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Nominalization in Academic Writing: A Cross-disciplinary Investigation of Physics and Applied Linguistics Empirical Research Articles

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Abstract

The present study aimed to explore how nominalization is manifested in a sample of Physics and Applied Linguistics research articles (RAs), representing hard and soft sciences respectively. To this end, 60 RAs from discipline-related professional journals were randomly selected and analyzed in light of Halliday and Matthiessen's (1999) taxonomy of nominalization. Comparing the normalized frequencies indicated that articles in Applied Linguistics differ significantly from their counterparts in Physics as they include more nominalized expressions. Moreover, the analysis brought out the findings that deployment of nominalization Type Two is significantly different from the other three types of nominalization in each discipline. Subsequently, the obtained expressions were put into their context of use in order to extract the most prevalent patterns of nominalization in the RAs. The investigation into the embedded patterns introduced 15 common patterns for Physics and Applied Linguistics RAs. Chi-square analyses suggested statistically significant differences in using only four patterns. Finally, implications accrue to the findings in reference to academic writing teachers and course designers.

Keywords: Academic Writing, Nominalization, Research Articles, Systemic Functional Linguistics, Physics, Applied Linguistics

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1. Introduction

Owing to the importance of scientific writing in sharing knowledge, an extensive number of linguistic studies have been carried out in this area in recent years (e.g., Abdi, 2011, 2009; Abdollahzadeh, 2011; Gillaert & Van de Velde, 2010; Hu & Cao, 2011; Hyland, 2008, 2003; Jalilifar, Alipour & Parsa, 2014; Jalilifar, Saleh, & Don 2017a; Jalilifar, White, & Malekizadeh, 2017b; Ren & Li, 2011; Samraj, 2005; Zarei & Mansoori, 2012; Yang, 2014). Academic writing is the most prominent means of exchanging information among discourse community members and can be considered as an eminent channel via which it will be possible for academics to talk to each other and share their knowledge. According to Vazquez and Giner (2008), academic writing should improve the credibility of the writer which constructs a reliable description of the researcher's analysis. Academic writing has its own salient features to which special probabilities are attached. It is a form of scientific writing in which certain words and grammatical forms are strongly favored while others are not taken as the most favored constructions in varieties of writings (Halliday & Martin, 1993).

Among the various types of academic writings, it is the research article (RA) which has garnered the attention of scholars (Hyland, 2005; Jalilifar, 2012; Jalilifar et al., 2017a; Oztürk, 2007; Samar & Talebzade, 2006; Samraj, 2002; Swales, 1990). As contended by Koutsantoni (2006), RAs are conceived as one of the key genres that members of research communities use to expand and share the knowledge of the field. To disseminate new information which would probably certify or contradict previous findings, researchers place great importance on RAs; hence, authors are cautious as the acceptance or rejection of their findings is highly dependent on the method of its presentation to the disciplinary community (Nivalas, 2011).

To improve the method of development a prominent feature of academic texts is the high degree of formality, and this is obtained through the use of specialist vocabulary, information packaging, and impersonal voice which are all respectively reflected in three areas: high lexical density, high nominal style and impersonal constructions (Hyland, 2006). As a result, the presence of a specialized pattern of information packaging and texture which assist the economy of words and maintain the sophistication as well as erudite touch which distinguishes a particular text as an academic discourse is necessary (Ezeifeka, 2014).

In introducing the nuances and structures typical of academic writing such as the use of nominalization, teachers require a suitable means of clarifying and explaining how these characteristics work in context. One of the most useful tools for examining such patterns is provided by Systemic Functional Linguistics (SFL). In SFL, language is construed as different and interrelated options to make meanings and it provides a clear relationship between functions and grammatical systems (Halliday, 1994). Systemists focus on "how the grammar of a language serves as a resource for making and exchanging meanings" (Lock, 1996, p.3). That is, being concerned with the grammatical patterns, lexical items, as well as choices of those items, SFL is functional since it is designed to account for how language is used in written or spoken texts. To analyze texts, systemists prefer to take different approaches so they can clarify the main functions of a text served through linguistic forms. There does, in fact, seem to be a considerable emphasis given to grammatical metaphor (GM) among these features. Martin and Rose (2007) elaborate on GM as involving transference of meaning from one kind of element to another kind (p. 110).

Among the lexico-grammatical realizations of grammatical metaphor, nominalization is the most common form, particularly in science and

technology discourse. As an essential resource for creating scientific discourse, nominalization is used for a more formal, concise and stylistic textual representation and packaging of meaning in an economical way. Reliance on nominalized constructions is particularly prominent in academic writing (e.g., Banks, 2008; Halliday, 2004). Nominalization, as has been presented in metaphor studies, is the means by which the processes and qualities are turned into nouns. At the grammatical level, nominalization can be treated as a grammatical resource for deriving nouns from other word classes such as verbs and adjectives (Halliday & Matthiessen, 2004). Obtaining the meaning of nominalization requires the analysis of both the metaphorical and the congruent realizations (Halliday, 1994; Heyvaert, 2003). Thus, in the following example, if we want to talk about the differences between two types of something, the natural way to do it would be (1).

