical analysis. These groups are: **length of production unit**, **amount of subordination**, **amount of coordination**, and **degree of phrasal sophistication**. Therefore, the approach aligns with established methodologies in prior research, facilitating the identification of meaningful differences and trends in syntactic complexity among the corpora under investigation.

Table 2.

Grouping Syntactic Complexity Measures Based on Ai and Lu (2013)

Group	Label	Description
Length of Production Unit	MLC	Mean length of clause
	MLS	Mean length of sentence
	MLT	Mean length of T-unit
Amount of Subordination	DC/C	Number of dependent clauses per clause
	DC/T	Number of dependent clauses per T-unit
Amount of Coordination	CP/C	Number of coordinate phrases per clause
	CP/T	Number of coordinate phrases per T-unit
	T/S	Number of T-units per sentence
Degree of Phrasal Sophistication	CN/C	Number of complex nominals per clause
	CN/T	Number of complex nominals per T-unit

Methodological Procedure for the inferential Analyses

To examine variations in syntactic complexity across six corpora, a one-way MANOVA (Multivariate Analysis of Variance) was conducted using SPSS (Statistical Package for the Social Sciences). This analytical approach was selected for its ability to assess multiple dependent

variables simultaneously while accounting for their interdependence, providing a comprehensive examination of syntactic complexity across the corpora.

Variables and Data Organization

The analysis incorporated four dependent variables, representing distinct dimensions of syntactic complexity:

1. **Length of production unit**, indicating overall syntactic elaboration.
2. **Amount of subordination**, measured as the frequency of dependent clauses relative to other units.
3. **Amount of coordination**, reflecting the extent of coordinate structures.
4. **Degree of phrasal sophistication**, which captures the intricacy of phrasal elements.

The independent variable, **corpus**, consisted of six categories, each corresponding to a distinct textual source. Data preparation involved calculating the syntactic complexity indices for all samples within each corpus, ensuring consistency and comparability across groups, the descriptive report of which is already presented above.

Statistical test

The MANOVA procedure was structured to test whether the mean vectors of the four dependent variables varied across the six corpora. Wilks' Lambda was employed as the primary multivariate test statistic, evaluating the significance measure of the overall effect of the independent variable on the combined dependent variables.

To ensure reliable results, the analysis treated each corpus as independent, with no overlap or dependency between the groups. Each corpus was carefully organized to reflect the unique characteristics of specific textbooks and research papers. MANOVA was chosen for its ability to analyze multiple related variables at once, making it ideal for exploring differences in syntactic complexity across the academic fields of Psychology, Pharmacy, and Accounting, as reflected in their textbooks and research papers corpora. This approach was used to highlight how syntactic features vary between these written genres.

4. **Results and Discussion**

4.1 Descriptive Analysis of the Results

Psychology Books and Research Papers

Based on Table 3, the comparison between the *"Psychology books corpus"* and the *"Psychology papers corpus"* revealed several key differences. The *"Psychology papers corpus"* contained more words (12,720) than the *"Psychology books corpus"* (5,488), indicating that the former was a significantly larger and more comprehensive text corpus.

In terms of sentence structure, the mean length of sentence (MLS) in the *"Psychology books corpus"* was shorter (16.33) compared to the *"Psychology papers corpus"* (27.24). This suggested that sentences in the books were more concise, while those in the papers were longer and more information-dense. Similarly, the mean length of T-unit (MLT) and mean length of clause (MLC) were higher in the *"Psychology papers corpus,"* reflecting its use of more complex sentence structures.

Table 3

Descriptive Results of the Syntactic Complexity Measure in Psychology EAP Textbooks versus Papers

Measure	Books Corpus	Papers Corpus	Difference
Words (nwords)	5,488	12,720	+7,232
Mean Length of Sentence (MLS)	16.3	27.2	+10.9
Mean Length of T-unit (MLT)	14.8	25.3	+10.5
Mean Length of Clause (MLC)	9.94	15.2	+5.26
Clauses per Sentence (C_S)	1.64	1.78	+0.14
Verb Phrases per T-unit (VP_T)	2.13	2.38	+0.25
Clauses per T-unit (C_T)	1.49	1.66	+0.17
Dependent Clauses per Clause (DC_C)	0.34	0.40	+0.06
Dependent Clauses per T-unit (DC_T)	0.52	0.67	+0.15
T-units per Sentence (T_S)	1.09	1.07	-0.02
Complex T-units per T-unit (CT_T)	0.38	0.47	+0.09
Complex Phrases per T-unit (CP_T)	0.60	0.87	+0.27
Complex Phrases per Clause (CP_C)	0.40	0.52	+0.12
Complex Noun Phrases per T-unit (CN_T)	1.75	3.90	+2.15
Complex Noun Phrases per Clause (CN_C)	1.17	2.34	+1.17

