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INVESTIGATING INTRICATE NOMINAL PHRASES ACROSS DIFFERENT TECHNICAL REGISTERS IN ENGLISH FOR SPECIFIC PURPOSES (ESP)

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Abstract: *Instructing students on technical vocabulary necessitates specific methodologies and contextual application. Scientific literature often features intricate noun phrases or compounds that serve a communicative purpose within a concept-driven theoretical framework. The presence of these combinations is a typical characteristic of the aforementioned texts. This paper aims to explore the various functions that underpin these phrases and the manner in which they are formed based on the information they express. Utilizing a communicative approach, we introduce these nominal compounds to our students as tools for defining and elucidating new objects and concepts. To create reliable, well-structured, and acceptable complex nominal compounds, we analyze their complexity and deconstruct the various components to comprehend how each part contributes to the conveyance of new information. We suggest that, alongside context and extralinguistic knowledge (i.e., the shared technical background that the ESP instructor may not inherently possess), the configuration of the nominal group—or more specifically, the arrangement of modifiers within the group—also influences the resolution of syntactic ambiguity and the clarification of meaning. Consequently, modifiers that are positioned farthest from the head possess the least specificity and are succeeded by additional modifiers that refine the meaning of the entire nominal phrase. The primary contribution of this paper lies in the domain of ESP teacher education, as it assists ESP educators who lack specialization in civil or mechanical engineering, economics, and dentistry to effectively process, comprehend, and teach complex nominal compounds.*

Keywords: *complex nominal compounds (CNCs), nominal compounds (NCs), complex noun phrase (CNP), English for Specific Purposes (ESP), syntactic ambiguity.*

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INTRODUCTION

In recent decades, there have been swift advancements in technological progress, resulting in devices that improve and facilitate human life on Earth. These inventions encompass various modes of transportation (for instance, *electric cars, gyro scooters, electric unicycles*), home appliances, and small gadgets (such as *electric dryers, electronic cigarettes, hot rollers, e-books, smartwatches,* etc.).

The most recent technological breakthroughs have contributed to the development of scientific and technical terminology, notably within civil and mechanical engineering (*reinforced concrete foundations, recycled aggregate materials, automotive intake manifolds, enhanced thermal efficiency,* etc.), economics (*fiscal consolidation strategies, domestic manufacturing sectors, cost-benefit analyses*, etc.), and dentistry (*implant-supported prostheses, root canal obturation methods, minimally invasive restorative procedures*, etc.), incorporating complex noun phrases to express information in a precise and concise manner. The construction of intricate nominal phrases is primarily influenced by society's necessity to identify emerging concepts resulting from the vigorous advancement of science and technology. Consequently, the English language has been enriched with compound term-nouns that represent subjects, processes, or phenomena, and these terms are derived not only from established concepts but also from previously unrecognized ones (Humovska, 2000; Kizil, 2016; Kryshtal, 2003; Litvinko, 2007; Nazarova, 2014; Rybachok, 2004). In this research, we characterize a complex noun phrase as a lexical entity created by 1) merging two or more stems or independent words, 2) condensing terms from a particular phrase or sentence in accordance with established patterns in the language. Within scientific and technical literature, the compound, complex noun phrase corresponds to a specific grammatical category, functions as an integral component of a sentence, and conveys scientific knowledge to society (Akhmanova, 2013; Karaban, 2004; Vovchanska, 2014).

Complex nominal phrases and compounds are structures frequently employed in scientific literature. Although they are quite common, there is a limited understanding of their distribution within scientific articles. According to the Uniform Information Density hypothesis (Genzel & Charniak, 2002; Jaeger & Levy, 2006; Meister et al., 2021), which posits that speakers convey information at a uniform rate while mitigating fluctuations in information transfer, we hypothesize that complex nominal phrases will tend to appear toward the conclusion of scientific texts, will be preceded by contextual text that aids in their comprehension, and will be reaffirmed on multiple occasions following their initial introduction. This paper presents an analysis of these complex nominals, utilizing both quantitative and qualitative methods, based on a corpus of scientific articles in the fields of Civil and Mechanical Engineering, Economics, and Dentistry.