(1) *These two types are different. It is assumed in the second type that there are certain generic elements that indicate the quality of research articles.* (Applied linguistics, Jaroongkhongdach et al., 2012, p. 196)

We could also talk about how the two types differ in an incongruent manner as in (2).

(2) *The main difference between these two types is that the second type follows the assumption that there are certain generic elements that indicate the quality of research articles.*

Taking the Hallidayan analysis, the nominalized structures like *difference* and *assumption* are viewed as the metaphorical counterparts of *different* and *assumed*. These changes illustrate what is meant by grammatical metaphor.

There has been a considerable surge of attention to research on nominalization through the study of the academic texts employed in different

scientific disciplines (Biber & Gray, 2013; Babaii & Ansary, 2005; Comrie & Thompson, 2007; Halliday & Martin, 1996; Halliday & Matthiessen, 1999; Heyvaert, 2003; Jalilifar et al., 2014; Jalilifar, et al, 2017b; Mair & Leech, 2006; Moltmann, 2007; Noonan, 2007; Rathert & Alexiadou, 2010; Zucchi, 1993). Close textual inspection and principled methods of analysis of these sets of studies which deal with specific disciplinary contexts in single disciplines have depicted the prevailing utilization of nominalization which plays an important role in academic discourse (Galve, 1998; Fatonah, 2014; Starfield, 2004; Vu Thi, 2012). However, other cross-disciplinary studies have gone further in analyzing the deployment of nominalization more profoundly. More recent studies surveyed nominalized expressions as unique discourse features in academic writings across disciplines and the results showed no significant differences in using nominalizations in the intended disciplines (Jalilifar et al., 2017b; Jalilifar & Memari, 2017; Jalilifar, Alipour & Parsa, 2014; Ahmad, 2012; Hadidi & Raghami, 2012). Jalilifar et al. (2017b), for example, investigated nominalization types and patterns in eight academic textbooks from Physics and Applied Linguistics. They reported similarities in the deployment of the first three most prevalent patterns in the sample textbooks, and marked disciplinary distinctions in the distribution of these patterns. However, their study showed no significant difference in deployment of the four types of nominalization ascribable to disciplinary variations. Nevertheless, other studies have acknowledged marked disciplinary characteristics by the use of nominalization, (Tabrizi & Nabifar, 2013; Pun & Webster, 2009; Holtz, 2009; Alise, 2008). This disparity in the use of nominalization across various branches of science suggests that, influenced by the epistemological nature of the inquiry, nominalization may be used in different disciplines to account for the nature of discipline-specific academic writings. Thus, previous studies have

failed to provide a conclusive answer to the question of nominalization across disciplines.

It is thus worth exploring lexico-grammatical features of nominalization across various sciences to enhance writers' awareness of how to participate in their respective field's knowledge-making practices and how the language system operates in different academic disciplines. The need to study disciplinary differences motivates researchers to shed more light on nominalization in academic writing, investigating how nominalization is manifested in the sample experimental RAs of Physics and Applied Linguistics, representing hard and soft sciences respectively, to reveal the probable intrinsic disciplinary peculiarities in the deployment of nominalization which seem to have been underrepresented in the existing literature. More specifically, the current study targeted seeking answers to the following questions:

1. To what degree does the distribution of nominalization differ in a comparison of the sample RAs in Physics and Applied linguistics?
2. To what extent are the rhetorical functions of nominalization different in the RAs?

2. Method

To explore the extent of nominalization deployment in RAs, the present comparative, corpus-based study draws on the qualitative and quantitative analyses of instances of nominalization in a corpus of RAs as representatives of Physics and Applied linguistics to find out whether the distribution of nominal expressions and their related patterns mark any disciplinary distinctions.

2.1. Disciplinary Representation

Following a cognitive approach, that is setting the categories on the basis of both the experience of scientometricians and external experts, Glanzel and Schubert (2003) proposed a two-level hierarchical classification scheme for three main discipline areas: *Sciences*, *Social Sciences*, and *Humanities*. Glanzel and Schubert's (2003) two-level scheme includes 12 first-level fields and 60 second-level subfields of the Sciences, as well as three major fields and seven subfields for the Social Sciences and Humanities. Another major area, *applied disciplines,* has been introduced by Coffin, Curry, Goodman, Hewings, Lillis, and Swann (2003). They have provided some representative examples for these four main discipline areas.