The papers also exhibited a greater reliance on dependent clauses and complex nominal phrases. Higher ratios of dependent clauses per clause and per T-unit (DC_C and DC_T) in the papers pointed to their use for structuring information and enhancing cohesion. Additionally, the ratios of complex nominal phrases per T-unit and per clause (CN_T and CN_C) were also higher, indicating a stronger use of intricate nominal constructions.

These findings underscored Psychology's tendency toward detailed and intricate discourse in academic writing. The longer sentences, higher density of dependent clauses, and greater use of complex nominal constructions in papers aligned with the discipline's commitment to academic rigor and comprehensive exploration of theoretical concepts and empirical findings(Beech, 2009; Hartley, 2008). Furthermore, the larger word count in papers compared to the EAP psychology textbooks reflected the expansive nature of psychological research, incorporating detailed analyses and experimental findings that went beyond the brevity typical of textbook passages (Breakwell et al., 2012)

These linguistic patterns not only highlighted the complexity of psychological writing but also emphasized the discipline's dedication to effectively communicating the depth and richness of its research. The statistical significance of these findings was further explored in the following sections.

Accounting Books and Papers

The comparison of the "Accounting book corpus" and "Accounting papers corpus" revealed key insights into their linguistic characteristics. According to Table 4, the "Accounting papers corpus" was larger, containing 9,873 words compared to 6,387 words in the "Accounting book corpus." This indicated that the papers corpus was more extensive and likely covered a broader range of accounting topics, providing researchers and practitioners with a larger pool of information for reference and analysis.

Table 4

Descriptive Results of the Syntactic Complexity Measure in Accounting EAP Textbooks versus Papers

Measure	Books Corpus	Papers Corpus	Difference
Words (nwords)	6,178	15,264	+9,086
Mean Length of Sentence (MLS)	19.9	28.31	+8.41
Mean Length of T-unit (MLT)	19.1	24.94	+5.84
Mean Length of Clause (MLC)	15.7	11.7	-4.0
Clauses per Sentence (C_S)	1.26	2.41	+1.15
Verb Phrases per T-unit (VP_T)	2.07	2.92	+0.85
Clauses per T-unit (C_T)	1.21	2.13	+0.92
Dependent Clauses per Clause (DC_C)	0.21	0.51	+0.30
Dependent Clauses per T-unit (DC_T)	0.25	1.10	+0.85
T-units per Sentence (T_S)	1.04	1.13	+0.09

Complex T-units per T-unit (CT_T)	0.22	0.656	+0.436
Complex Phrases per T-unit (CP_T)	1.03	0.80	-0.23
Complex Phrases per Clause (CP_C)	0.85	0.37	-0.48
Complex Noun Phrases per T-unit (CN_T)	2.63	3.4	+0.77
Complex Noun Phrases per Clause (CN_C)	2.16	1.61	-0.55

In terms of sentence structure, the "Accounting papers corpus" exhibited longer and more complex sentences than the "Accounting book corpus." The mean length of sentence (MLS) in the papers corpus was 26.46, reflecting greater syntactic intricacy, while the books corpus had a lower MLS of 19.72, indicating shorter and more concise sentences. This difference suggested distinct writing styles and purposes between books and academic papers.

Both the mean length of T-unit (MLT) and mean length of clause (MLC) were higher in the "Accounting papers corpus," further demonstrating its more elaborate syntactic structures. This linguistic complexity likely stemmed from the academic rigor required to explore theoretical concepts and empirical findings in the papers.

Additionally, the "Accounting papers corpus" showed a greater prevalence of dependent clauses and complex nominal phrases. Higher ratios of dependent clauses per clause (DC_C) and per T-unit (DC_T) highlighted its reliance on these structures for cohesion and detailed information. Similarly, the higher ratios of complex nominal phrases per T-unit (CN_T) and per clause (CN_C) reflected frequent use of intricate nominal constructions, contributing to the precision and specificity expected in scholarly writing.