While the extralinguistic context aids in comprehending intricate nominal groups (Kereković, 2016), it necessitates a specific technical understanding that is often absent in nonspecialists, such as ESP instructors. Therefore, this paper intends to identify a proficient approach for processing and analyzing complex nominal groups in technical English, particularly those composed of three or more elements featuring one of the subsequent structures: N1 + N2 + N3 + NN, Adj + N1 + N2 + NN, or a blend of both. There are various reasons that underscore the significance of NP complexity in technical communication. First, mastering NP complexity is crucial for achieving proficiency in ESP, as it serves as a defining characteristic of polished academic writing (Schleppegrell 2004; Biber et al. 2011). Additionally, prior studies have indicated that an increase in NP complexity is among the most reliable indicators of overall syntactic progression in the skills of ESP students (Durrant et al. 2021).

LITERATURE REVIEW

All languages worldwide permit some form of compounding (Dressler, 2006). In English, this process can yield a single word (e.g., *outstanding, snowman, strawberry, highlight*) or a more intricate phrase consisting of multiple words (e.g., *blood moon, health care provider, dopamine production suppressor protein*). This method of word formation is so widespread that it has been

termed the universally fundamental word formation process (which is also a compound), providing the simplest and most efficient means to generate and convey new meanings (Libben, 2006).

Complex nominal phrases (CNPs), such as *power plant*, *reinforced concrete foundations*, occur with high frequency in specialized English texts (Nakov, 2013; Daille et al., 2004; Hendrickx et al., 2013; Fernández-Domínguez, 2016; Kageura, 2012). These phrases consist of a head noun that is preceded by one or more modifiers (that is, nouns or adjectives) (Levi, 1978). Such multi-word expressions display syntactic-semantic complexity because they juxtapose two or more concepts without any explicit indication of the relationship among them (Ó Séaghdha et al., 2013). This often results in lengthy CNs that may pose comprehension challenges (Rallapalli et al., 2012), emphasizing the need for their description in specialized resources. To adequately understand and accurately interpret such ambiguous constructs (for instance, *the new control system updated continuously exhibited robust performance*), a broader contextual framework is considered necessary. In this paper, we refer to the term syntactic ambiguity as we address nominal groups with complex structures that are challenging to process and can be easily misconstrued or interpreted in multiple ways.

We will address the type of compounding that results in the creation of intricate structures made up of several words. Specifically, we concentrate on the entities we denote as nominal compounds (NC), which are multiword formations that are collectively classified as nouns. We designate longer NCs, consisting of three or more words, as complex nominal compounds (CNC). CNCs are often deemed challenging to comprehend and are generally discouraged in recommendations for "good writing" (e.g., Tobin 2002). Indeed, a multitude of research has indicated that they can lead to difficulties under certain conditions. For instance, it has been demonstrated that individuals may struggle to identify the head of a specific CNC (Geer et al. 1972; Limaye and Pompian 1991), and these CNCs may occasionally introduce ambiguity (cf. Montero 1996): as pointed out by Kvam (1990), a *kitchen towel rack* could refer to a rack designed for kitchen towels or to a towel rack situated in the kitchen. Furthermore, L2 speakers, who frequently produce and consume scientific literature, often translate CNCs inconsistently (Carrió Pastor 2008; Carrió Pastor and Candel Mora 2013) and may sometimes fail to retrieve the implicit semantic connections between the words in the NC (Horsella and Pérez 1991). In the realm of scientific terminology, elongated nominal compounds are recognized as compact repositories of information, making them prime candidates for structures that can induce difficulties in comprehension. To illustrate this in a more straightforward manner, let us examine the CNC wastewater treatment facility. The entire CNC designation consists of three words, with each word conveying, on average, 33% of its informational content. Conversely, consider an alternative phrasing that imparts the same meaning by utilizing prepositions: facility for the treatment of water from waste (which comprises eight words). If we assume that the overall information encapsulated in both expressions is approximately equivalent, it follows that each word in the latter phrase conveys, on average, half the information found in each word of the CNC. In other words, the information is distributed more evenly throughout the linguistic signal. Consequently, nominal groups present the most significant challenges in comprehension since they are structured as sequences of lexical words devoid of any grammatical words interspersed (Halliday, 1993, p.84). For instance, *piston outlet lubrication oil temperature* could be rephrased to the temperature of the lubrication oil used for cooling the piston, which is recorded at the outlet.