With reference to the complexity of demarcating disciplines and the various analytical frameworks used to classify academic disciplines, the choice of the disciplines under the study was based on the new classification scheme of science fields which is a way of grouping disciplines into four main areas: *Sciences*, *Social Sciences*, *Humanities/Arts*, and *Applied Disciplines* (Coffin, et al., 2003; Glanzel & Schubert, 2003). As displayed in Figure 1, these four main areas are placed along a continuum from *sciences* to applied disciplines (Hyland, 2009, p. 63).

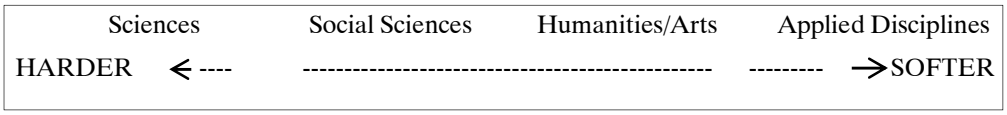

Figure 1. ***Continuum of Disciplines***

Taking Glanzel and Schubert's (2003) and Coffin et al.'s (2003) classification schemes for the main discipline areas, we included Physics [PH] to represent the Sciences at the so-called hard end of the continuum and

Applied linguistics [AL] to represent the Applied Disciplines at the soft end of the continuum.

2.2. Research Article Selection

Decision on journals was made by consulting five experts in each discipline. To this aim, the university professors in the related departments at Shahid Chamran University of Ahvaz were met and they were asked to recommend the most important and prestigious journals they, as experts in the field, consider as essential in their own discipline. The suggestions made by these experts were then juxtaposed to arrive at a final decision on the selected materials for the analysis. Acknowledging that genres, according to Ramanathan and Kaplan (2000), are dynamic and likely to be temporal, we downloaded only RAs published since 2011 onwards from the respective journals. The papers for the analysis were retrieved from seven academic journals from Applied Linguistics (*Journal of Pragmatics, English for Specific Purposes, English for Academic Purposes, Discourse Studies, Discourse and Communication, International Journal of Applied Linguistics* and *Language Learning*) and three journals from Physics (*Biomaterials, Solar Energy Materials and Solar Cells, Journal of Magnetism and Magnetic Materials*). Assuming that the generic structure of a research article might change depending on whether the article reports an empirical study or reflects on the existing theories or reviews a book (Crookes, 1986), we included only those articles with an empirical design. This led to the selection of an unequal number of articles from the journals. All the papers were published between 2010 and 2015 except for two papers in Physics which were published in 2007 and 2008. Consequently, each discipline was represented by random selection of 30 sample RAs. A corpus of this size can be regarded as representative of the empirical papers published in the two

disciplines in focus and is expected to be satisfactory to make tentative generalizations about the rhetorical structure preferences of the members of the academic communities in the related disciplines (Holmes, 1997; Ruiying & Allison, 2003). What makes this study interesting is that contrary to other studies (Giannoni, 2002; Jalilifar et al., 2017a), the analysis here was not restricted to only one part of RAs but all parts of an RA, after removing the abstract, reference list, acknowledgments, and appendices, were subjected to analysis.

3. Data Analysis

The first phase in the analysis was identification, quantification, and classification of nominalization instances. In order to locate the instances of nominalizations in the RAs, one of the researchers first read the entire texts. In light of Halliday and Matthiessen's (1999) taxonomy of nominalizations, all occurrences of nominalizations were excerpted manually. According to Halliday (1999), each metaphorical wording must have its equivalent congruent wording. Therefore, in this study, to make sure that the excerpted instances truly function as nominal, the congruent domains of extracted instances were discussed, a pursuit which Thompson (2004) refers to as unpacking a grammatical metaphor (arriving at or hypothesizing about a potential wording that mirrors that instance of grammatical metaphor in its congruent domain). In addition, to ensure that instances of nominalizations were identified with a high degree of accuracy, inter-coder procedures were implemented in the second stage: to check the inter-coder reliability, about 10 percent of the sample was cross-checked by a second coder working independently. This was followed by applying Pearson correlation to calculate the inter-rater reliability of the analyses. The coefficient of correlation obtained for the analysis was 0.80

which is an acceptable index. The two researchers then discussed the results and adjudicated any disagreements. The main researcher then continued locating nominalization instances in the rest of the papers

The process of analysis was pursued by counting each instance of nominalization and then various types of instances were classified based on the four types of nominalizations enumerated by Halliday and Matthiessen (1999) (see Table 1). First, nominalization instances were identified manually and tagged based on suffixes: nouns ending in the suffixes *-ity* and *-ness* were tagged as Type 1 (deriving from adjectives, originally realizing properties); nouns ending in the suffixes *-age* , *-al* , *-(e)ry*, *-sion / -tion*, *-ment*, *-sis*, *-ure*, and *-th* were tagged as Type 2 (deriving from verbs, originally realizing processes); and nouns not ending in suffixes were tagged through consulting dictionaries to find the related derivation from adjectives, verbs, prepositions, and conjunctions.