In the domain of Accounting, these findings underscored differences between books and papers. The longer, more complex sentences in the papers, alongside a higher density of dependent clauses and complex nominal phrases, emphasized the precision and specificity characteristic of academic writing. This also suggested that EAP textbooks could benefit from better alignment with the academic language found in accounting research.

Consistent with these findings, Davidson (2005) and Amnuai (2019) highlighted the need for precision and specificity in scholarly writing within the field of accounting. Davidson's analysis of accounting textbooks over the past century revealed a decrease in sentence complexity and an increase in word complexity, while Amnuai's study of accounting research article abstracts emphasized differences in rhetorical moves and linguistic realizations. These observations

supported the recommendation for EAP textbooks to align more closely with real-world academic language in accounting. Loughran and McDonald (2016), and Hussain et al. (2020) further stressed the importance of understanding textual nuances and the dichotomy in source material usage in accounting research. The statistical significance of these findings is addressed in the following sections.

Pharmacy Books and Research Papers

The comparison of the "Pharmacy book corpus" and the "Pharmacy papers corpus" reveals significant differences in their linguistic characteristics. The "Pharmacy papers corpus" is larger, containing 8,431 words compared to 5,749 words in the "Pharmacy book corpus," suggesting that the papers corpus covers a broader range of pharmacy topics. This comprehensive collection of academic papers provides researchers and professionals with access to more specialized subjects and detailed research findings.

Table 5.

Descriptive Results of the Syntactic Complexity Measure in Pharmacy EAP Textbooks versus Papers

Measure	Books Corpus	Papers Corpus	Difference
Words (nwords)	7,483	8,135	+652
Mean Length of Sentence (MLS)	17.90	22.66	+4.76
Mean Length of T-unit (MLT)	18.29	21.57	+3.28
Mean Length of Clause (MLC)	14.58	13.90	-0.68
Clauses per Sentence (C_S)	1.227	1.62	+0.393
Verb Phrases per T-unit (VP_T)	2.01	2.05	+0.04
Clauses per T-unit (C_T)	1.254	1.55	+0.296
Dependent Clauses per Clause (DC_C)	0.19	0.35	+0.16
Dependent Clauses per T-unit (DC_T)	0.24	0.55	+0.31
T-units per Sentence (T_S)	0.97	1.05	+0.08
Complex T-units per T-unit (CT_T)	0.21	0.40	+0.19
Complex Phrases per T-unit (CP_T)	0.98	0.58	-0.40
Complex Phrases per Clause (CP_C)	0.78	0.37	-0.41
Complex Noun Phrases per T-unit (CN_T)	2.70	3.18	+0.48
Complex Noun Phrases per Clause (CN_C)	2.15	2.04	-0.11

In terms of sentence structure, the "Pharmacy papers corpus" exhibits longer and more complex sentences. Its mean length of sentence (MLS) is 25.18, indicating greater syntactic intricacy, whereas the "Pharmacy book corpus" has a lower MLS of 21.36, reflecting shorter and

more concise sentence structures. This distinction highlights variations in writing style and potentially differing purposes between academic papers and textbooks.

Further analysis shows that the mean length of T-unit (MLT) and mean length of clause (MLC) are both higher in the "Pharmacy papers corpus" than in the "Pharmacy book corpus," revealing that sentences in the papers corpus are more clause-dense and syntactically elaborate. This complexity reflects the academic rigor and detailed exploration of theoretical or empirical concepts characteristic of pharmacy papers.

Additionally, the "Pharmacy papers corpus" demonstrates a higher frequency of dependent clauses and complex nominal phrases. The ratios of dependent clauses per clause (DC_C) and per T-unit (DC_T) are greater in the papers corpus, indicating a stronger reliance on dependent clauses for cohesion and the provision of supplementary information or evidence. Similarly, the ratios of complex nominal phrases per T-unit (CN_T) and per clause (CN_C) are higher, reflecting the frequent use of intricate nominal constructions. These linguistic features contribute to the precision, specificity, and formal tone expected in scholarly writing.