Historically, much of the research has concentrated on the complexity found within the verb phrase, that is, due to the increased utilization of subordination (Díez-Bedmar and Pérez-Paredes 2020; Durrant et al. 2020). Nevertheless, scholars focusing on second/foreign language writing are now progressively directing their attention toward complexity within noun phrases (e.g., Bulté and

Housen 2014; Verspoor et al. 2017; Kyle and Crossley 2018; Díez-Bedmar and Pérez-Paredes 2020). At the core of this transition is Biber et al.'s suggestion of a developmental framework founded on the notion that as writers of academic texts develop, they evolve from constructing sentences utilizing finite dependent clauses that act as components of clauses to constructing them with phrases that serve as modifiers within noun phrases (Biber et al. 2011, 2020). Consequently, the noun phrase is regarded as a crucial indicator of an advancing academic style.

Over the past two decades, research on complex nominal compounds (CNCs) has concentrated on their formation and application as multi-word units, along with their semantics and various approaches for their interpretation (Levi, 1978; Vanderwende, 1994; Rosario, 2002; Downing, 1974; Lauer, 1995; Warren, 1978). In more recent studies, CNs have been explored specifically for translation purposes, receiving particular emphasis on their creation and interpretation (Kaguera, 2012; Kim et al., 2013), particularly through the use of paraphrasing verbs and prepositions (Nakovv, 2013; Butnariu et al., 2010). Nevertheless, the predominant focus has been on two-term compound nouns.

Typically, these nominal compounds (NCs) consist of a head noun paired with one or more modifiers. NCs are especially common in scientific literature (Bhatia 1992). Within this context, it is estimated that between 9% and 16% of all words fall under the category of NCs, which are generally longer than those found in everyday English (Salager 1984). Analyzing the usage of NCs from the 18th century to the present across various English registers, Biber and Gray (2011) discovered that the occurrence of these compounds in the scientific domain surged tenfold between 1875 and 2005. Furthermore, they observed a rise in complexity, with three-word compounds that were once rare becoming prevalent by the 1950s. This increase in complexity was linked to a "principle of economy" characteristic of these specific registers. This conclusion resonates with the findings of Montero (1996), who further proposed that the use of NC stems from a "desire for novelty"; as well as with Salager (1984, p.142), who defines an NC as "a new concept for which the language code has no name … crystallized into a fixed expression owing [sic] a scientific meaning which the individual constituents do not have". Based on Salager's analysis, this novel concept, when employed for the first time, can be utilized again or referenced as an entity that the authors are confident the readers will comprehend.

To comprehend technical language, it is essential to look beyond mere vocabulary and to redirect our attention towards grammar, or more specifically, the interplay between grammar and vocabulary (Halliday, 1993). Furthermore, Pastor Gómez (2010, p.21) contends that shared knowledge among interlocutors leads to a decrease in explicitness; in other words, speakers refrain from reiterating what is already established or can be deduced from prior statements, or, in the words of Quirk, 'linguistic interchanges' (cf. Quirk, Greenbaum, Leech & Svartvik, 1985, p.1234). Consequently, effective communication signifies that a minimal number of words, groups, and/or clauses should be utilized to convey specific content. Nonetheless, the ESP instructor may not inherently possess this common knowledge because he/she lack expertise in the specialized domain and must depend on linguistic tools to decipher intricate nominal groups, including the configuration of the nominal group itself. Hence, the principal research inquiry is: Can the linguistic arrangement of the nominal group assist in comprehending the extralinguistic content? Considering that terms represent universal concepts within a particular domain, knowledge of syntax and terminology could aid ESP instructors in grasping the extralinguistic content, consequently allowing them to teach complex nominal groups more effectively.