Table 1. *Halliday and Matthiessen's (1999) Classification of Nominalizations*

	Conversion			Example		
Type 1	Adjective	→	Thing	unstable	→	instability
Type 2	Verb	→	Thing	transform	→	transformation
Type 3	Circumstance	→	Thing	with	→	accompaniment
Type 4	Conjunction	→	Thing	if	→	Condition

Text analysis is a very knotty and onerous task because it assumes possessing analytical skills on the part of the analyst to arrive at sound analyses and avoid wrong interpretations and classifications. For instance, decision on a nominalization instance or a gerund can sometimes be a hard nut to crack. To this aim, an extensive manual checking was carried out to correctly categorize the nouns ending in *–ing* as either instances of nominalization derived from verbs (e.g., *After giving answers* [AL, Alfahad (2015, p. 60)] (*give- giving*), or not, for example as a gerund (e.g., *Presenting them with such a model is vital*

not only because they have not been expected … [AL, Hawes & Thomas (2012, p. 176)]).

The second phase in the analysis included identification, quantification, and classification of the patterns in which the nominal groups cropped up. In so doing, the main researcher extracted the patterns used in each discipline through analyzing the lexicogrammatical contexts in which nominals occurred. As the purpose of this part of the study was identification and categorization of the nominalization patterns that appeared in the studied texts, the analysis of the texts ceased when dominant patterns were identified and no further similarities/differences emerged in the way these patterns were realized. The analysis of about 7 RAs from Applied linguistics and only 4 RAs in Physics resulted in data saturation. Extracting the patterns was obtained through the identification of the word order of the elements of the nominal groups in which instances of nominalization occurred. The basis for extracting the patterns was Halliday (2004, p. 320), as illustrated in Figure 2:

Deictic	Deictic 2	Numerative	Epithet	Classifier	**Thing**	Qualifier
determiner	adjective	numeral	adjective	noun/ adjective	**noun**	Prepositional phrase/ (in)finite clause

Figure 2. ***Experiential Functions and Word Classes***

4. Results and Discussion

In this section, the results obtained from data analysis are presented and discussed. As the total number of words in each group of RAs varied across the selected disciplines, (248418 in Applied Linguistics vs. 140523 in Physics), normalization of the data was necessary. In simple terms, the instances of nominalization per equal number of words in both corpora were counted. In comparing the normalized frequencies as reported in Table 3, the use of 10196

instances of nominalization or approximately 21 instances per 500 words in Applied Linguistics almost doubles that in Physics, indicating that authors in Applied Linguistics differ from their counterparts in Physics in the use of nominalized expressions.

Table 3. *Frequency Analysis of Nominalized Expressions in Each Discipline Per 500 Words*

Discipline	Raw number of nominal expressions	Per 500 Words of nominal expressions	Word counts
Physics	2939	10.457	140523
Applied Linguistics	10196	20.521	248418
Total	13135	30.978	388941

The result was analyzed through Chi-square (X2), to test whether the difference between the RAs in the selected disciplines, in terms of the use of nominalization, was significant. Chi-square test showed a significant difference at 0.05 (X=3.903; critical value=0.0482). This finding is compatible with those gained by Jalilifar et al. (2014). They, as well, found that the use of nominalization in Applied Linguistics by far outran that in the hard discipline of Biology.

The difference between Applied Linguistics and Physics RAs might reflect the attitudes of the writers of the two disciplines in construing academic knowledge. A further reason for the existing disparity relates to the nature of the two disciplines, with Applied Linguistics dealing with more abstract topics (e.g., language proficiency, politeness, thematicity, metadiscourse, oral request) than Physics (e.g., particles and nano-particles). Results indicated that the more abstract a discipline, the more abstraction is required in the language to write in that discipline.

As can be seen from Table 4, frequency analysis revealed that there are worth-pointing differences in the use of various types of nominalization in these two disciplines. Nominalization type two, verb (Process) to noun (entity), outnumbered the other three types of nominalization with a higher percentage (84.84 and 83.94) in both disciplines, followed by nominalization type 1 (quality). The other types of nominalization were not substantially employed.

Table 4. *Frequencies of Nominalization Types in the RAs of Hard and Soft Sciences*

		Type 1 (Qualities)	Type 2 (Processes)	Type 3 (Circumstances)	Type 4 (relators)
Applied Linguistics	Raw number	1433	8651	103	9
	Per 500	70.27	424.2	5.05	0.44
	Percentage	14.05	84.84	1.01	0.08
Σ = 10196					
Physics	Raw number	401	2460	65	4
	Per 500	68.43	419.7	11.09	0.68
	Percentage	13.43	83.94	2.21	0.13
Σ = 2930					

Results of the Chi-square revealed that deployment of nominalization type two is significantly different from the other three types of nominalization in each discipline. The exact statistical results are provided in Tables 5 and 6.