In the field of Pharmacy, these findings underscore the more extensive and linguistically complex nature of academic papers compared to EAP pharmacy textbooks. The longer sentences, greater prevalence of dependent clauses, and higher frequency of complex nominal constructions align with the in-depth discussions and specialized analyses typical of pharmacy research. This comparison enhances understanding of the linguistic nuances and content specific to academic literature in this domain.

4.2 Inferential Analysis of the Results

To deepen the insights from the descriptive analysis, a one-way MANOVA was conducted to evaluate linguistic differences across six corpora: Psychology books (PsychoBok), Accounting books (AccBok), Pharmacy books (PhrmBok), Psychology papers (PsychoPprs), Accounting papers (AccPprs), and Pharmacy papers (PhrmPprs). The analysis included four dependent variables: length of production unit, amount of subordination, amount of coordination, and degree of phrasal sophistication. The results offered a robust statistical foundation for the trends identified in the descriptive analysis. Additionally, the plots provided in the analysis visually summarized the

relationships between corpus type and dependent variables, illustrating patterns of variation for each linguistic feature across the corpora.

The MANOVA results revealed a significant multivariate effect of corpus type on linguistic features (Wilks' Lambda = 0.000, $p < 0.001$), confirming significant linguistic differences across the corpora. These findings supported the observation that academic papers generally employed more complex syntactic and phrasal structures than textbooks. Table 6 displays the multivariate test results from SPSS.

Table 6.

Multivariate Tests Results

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	1.000	10682.348[b]	4.000	3.000	.000
	Wilks' Lambda	.000	10682.348[b]	4.000	3.000	.000
	Hotelling's Trace	14243.130	10682.348[b]	4.000	3.000	.000
	Roy's Largest Root	14243.130	10682.348[b]	4.000	3.000	.000
corpus	Pillai's Trace	2.904	3.179	20.000	24.000	.004
	Wilks' Lambda	.000	23.089	20.000	10.900	.000
	Hotelling's Trace	647.333	48.550	20.000	6.000	.000
	Roy's Largest Root	606.144	727.372[c]	5.000	6.000	.000

According to Table 7, the length of production units, including sentences and clauses, varied significantly across the corpora ($F = 25.361$, $p < 0.001$). Academic papers in Psychology ($M = 26.31$), Accounting ($M = 26.63$), and Pharmacy ($M = 22.12$) consistently demonstrated longer production units compared to textbooks. This aligned with the descriptive observation that academic papers favored longer, information-rich sentences to meet the demands of academic rigor and theoretical exploration. For example, the longer sentences in Psychology papers reflected the

field's reliance on detailed empirical reporting. Additionally, the plot (Figure 2) for length of production unit clearly highlighted the higher values for Psychology, Accounting, and Pharmacy papers compared to their corresponding book corpora, showcasing the distinction between complex academic writing and simpler textbook language.

Table 7.

Descriptive Results, Mean, and Standard Deviation Across all Corpora

Measure	Corpus	Mean	Standard Deviation
Length of Production Unit	**PsychoBok**	15.60	1.03
	AccBok	19.53	0.57
	PhrmBok	18.10	0.28
	PsychoPprs	26.31	1.31
	AccPprs	26.63	2.39
	PhrmPprs	22.12	0.77
Amount of Subordination	**PsychoBok**	0.44	0.12
	AccBok	0.23	0.03
	PhrmBok	0.22	0.03
	PsychoPprs	0.54	0.19
	AccPprs	0.81	0.41
	PhrmPprs	0.45	0.14
Amount of Coordination	**PsychoBok**	0.51	0.14
	AccBok	0.94	0.13
	PhrmBok	0.89	0.14
	PsychoPprs	0.70	0.25
	AccPprs	0.59	0.30
	PhrmPprs	0.48	0.15
Degree of Phrasal Sophistication	**PsychoBok**	1.46	0.41
	AccBok	2.40	0.33
	PhrmBok	2.43	0.39
	PsychoPprs	3.12	1.10
	AccPprs	2.54	1.29
	PhrmPprs	2.62	0.80