Additionally, Pastor Gómez (2010) states that the count of items that can exist in a premodifying position is theoretically boundless. However, it is rare to encounter more than four, as

"excessive complexity in NP modification results in a processing overload, which consequently leads to a degradation in meaning and content" (Pastor Gómez, 2010, p.10). This is exemplified by the phrase *Internal Combustion Auto Engine Piston Car Pendant Alloy Keychain Key Ring*, where the content load of the nominal group is excessively "heavy" due to comprising 11 components. Therefore, determining the head or type of premodification, along with accurately interpreting the intricate nominal group, becomes nearly impossible.

METHOD

In this research, we examine the application of CNPs and analyze their distributional characteristics within scientific literature. We developed a collection of scientific articles sourced from high-impact journals spanning various disciplines, identified their CNPs, and conducted both qualitative and quantitative analyses. Our quantitative analysis involved counting the number of CNPs present in different sections of the corpus articles, tracking their frequency of reuse, and noting the occurrence of two-word subparts in the text passages that precede the CNPs. In our qualitative analysis, we examined how CNPs are established within their context, determining the strategies employed by authors when presenting a new CNC. Additionally, we carried out informal interviews with non-ESP English teachers to assess their comprehension of complex nominal groups. As anticipated, the interviewees faced significant challenges in processing and understanding the nominal compounds provided, primarily due to their lack of familiarity with the meanings or, more specifically, the functions of distinct engine components, types of foundations, or types of dental materials. In contrast, students studying mechanical and civil engineering or dentistry encountered no difficulties in interpreting these complex nominals.

FINDINGS AND DISCUSSIONS

A complex nominal phrase is made up of a head, typically a noun, which may be premodified by adjectives, participles, and even other nouns, while being postmodified by nouns, prepositional phrases, and relative clauses. Additional kinds of postmodifiers, including adjectives, can also be utilized. Prior research indicates that the occurrence of complex nominal phrases (CNPs) rises with the technical sophistication of the scientific publication: the greater the sophistication, the more frequent and intricate the CNPs (Horsella and Pérez, 1991). Notwithstanding this and other earlier research that discusses the frequency (Biber and Gray, 2011) and the complexity (Geer et al., 1972) of CNPs, there remains limited knowledge regarding their distributional characteristics within the scientific register. Specifically, it is unclear how the preceding content facilitates their introduction, their rate of reutilization, or whether they tend to group in specific sections of the article.

As mentioned previously, authors like Salager (1984) proposed that CNPs are considered 'ad hoc names', employed to signify new concepts. Furthermore, it was suggested earlier that terms that have been recently introduced become increasingly 'available' in the cognition of the reader. Both perspectives imply that once a CNP is utilized for the initial time, it is likely to integrate into the reader's lexicon and be reiterated multiple times throughout the scientific paper. We also took into account the potential impact of the length of these structures on whether they may evolve into an ad hoc name. It can be argued that, on average, longer CNPs exhibit greater "density"; for example, a term like "unconditional mean audited statement collection rate" likely signifies a higher information density peak compared to a term such as "*Chinese stock market*." Therefore, it is possible that the distribution of shorter CNPs differs from that of longer ones.

Modifiers can encompass adjectives and adjective phrases, nouns and noun phrases, prepositions and prepositional phrases, the infinitive form, participial phrases, as well as relative clauses, among other elements. Those modifiers that precede the noun head are termed pre-modifiers, while those that succeed the noun head are classified as post-modifiers (Quirk et al., 1985; Carter and McCarthy, 2006; Huddleston and Pullum, 2008). The scholarly literature identifies predominantly six types of premodifier elements: adjectival premodifiers (for instance, "the *smart* engineer/ *periodontal* disease/ *competitive* market"); nominal premodifiers (for example, "a *piston* engine/ *enamel* erosion/ *inflation* rate"); participle premodifiers (such as "*desired* torque/ *energy-saving* car/ *medically-comprised* patient/ *declining* labor"); genitive premodifiers (like "*engineer's* hypothesis/ *doctor's* orders/ the bank's decision"); adverbial phrase premodifiers (for example, "*a hard-to-get* material/ *rapidly* progressing caries/ *a poorly* managed debt"); and premodifier sentences in which a compound or idiomatic expression functions as a premodifier preceding a noun; such expressions are frequently evaluative, metaphorical, or descriptive, and although they are less prevalent in technical writing, they may be found in more narrative, reflective, or patient-oriented contexts (as in "*a can-do* attitude/ *a data-driven framework* for clinical decision-making/ *a data-driven* empirical *analysis*").