Table 5. *Chi-square Values of Nominalization Types in the RAs of Physics*

Nominalization types	Chi-square	Df	P value
Type 2 & 1	253.902	1	0.0001*
Type 2 & 3	388.123	1	0.0001*
Type 2 & 4	417.010	1	0.0001*

*Extremely statistically significant

Table 6. *Chi-square Values of Nominalization Types in the RAs of Applied Linguistics*

Nominalization types	Chi-square	Df	P value
Type 2 & 1	2221.859	1	0.0001*
Type 2 & 3	2409.041	1	0.0001*
Type 2 & 4	2421.002	1	0.0001*

*Extremely statistically significant

This finding is in conformity with previous research (Kazemian & Hashemi, 2014; To, Lê & Lê, 2013; Sarani & Talati, 2015; Jalilifar et al., 2014; Jalilifar et al., 2017b). Particularly noteworthy, though, is that our findings resonate with the study by Jalilifar et al. (2014), as they found no significant difference in using nominalized expression types in Applied Linguistics and Biology disciplines. A possible explanation for the high interest in the use of deriving nouns from verb class, according to Biber and Gray (2013), could be the historical shift, which began at the turn of the 20th century. This shift is the development in the use of nouns and decline in the use of verbs in all academic writing registers (Banks, 2008).

To provide a complementary micro-level perspective, the subsequent qualitative analysis focused on putting the obtained nominalized expressions into their context of use in order to extract the most prevalent patterns used in each discipline. The investigation into the embedded patterns of nominalized expressions showed 14 common patterns for Physics and 15 for Applied Linguistics experimental research articles. The search revealed that there was just one pattern with scarce exploitation in Physics (pattern no. 13). Due to limitations of space, readers are referred to Appendices A and B for the research articles included in the analysis. The following examples are selected from the datasets in order to illustrate the patterns that were identified.

Table 7. *Common Patterns in Applied Linguistics and Physics*

Pattern No.	Patterns and related examples
1	*(Verb) + Premodifier +(of) + Nominal + Prepositional Phrase*
	analyzed the *use* of aggressive questions … [AL, Alfahad (2015, p. 58)]
	…clearly revealed the *presence* of Fe elements in the microbubbles… [PH, Niu et al. (2013, p. 2312)]
# 2	*(Deictic) +Epithet + Nominal*
	…negatively formulated *questions* …[AL, Alfahad (2015, p. 61)]
	narrow size *distribution* and smooth surface ... [PH, Niu et al. (2013, p. 2307)]
# 3	*Classifier + Nominal*
	writing *requirements*… [AL, Charles (2014, p. 39)]
	…using an MTS assay following manufactures *instructions*. [PH, Riegler et al. (2013, p. 1988)]
# 4	*Deictic + Nominal*
	Their *findings* once again reflected… [AL, Alfahad (2015, p. 59)]
	Our in vitro *results* demonstrated… [PH, Niu et al. (2013, p. 2307)]
# 5	*Prepositional Phrase + (Premodifier) + Nominal +(Prepositional Phrase) +(Premodifier) + (Noun)*
	from the *perspective* of the information structuring … [AL, Hawes & Thomas (2012, p. 176)]
	for *determination* of the micro blood vessel density … [PH, Niu et al. (2013, p. 2316)]
# 6	*Nominal*
	Interactions between journalists and officials or public figures… [AL, Alfahad (2015, p.59)]
	Limitations in the scalability of this technique… [PH, Riegler et al. (2013, p. 1992)]
# 7	*(Deictic) + Numerative + Nominal*
	the two *examples* below give us … [AL, Hawes & Thomas (2012, p. 180)]
	Several *explanations* had been proposed so far on this observation [PH, Niu et al. (2013, p. 2312)]
# 8	*(Premodifier) + Nominal + Prepositional Phrase +(Premodifier) + Nominal*
	a significant *departure* from earlier *definition* … [AL, Hawes & Thomas (2012, p. 176)]
	the *advantage* of *employing* ultrasonographic contrast … [PH, Niu et al. (2013, p. 2308)]
# 9	*Infinitive + (Premodifier) +Nominal + (Prepositional Phrase)*
	to impose certain *constraints* on the answer given … [AL, Alfahad (2015, p.63)]
	to promote *release* of doxorubicin …[PH, Niu et al. (2013, p. 2310)]
# 10	*Nominal + Postmodifier*
	… the *changes* reported by some students..' [AL, Charles (2014, p. 32)]
	internalization of a range of commercially available particles …[PH, Riegler et al. (2013, p. 1989)]
# 11	*No + (Premodifier) + Nominal*
	… no Arabic equivalent or idiomatic *translation* … [AL, Alfahad (2015, p.61)]
	no appreciable *attachment*… [PH, Riegler et al. (2013, p. 1992)]
# 12	*Nominal + conjunction + Nominal*
	corruption and *censorship* [AL, Alfahad (2015, p.59)]
	unspecific *contrast* and possible *misinterpretation* …[PH, Trekker et al. (2014, p. 163 3)]
# 13	*(Premodifier) + Nominal + Relative clause*
	questions that are negatively formulated favor a yes –answer… [AL, Alfahad (2015, p.68)]
	…*concentrations* which might not be possible elsewhere [PH, Riegler et al. (2013, p. 1993)]
# 14	*Gerund + Premodifier + Nominal + (Prepositional Phrase)*
	Relying on the *presence* of interrogative forms… [AL, Alfahad (2015, p.60)]
	providing an additional *explanation*…[PH, Trekker et al. (2014, p. 1633)]
# 15	*There +is/are/have/has…+Premodifier +Nominal*
	There is an interesting *mixture* of formality …[AL, Don & Izadi (2012, p. 3)]
	There were no significant *difference* in the proportion of …[PH, Eamegdool et al. (2014, p. 5555)]