Although MANOVA did not identify statistically significant differences for subordination ($F = 2.347$, $p = 0.164$), descriptive trends indicated that papers, particularly in Psychology ($M = 0.54$) and Accounting ($M = 0.81$), employed higher ratios of dependent clauses than textbooks. This suggested that papers relied on subordination to achieve cohesion and elaborate on complex ideas. Table 7 shows the descriptive statistics for subordination. The plot for subordination revealed a slight increase in paper corpora, particularly in Psychology and Accounting papers,

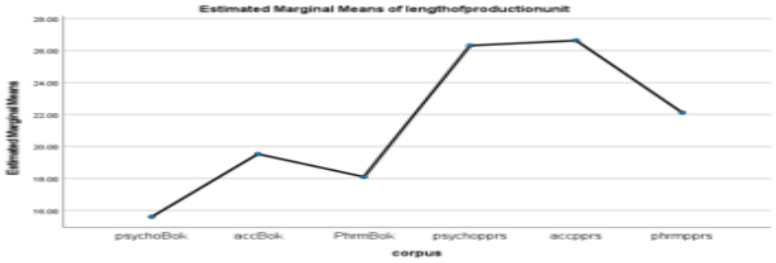
though the difference between book and paper corpora was less pronounced, consistent with the MANOVA results.

No significant differences were found for coordination ($F = 2.006$, $p = 0.211$). However, descriptive statistics indicated greater coordination in textbooks, particularly in Accounting ($M = 0.94$) and Pharmacy ($M = 0.89$). This supported the observation that textbooks favored simpler structures with coordinated clauses for accessibility, contrasting with the subordination-dominated style of academic papers. Table 7 presents data on coordination. The coordination plot (Figure 2) reflected higher coordination in the Accounting and Pharmacy book corpora, with a reduction in coordination in the Pharmacy papers corpus. This suggested that while coordination was prevalent in textbooks, academic papers favored more syntactically complex structures involving subordination.

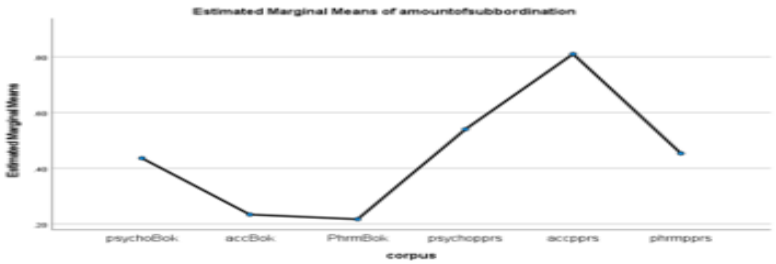
Figure 2

Plots for Length of Production Unit, Amount of Subordination, Amount of Coordination, and Degree of Phrasal Sophistication Across all Corpora

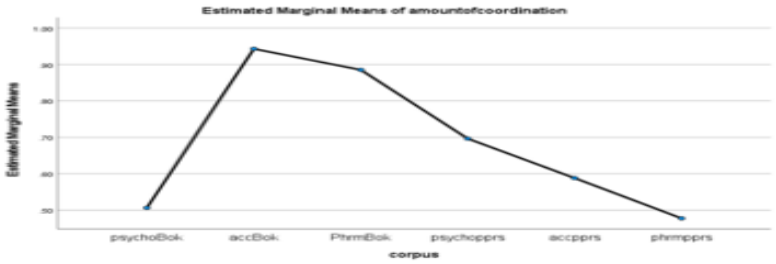
Plot 1: Length of Production Unit



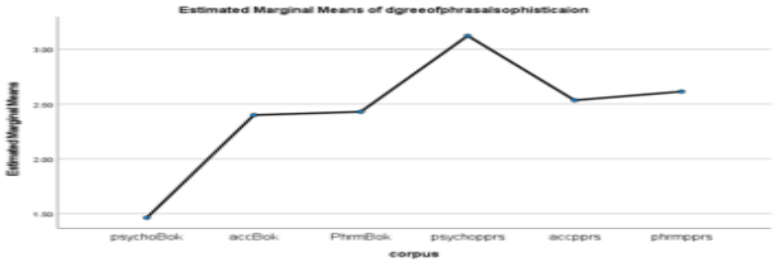
Plot 2: Amount of Subordination



Plot 3: Amount of Coordination



Plot 4: Degree of Phrasal Sophistication



The degree of phrasal sophistication did not show statistical significance in MANOVA ($F = 0.586$, $p = 0.542$). Nonetheless, descriptive trends suggested a higher degree of sophistication in papers, especially in Psychology ($M = 3.12$), reflecting the field's linguistic demand for precise expression of nuanced concepts. Table 7 provides data on phrasal sophistication. The plot for phrasal sophistication confirmed the descriptive results, with academic papers generally exhibiting greater sophistication than textbooks. The Psychology papers corpus stood out with the highest sophistication level, supporting the idea that academic papers require more complex linguistic features.