Premodification is indicated through the use of nominal adjectives, a feature commonly seen in the right-to-left structure of the English language. This trait is more prevalent in English for Specific Purposes (ESP) and results in compound structures that are lengthier compared to standard English (Salager, 1994). Within this framework, nouns that function as adjectives are preferred over traditional adjectives (Hughes, 1988). Nevertheless, this inclination generally does not apply to cases where the quantity exceeds six, as a result of the constraints imposed by human short-term memory capacity (Miller, 1967). Moreover, such situations require heightened interpretive effort from the recipient, who must depend on both their language proficiency and specialized knowledge to alleviate ambiguity, while also taking into account the context and the surrounding text. At times, a hyphen is used as a method of clarification, signifying semantic connections between terms. In certain cases, ambiguity may originate from a polysemous premodifier or the inclusion of adjectives and past participles, leading to a hybrid form of premodification — as seen in the expressions "*a high-strength steel-reinforced* beam/ *patient-centered evolving* protocol/ *comprehensive policy-based* approach/ *high-quality* products." Although premodification ensures brevity in text, it frequently compromises clarity of concepts. However, it does present various benefits: expertise can help clarify potential misunderstandings, it facilitates the creation of more complex sentence structures, and it often leads to the creation of new ideas that alter the current understanding, thus adding further meanings and uses. The rationale for employing expanded noun premodifiers cannot be based solely on a quest for brevity, as they are not invariably the most concise method for communicating thoughts. Further justifications are rooted in the text's composition. By emphasizing the rewording of ideas in a thematic context, this method improves the flow of information from novel to established, thus aiding in the elaboration of the text and enhancing its cohesion. Additionally, it allows for the enhancement of the objectivity of the author's viewpoints, as observed by Halliday (1990), while also fostering increased precision and thoroughness, especially within the field of ESP, as pointed out by Bhatia (1994). The application of premodification leads to an increase in lexical density, indicating that there is a considerable ratio of content words to the total word count in a given text. This occurrence is especially prominent in written technical documents, which are generally more organized, devoid of hesitation markers, and show diminished redundancy.

The use of noun-noun combinations can certainly optimize the linguistic structure and improve the succinctness of an article, which aligns seamlessly with the goals of English for Specific

Purposes that emphasize narration and deduction. Additionally, nouns utilized as attributes typically encompass a range of situations that may introduce semantic difficulties related to the form, which is rich in information and necessitates significant levels of inference for semantic unpacking.

This section presents a case study that examines the use of [noun] + [noun] constructions by Romanian students pursuing English studies in the fields of civil and mechanical engineering, economics, and dentistry.

A solitary noun functioning as the modifier for another noun or nominal phrase:

"In conclusion, both methods were found suitable to use for *vulnerability assessment* of buildings in Bangladesh." (Adapted from Kairi, A. B., Ahmed, M., Nath, S. C. (2024). Seismic Risk Assessment for Sreemangal Town: Exploring the Use of Reliability-Based and RVS-FEMA 154 Methods for Building Safety in Bangladesh. *American Journal of Civil Engineering*, *12*(6), 188-198. https://doi.org/10.11648/j.ajce.20241206.12)