Table 8 *Frequencies of Nominalization Patterns in the RAs of Hard and Soft Science*

	Applied		Physics	
Pattern No.	Raw No.	Per 500	Raw No.	Per 500
Pattern 1	1591	76.33	781	132.86
Pattern 2	1296	62.18	356	60.56
Pattern 3	302	14.48	152	25.85
Pattern 4	2264	108.62	366	62.26
Pattern 5	2408	115.53	962	163.66
Pattern 6	731	35.07	112	19.05
Pattern 7	276	13.24	59	10.03
Pattern 8	495	23.75	110	18.71
Pattern 9	410	19.67	96	16.33
Pattern 10	18	0.86	37	6.29
Pattern 11	48	2.30	29	4.93
Pattern 12	203	9.73	17	2.89
Pattern 13	61	2.92	0	0
Pattern 14	249	11.94	55	9.35
Pattern 15	69	3.31	11	1.87
Σ	10421		3143	

Although Table 8 has clarified, to some extent, the differences between the samples regarding the use of patterns in the two disciplines, Chi-square analyses were run to help make sound conclusions about the observed discrepancies. The illustrated outcomes of Chi-square analyses, presented in Table 9, suggested statistically significant differences for patterns 1, 4, 5 and 6 because the critical value exceeds the level of significance designated for the chi-square test.

Table 9. *Chi-square Values of Patterns in the RAs of Hard and Soft Science*

Pattern No.	Chi-square	Df	P value
Pattern 1	15.545	1	0.0001*
Pattern 2	0.008	1	0.9282
Pattern 3	2.951	1	0.0858
Pattern 4	12.918	1	0.0003*
Pattern 5	8.229	1	0.0041*
Pattern 6	4.741	1	0.0295*
Pattern 7	0.391	1	0.5316
Pattern 8	0.581	1	0.4458
Pattern 9	0.444	1	0.5050
Pattern 10	3.571	1	0.0588
Pattern 11	1.286	1	0.2568
Pattern 12	3.766	1	0.0522
Pattern 14	0.429	1	0.5127
Pattern 15	0.200	1	0.6547

The distribution of patterns 1, 4, 5 and 6, which serve the textual function of increasing lexical density and information load of the texts, illustrates disciplinary distinction. Therefore, in what follows, we only present an account of the above four patterns as distinct characteristics of Applied Linguistics and Physics considering the other patterns as marginal to our analysis. Examination of Table 8 demonstrates that the most frequent pattern in Physics and Applied Linguistics is pattern number 5 [*Prepositional Phrase + (Premodifier) + Nominal + (Prepositional Phrase) + (Premodifier) + (Noun)*], with more frequency of occurrence of this pattern in Physics (32.73%). Investigating the data of the current study reveals that pattern 5 which has the syntactic structure of [Premodifier] Head [Qualifier] contains compound and complex nominal phrases. In this pattern, the conversion of process to entity happens after

preposition. Put another way, nominal expressions occur after preposition, as indicated below:

1. … as well as the changes that came with the *emergence* of satellites … (Applied linguistics, Alfahad, 2015, p. 59)

In this example, the verb *emerged* is the unpacked form of the nominalized expression, emergence, and the congruent form is *when the satellites emerged.*

2. …was administered by email approximately one year after *completion* of the course (Applied linguistics, Charles, 2014, p. 32)
3. … even after a relatively short course and in the *absence* of further input or help from a corpus specialist (Applied linguistics, Charles, 2014, p. 33)

The congruent form of example 2 is *approximately one year after the course was completed*, and the congruent form of example 3 is *even when the course is relatively short and further input or help from a corpus specialist is absent.* The corpus was scrutinized and it was manifested that in more than half of these utterances, the nominalized expressions are followed by the preposition *of*, which is in accordance with Bloor and Bloor's (2004) claim that "the most frequent preposition in Qualifiers is *of* (p. 143). The example reveals that through the use of nominalization, the author is capable of packing more information in fewer clauses, a feature that corresponds to the characteristic of academic discourse.