The inferential results validated the descriptive analysis trends, demonstrating that academic papers across disciplines consistently displayed longer production units, greater syntactic complexity, and higher phrasal sophistication than textbooks. These findings highlighted a significant linguistic disparity between EAP textbooks and authentic academic written language, particularly their inability to capture the syntactic complexity required in disciplines such as Psychology and Accounting.

Similar to the findings of the present study, Grabowski (2015) reported that academic pharmaceutical texts exhibited a unique phraseological profile, significantly differing from non-academic pharmaceutical texts. While the academic genre in his study utilized fewer frequent phrase frames, these frames showed considerable phraseological variation. Although phraseological variation alone does not determine syntactic complexity, other factors such as sentence length, subordination, coordination, and clause arrangement also contribute to overall complexity. Text types with a wide range of phraseological variation appear to facilitate more manipulated sentence structures and intricate syntactic devices, thus indicating greater complexity in pharmaceutical academic texts.

Moreover, Grabowski (2015) found that academic pharmacy texts relied more heavily on variable frames composed of function words, indicating a preference for grammatical phraseology. Text genres favoring function words over content words tend to exhibit more intricate syntactic structures, as function words serve as the grammatical scaffolding that connects sentences and establishes conceptual relationships. Function words such as articles, conjunctions, prepositions, and pronouns act as grammatical "glue," linking nouns, verbs, and adjectives to clarify relationships and guide readers through complex arguments. Conversely, genres relying heavily on content words, such as nouns and verbs, tend to be more straightforward and less syntactically demanding, as content words primarily convey meaning while lacking the grammatical scaffolding provided by function words.

The comparison across disciplines highlighted the varied linguistic demands and purposes of academic writing. While Psychology and Pharmacy papers employed longer sentences and denser complex constructions, Accounting papers focused on detailed conceptual exploration within concise sentence structures. These distinctions underscored the need for tailored language instruction and curriculum development within each discipline. Additionally, the findings

indicated that EAP textbooks need better alignment with authentic academic content to include more syntactically complex language patterns and meet students' needs effectively.

5. Conclusions

In conclusion, the analysis of linguistic features in Psychology, Accounting, and Pharmacy enhanced our understanding of academic discourse in these disciplines. Patterns in sentence structures, clause lengths, and the use of dependent clauses and complex nominal phrases offered valuable insights for educators, curriculum developers, and academic material authors.

The distinctions between books and papers in each discipline highlighted the need to recognize the specific linguistic characteristics of scholarly communication. These findings carry significant pedagogical implications, encouraging educators to design language instruction programs that address the unique linguistic demands of students in Psychology, Accounting, and Pharmacy.

Implications for textbook development are particularly noteworthy, advocating for the inclusion of discipline-specific reading materials, targeted vocabulary exercises, and strategies to address linguistic challenges. Aligning content with professional practices, integrating research findings, and promoting interdisciplinary learning further enhance the relevance and effectiveness of educational materials.

One limitation of this study lies in its reliance on a selected corpus of texts from Psychology, Accounting, and Pharmacy, which, while representative, may not capture the full breadth of linguistic variation within these disciplines. The focus on specific text types, such as textbooks and research papers, excludes other potentially relevant academic genres, such as case studies or conference proceedings, that might reveal additional nuances in linguistic features. Moreover, the study's findings, though valuable, are context-dependent and may not fully generalize to other educational settings or disciplines. Future research could address these gaps by expanding the corpus to include a wider range of academic materials and exploring how linguistic features evolve across different genres and contexts.

Ultimately, this analysis not only revealed the complexity of academic language across disciplines but also outlined a framework for improving language instruction and materials. By addressing these linguistic nuances, educators and authors can enhance the quality of language

learning in Psychology, Accounting, and Pharmacy, better preparing students for academic and professional success.

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