"In the 1960s, research on ceramics expanded significantly, exploring their applications not only as aesthetic dental materials but also as biomaterials for *bone replacement*." (Adapted from Aguirre-Osorio, A. F. (2025). The Role of Zirconia Implants in Implantology: Potential Benefits and Challenges. International Journal of Dental Medicine, 11(1), 1-9. https://doi.org/10.11648/j.ijdm.20251101.11)

"The problem in *conservation practices* today and before is that the integrity of tangible cultural heritage and intangible cultural heritage is not understood… Old and new designs can be completely opposite or compatible in terms of features such as *material selection, connection details and building system*." (Adapted from Dizdar, S. I. (2024). Building Design in Historical Environment-Periodical Study-Haydarpaşa / Selimiye. *Landscape Architecture and Regional Planning*, *9*(3), 54-63. https://doi.org/10.11648/j.larp.20240903.11)

"Additionally, interviews with experts have been conducted to identify potential strategies to enhance *investment opportunities*." (Adapted from Ticona, Y. G., Gómez, M. R. (2025). Strategies to Increase the Value of Foreign Direct Investment in Bolivia. Journal of World Economic Research, 14(2), 113-119. https://doi.org/10.11648/j.jwer.20251402.11)

"*Design management* plays a critical role in overseeing the *design process* and fostering effective collaboration within organizations, yet its conceptual understanding remains fragmented due to limited cohesive research literature." (Adapted from Agegn, A. A., Meharie, M. G., Dinku, G. F. (2024). Bibliometric Study on the Determinants of Building Design Management Practice. *Journal of Civil, Construction and Environmental Engineering*, *9*(6), 226-245. https://doi.org/10.11648/j.jccee.20240906.15)

A nominal phrase acting as a modifier for an individual noun:

"This article investigates the effectiveness of *land use administration and governance* on controlling middle-income housing developments in Nairobi." (Adapted from Mwangi, M. M. (2024). The Effectiveness of Land Use Administration and Governance on Controlling Urban Spatial Forms in Nairobi. *Urban and Regional Planning*, *9*(1), 12-23. https://doi.org/10.11648/j.urp.20240901.12)

"This turning point introduced *new dental health challenges*, with edentulism becoming especially prominent." (Adapted from Aguirre-Osorio, A. F. (2025). The Future of Conventional

Complete Dentures: A Narrative Review on Edentulism Risk Factors. International Journal of Dental Medicine, 11(1), 25-33. https://doi.org/10.11648/j.ijdm.20251101.14)

"In this regard, resistances of 46%, 33% and 32% higher than the minimum limit were obtained to be used in *pavement patching actions* as a subbase." (Adapted from Gutsens, A. S., Rodríguez, Y. D., Soroa Bell, M. R., Muñoz, S. R. (2024). Reuse of Drill Cuttings Contaminated with Diesel in the Formation of Asphalt Pavement. *Journal of Civil, Construction and Environmental Engineering*, *9*(2), 33-41. https://doi.org/10.11648/j.jccee.20240902.11)

"While this occurrence has been rare, it highlights the importance of monitoring *long-term implant stability* and suggests that further investigation into the underlying causes of this phenomenon is necessary." (Adapted from Aguirre-Osorio, A. F. (2025). The Role of Zirconia Implants in Implantology: Potential Benefits and Challenges. International Journal of Dental Medicine, 11(1), 1-9. https://doi.org/10.11648/j.ijdm.20251101.11)

"By following the *topology construction method* outlined in the paper, engineers can gain valuable insights and guidelines for designing circuits in the field of power electronics. Theoretical analysis has been verified in the experimental prototype and the provided resources also serve as an educational tool for those studying *power electronics engineering*. " (Adapted from Pan, Y., Lv, D., Lu, C., Lu, J. (2024). Switched-Capacitor Enhanced Circuits for Voltage-Boosting DC-DC Converters: Principles and Applications. *American Journal of Electrical Power and Energy Systems*, *13*(1), 14-20. https://doi.org/10.11648/j.epes.20241301.12)