Pattern 1 [*(Verb) + Premodifier + (of) + Nominal + Prepositional Phrase*] subsumes nominalizations that are qualified by prepositional phrases. This pattern occurs more frequently in the Physics corpus (26.57%) than in the Applied Linguistics RAs (15.26%). In the following examples, the head noun is followed by a Postmodifier or Qualifier which is realized as a prepositional

phrase (Bloor & Bloor, 2004). Using this pattern, the flow of information can be compacted by means of modifiers and qualifiers into fewer words.

4. …some statement can actually be a *request* for information… (Applied linguistics, Alfahad, 2015, p. 60)
5. …a comprehensive study that analyzed the *use* of aggressive questions… (Applied linguistics, Alfahad, 2015, p. 58)
6. Interviewers have *control* over the interview… (Applied linguistics, Alfahad, 2015, p. 61)
7. …for *detection* of iron expression… (Physics, Niu et al., 2013, p. 2309)
8. …for *determination* of blood vessel density… (Physics, Niu et al., 2013, p. 2311)
9…. after *injection* of Technetium-99m-labled PLGA nanoparticle… (Physics, Niu et al., 2013, p. 2308)

The congruent reconstrual of these examples can be represented as follows, respectively: *can actually be used to request for information, that analyzed how aggressive questions are used, interviewers control the interview, how iron expression is detected, to determine the density of blood vessel,* and *after Technetium-99m-labled PLGA nanoparticle is injected.* As can be deduced from these examples, the authors in Physics mostly preferred to change the form of *being process* into the metaphorized form of *being an entity*.

Results suggested significant differences in pattern 4 [*Deictic + Nominal*], acknowledging that using Deictic as premodifier of nominal expressions is exploited more in Applied Linguistics (21.72%). The following examples were selected from Applied Linguistics and Physics sample RAs in order to illustrate this pattern.

10. In order to compare our *results* with those of the Pt (II) analogue … (Physics, Linfoot et al., 2011, p. 1199)
11. The *ability* to track endogenous precursors under pathophysiological conditions is therefore restricted… (Physics, Eamegdool et al., 2014, p. 5549)
12. The *studies* on TiO2– DSSCs have become more diverse (Physics, Lee et al., 2011, p. 179)
13. … based on their *findings*, Hyland and Tse (2007) criticized the argument … (Applied linguistics, Valipour et al, 2013, p. 250)
14. … the *aim* of pure mathematics is to achieve simplicity and generality by reducing … (Applied linguistics, McGrath et al, 2012, p. 162)
15. …by clarifying the *distinction* between first and second order concepts … (Applied linguistics, Tylor, 2015, p. 127)

The congruent rewording of examples 10, 11 and 12 are *to compare what was resulted from, we are able to track,* and *when we study TiO2– DSSCs,* respectively. Examples 13, 14 and 15 can be unpacked into *based on what they have found, pure mathematics aims to achieve, the distinctive concepts of first and second order is clarified*, as well. However, the authors prefer to package these expressions into nominalization so as to avoid deployment of long parts of information.

The results of the current study indicated a significant difference in using *pattern 6:* [*Nominal*] in both disciplines. This pattern is more common in the Applied Linguistics corpus (35.07) than in the Physics corpus (19.05). In this pattern, nominal expressions are employed without any pre/post modifiers to express generality in producing academic texts. Consider the following examples:

16. *Results* show that 70% of the respondents had used their corpus… (Applied linguistics, Charles, 2014, p. 30)
17. …to convey *knowledge* which is recognized within an academic… (Applied linguistics, Sheldon, 2011, p. 241)
18. … *behaviors* labelled as sarcastic do not always perform mock politeness… (Applied linguistics, Tylor, 2015, p. 127)
19. *Studies* of the effects of potential pulse electrodeposition modes on structural… (Physics, Sokol et al., 2014, p. 380)
20. *Application* of environmentally benign solvents instead of toxic… (Physics, Khoobi et al., 2015, p. 217)
21. In addition to the aqueous conditions, excellent yields, operational simplicity, *practicability*, product purity, cost efficiency… (Physics, Khoobi et al., 2015, p. 225)

In these examples, the incongruent metaphoric realizations of actions (*what was resulted*, *what we know*, *to behave, to study, to apply, to be practical*) are changed into entities (*result*, *knowledge*, *behavior, study, application, practicality*). These metaphoric manifestations refer to entities in general where their hypothetical unpacked versions cannot state such generality. Here, the authors in Applied Linguistics deploy nominalizations without any pre/post modifiers to convey generality of their intended information. However, in comparison with other significant patterns, the occurrence rate of pattern six was small in both areas (731 instances (7.01%) in Applied Linguistics and 112 instances (3.81%) in Physics).