"The absence of effective sanctions and *weak civil society engagement* worsens the situation. More than 50% of *identified tax evasion cases* between 2019 and 2022 did not result in sanctions." (Adapted from Rodolfo, B. (2025). Combatting Illicit Financial Flows in Mozambique: The Role of Tax Transparency Reforms. Journal of World Economic Research, 14(2), 120-126. https://doi.org/10.11648/j.jwer.20251402.12)

"*The proficiency testing (PT) program* is a critical part of quality assurance in laboratories, especially within industries like construction where cement testing is essential." (Adapted from Vashishtha, S. (2024). Ensuring Quality and Consistency in OPC-53 Cement Testing: A Comprehensive Proficiency Testing Evaluation. *American Journal of Science, Engineering and Technology*, *9*(4), 191-201. https://doi.org/10.11648/j.ajset.20240904.11)

Nominal phrases functioning as modifiers for other nominal phrases:

"This paper investigates the buckling behavior of Q690 *high-strength steel tubes* under combined axial compression and bending loads through experimental testing and finite element analysis (FEA)." (Adapted from Rajib, S., Chen, L. (2024). Experimental and Numerical Investigation of Buckling Behaviour in Q690 High-Strength Steel Tubes Under Combined Axial Compression and Bending Loads. *American Journal of Civil Engineering*, *12*(6), 178-187. https://doi.org/10.11648/j.ajce.20241206.11)

"The tongue showed multiple large ulcerations surrounded by erythema and *plaque-like background lesions* affecting the full dorsum surface of the tongue." (Adapted from Alsarraf, A., Almusallam, H., Alsalem, F., Alfadalah, Q. (2025). Oral Manifestations of Graft Versus Host Disease – Clinical Presentations After Allogeneic Hematopoietic Cell Transplantation. *International Journal of Dental Medicine*, 11(1), 20-24. https://doi.org/10.11648/j.ijdm.20251101.13)

"Firstly, it analyzes the impact of *Arctic sea ice changes* on ship navigation and the importance of sea ice monitoring in route planning." (Adapted from Chen, L., Wu, D., Shen, C. (2024). Exploring the Use of Fengyun-3 Meteorological Satellite for Monitoring Sea Ice to Provide Services for Polar Navigation. *American Journal of Traffic and Transportation Engineering*, *9*(5), 89-97. https://doi.org/10.11648/j.ajtte.20240905.13)

"These models, widely recognized as *English garden-city models* in Europe, also found prevalence under different terms like cité-jardins in France and Garten-stadts in Germany." (Adapted from Coskun, H. (2024). From Modern Ideas-Theories, and Pandemic, Garden-Cities of To-Morrow, and Today. *International Journal of Architecture, Arts and Applications*, *10*(4), 64-75. https://doi.org/10.11648/j.ijaaa.20241004.11)

"It's clear you have to start with an understanding of the impact of the disease on the people who have it, and what they value most in terms of alleviation, before you set up a measurement and go forward with *truly patient-focused drug development*." (Adapted from https://www.fda.gov/files/drugs/published/Clinical-Outcome-Assessment-Implementation-in-Clinical-Trials.pdf)

"Due to the randomness and high volatility of *urban road network short-term traffic flow*, it is difficult for a single model to accurately estimate traffic flow and travel time." (Adapted from Wang, X., Fang, F. (2024). Short-Term Traffic Flow Prediction Based on Wavelet Analysis and XGBoost. *International Journal of Transportation Engineering and Technology*, *10*(1), 15-24. https://doi.org/10.11648/j.ijtet.20241001.12)

"Kenya, on the other hand, has strengthened its Revenue Authority through the integration of Artificial Intelligence tools for tax auditing and introduced the iTax platform, which facilitates *real-time taxpayer services and monitoring*." (Adapted from Rodolfo, B. (2025). Combatting Illicit Financial Flows in Mozambique: The Role of Tax Transparency Reforms. Journal of World Economic Research, 14(2), 120-126. https://doi.org/10.11648/j.jwer.20251402.12)

"There are several researches on integrating the solar system with a diesel generator to form a *hybrid power generation system*." (Adapted from Hammadi, F. Y., Shaker, Q. K., Al-Mufti, A. W., Jabbar, R. H., Al-Chaderchi, M. (2024). Design of Local Micro-Grids to Solve the Electricity Shortage in Iraq Cities. *American Journal of Electrical Power and Energy Systems*, *13*(3), 49-58. https://doi.org/10.11648/j.epes.20241303.12)

The author's extensive teaching experience consistently reinforces the observation that constructions structured as [noun] + [noun] pose specific difficulties for Romanian students in fields such as engineering, economics, and dentistry. It is evident that students face challenges with the [noun] + [noun] construction, especially those who demonstrate lower proficiency levels in English (particularly A2 according to the Common European Framework of Reference for Languages (CEFR), and B1 in certain assessments). These difficulties can chiefly be ascribed to the variations between Romanian and English noun phrases. Being a Romance language, Romanian usually applies post-modification of the head noun, placing it at the forefront (for instance, "*motorul cu ardere internă/ strat de asphalt rezistent la apă/ material de umplere temporară/ comportamentul de cheltuieli al consumatorilor*"), whereas English, as a Germanic language shaped by Latin, primarily employs pre-modification, with the head noun situated at the end ("*internal combustion engine/ water-resistant asphalt layer/ temporary filling material/ Consumer spending behavior*"). Moreover, because [noun] + [noun] formations often become entrenched in the lexicon, learners frequently

encounter them when engaging with materials or videos pertinent to their main field of study. This implies that such formations can be learned both implicitly (through exposure to specialized terminology) and explicitly (through teaching of syntax alongside practice exercises, which are still common in Romania). The ability to convey meaning effectively through noun phrases and to create texts that demonstrate nominal complexity, rather than relying on clauses, is increasingly important for university students (Parkinson and Musgrave, 2014, p.48). Differently stated, as academic writers develop their skills, they transition from constructing sentences that utilize finite dependent clauses as clause components to using phrases that serve as noun phrase modifiers (Biber et al. 2011, 2020). Consequently, the noun phrase is regarded as a critical marker of an evolving academic style.

All examples presented in this section are obtained from credible journals written by global scholars and are indexed in Scopus. Our choice of Scopus-indexed works is founded on the belief that the articles published in these journals are broadly accessible and recognized worldwide. In light of this aim, this section examines the various types and distributions of pre- and post-modifiers of noun phrases (NPs). This paper aims to assist ESP educators and students who focus on academic writing. By analyzing the types and distribution of NPs in international journals, educators will enhance their understanding of which elements to underscore and prioritize for their students, especially in teaching NPs that conform to academic writing conventions. There are numerous reasons why NP complexity holds significance for writing development. Firstly, gaining mastery over NP complexity is crucial to mastering ESP language, as it serves as a defining characteristic of advanced academic writing. Secondly, earlier studies have indicated that increases in NP complexity represent one of the most reliable indicators of overall syntactic advancement in students' writing (Durrant et al., 2021).

CONCLUSIONS

The primary motivation for conducting this research was to assist the ESP teacher in overcoming the challenge of lacking specialization in the relevant field, and to explore how insights gained from this research can enhance their understanding and enable them to effectively teach complex nominal phrases. The most significant conclusion drawn from the study is that in technical English, two-word lexical units (for instance, *cylinder head/ drainage system/ enamel erosion/ exchange rate*) and sometimes even three-word lexical units (such as *external combustion engine/ reinforced concrete beam/ gum disease management/ trade balance deficit*) function as singular units. Complex terms that consist of two or three nouns are singularised—they change rank and operate as lexical units rather than syntactic ones. In a complex nominal group, these terms can either serve as a (pre)modifier or occupy a head position. The type of modification, along with the non-linear structure of the nominal group, is crucial for clarifying syntactic ambiguity.

An investigation into the ways various language users—such as English speakers lacking specialization in the area, English educators (both ESP and non-ESP), students, and field specialists—interpret, comprehend, and process nominal groups (that is, the strategies they employ to identify components of a nominal group and the influence of nominal group complexity on reading comprehension) would provide deeper insights into this intricate and often ambiguous subject.

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