5. Conclusion

The current study set out with the aim of exploring the possible discrepancy between Applied Linguistics and Physics regarding the deployment of

nominalization in RAs as one of the distinctive features of academic discourse. The higher frequency of nominalization in Applied Linguistics RAs can be attributed to the more abstract nature of discourse in this field as an instance of soft fields and the tendency among writers to create abstraction and maintain conciseness in their respective discourse. We conjecture, therefore, that the greater use of nominalization in Applied Linguistics RAs might reflect the greater degree of abstraction involved in this discipline. The study suggested four pervasive patterns which mark disciplinary distinctions in both Applied Linguistics and Physics. That is, academic writers in Applied Linguistics tend to enhance the general volume of information into fewer words through deploying patterns 4 and 6, in which nominal structures are preceded by Deictic or employed without any premodifiers or post modifiers to express generality in comparison to their counterparts in Physics. However, to convey their scientific perspective, Physics writers tend to increase the sophistication of the intended concepts through using more complex nominalization patterns 1 and 5 than Applied Linguistics writers.

The implications of this study are relevant to academic writing teachers and course designers. Teachers can attempt to raise their students' awareness of the nominalization mechanisms and the impact of nominal expressions on the structure and lexciogrammatical patterning of clauses in academic discourse. Likewise, awareness raising and explicit teaching of nominalization mechanisms has been called for in other studies (Cameron, 2011; Fang & Schleppegrell, 2008; Wenyan, 2012). It is often helpful to provide students with authentic models of writing to develop students' awareness of how the use of various linguistic features affects the chance of being published or accepted in high ranking and prestigious journals. Students who decide to join an academic community should be instructed to overcome their meager familiarity with

various styles of writing in imparting scientific knowledge as the applied disciplines make different writing demands than the sciences, social sciences or humanities (Coffin et al., 2003). The contention is that if novice writers consciously gain the appropriate awareness regarding the importance of nominalization in composing their writing, they would be able to elevate the acceptability of their papers and meet the requirements defined by the established members who are the gatekeepers of the community. This study may provide additional insights for further research into nominalization. For instance, it would be fruitful that other contextual variables than those addressed in the current study such as native and non-native authors, novice and experienced authors also be taken into account for an in-depth study. Moreover, it is worth prudent investigation whether the degree of abstraction involved in the topics discussed in a discipline relate to the degree of abstraction invoked by the use of nominalization. If so, researchers can then arrange disciplines on a continuum of abstraction with nominalization playing a pivotal role in this regard.

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Appendix A: Physics Experimental Research Articles

Bastianini, M., Vivani, R., Nocchetti, M., Costenaro, D., Bisio, C., Oswald, F., ... & Marchese, L. (2014). Effect of iodine intercalation in nanosized layered double hydroxides for the preparation of quasi-solid electrolyte in DSSC devices. *Solar Energy*, *107*, 692-699.

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Appendix B: Applied Linguistics Experimental Research Articles

Ädel, A., & Erman, B. (2012). Recurrent word combinations in academic writing by native and non-native speakers of English: A lexical bundles approach. *English for specific purposes*, *31*(2), 81-92.

Alfahad, A. (2015). Aggressiveness and deference in Arabic broadcast interviews. *Journal of Pragmatics*, *88*, 58-72.

Bocanegra-Valle, A. (2014). 'English is my default academic language': Voices from LSP scholars publishing in a multilingual journal. *Journal of English for Academic Purposes*, *13*, 65-77.

Charles, M. (2012). 'Proper vocabulary and juicy collocations': EAP students evaluate do-it-yourself corpus-building. *English for Specific Purposes*, *31*(2), 93-102.

Charles, M. (2014). Getting the corpus habit: EAP students' long-term use of personal corpora. *English for Specific Purposes*, *35*, 30-40.

Chen, Y. C., & Lai, H. L. (2014). The influence of cultural universality and specificity on EFL learners' comprehension of metaphor and metonymy. *International Journal of Applied Linguistics*, *24*(3), 312-336.

Cheng, S. W. (2012). "That's it for today": Academic lecture closings and the impact of class size. *English for Specific Purposes*, *31*(4), 234-248.

Chung Kwong Ho, V. (2011). A discourse-based study of three communities of practice: How members maintain a harmonious relationship while threatening each other's face via email. *Discourse Studies*, *13*(3), 299-326.

Deroey, K. L., & Taverniers, M. (2012). Just remember this: Lexicogrammatical relevance markers in lectures. *English for Specific Purposes*, *31*(4), 221-233.

Don, Z. M., & Izadi, A. (2011). Relational connection and separation in Iranian dissertation defenses. *Journal of Pragmatics*, *43*(15), 3782-3792.

Giannoni, D. S. (2014). A comparison of British and Italian customer-complaint forms. *English for Specific Purposes*, *34*, 48-57.

Hartig, A. J., & Lu, X. (2014). Plain English and legal writing: Comparing expert and novice writers. *English for Specific Purposes*, *33*, 87-96.

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