Analysis of Abstracts in Scientific Papers Written in English Using Corpora

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Abstract
Research article abstracts are the gateways to communicate the research findings. This function and the significant contribution in disseminating the knowledge production have been the issue of academic research studies across disciplines. Abstracts, indeed, after titles, are the most read section freely available online. However, despite the impressive output contribution to the academic discourse community, both national and international and much research developed on abstracts, investigations particularly contrasting article abstracts published in Ecuadorian and North American journals are scarce. The study examines the rhetorical organization and the linguistic realizations of abstract written in four disciplines, by first identifying the move structure and then their linguistic realizations, including verb tense, clauses, modal verbs, and stance markers. The contrastive analysis of English and Spanish texts is based on a corpus of 120 abstracts from the fields of humanities and science. Results showed that abstract published in Ecuadorian and North American journals from four disciplines do put more emphasis on *purpose, method, and product (results)* to introduce the new knowledge. Throughout the corpus present, past tense, and hedges were the most frequent categories. The present tense commonly occurred in M1-M2-M5. The similarities and differences in the rhetorical organization and linguistic realizations of abstract moves might be attributed to the context of publication; however, such rhetorical and style choices remain unclear, in terms of conventional patterns or authors' preferences.
Keywords: linguistic realizations; move structure; rhetoric and style

INTRODUCTION

The analysis of abstracts in scientific papers written by experienced and non-experienced academic writers has been the issue of many research studies across disciplines and languages (Samraj, 2002; Hyland, 2000; Lorés, 2004; Pho, 2008; Çakir & Fidan, 2019; Can, Jingjing & Qin, 2016). Accordingly, the way in which abstracts share research results has led to paying

extensive attention to the form of how native (NA) and non-native authors (NNA) construct the discourse. The massive production of knowledge and the necessity of spreading scientific information have made that scholarly journals publishing articles written either in English or in other languages include English-written abstracts that accompany the research (Martín, 2003). However, writing accurate abstracts is somehow challenging; it requires knowledge of the writing system in such a way, writers can follow the rhetorical and writing style set by the discourse community. Since abstracts serve as the main source of data for literature reviews, annotations, and genre-based analyses, non-English speaking journals include an English translated version of the original article to disseminate the research and hook an international audience (Martín, 2005).

Despite the fact that the English translated version of the RA abstract is a great chance for NNA advertise their research internationally, the English translated version seems not to be of much interest; indeed, many writers perceive it as a mere requirement set by the journal editors (Lorés, 2014,). As a result, some writers are not aware of the potential impact that abstracts have when translating the scope of the paper into the foreign language version. In this way, a considerable amount of literature published in the discipline of linguistics, applied linguistics, education, literature, law, experimental science, sociology, among others (Lau, 2004; Kafes, 2012; Suntara & Usaha, 2013; Hyland, 2015) emphasize the analysis of how generic structures contributes to the understanding of how writers' communicative purposes follow particular discursive practices (Bhatia, 1993; Swales, 1990) and how these practices influence the rhetorical selection and language use (Hyland, 2000).

Research outcomes on the surrounding context of the publication of abstracts show rhetorical and linguistic variations. For instance, in the cross-linguistic analysis, Kafes (2012) found that Turkish abstracts closely conform to international discursive practices: *purpose, method, results*. In the same research line, Martín (2003) and Lorés (2004) observe that abstracts written in Spanish reflect the *introduction*, *method, result, and discussion* schema (IMRD). Persian abstracts in Behnam & Golpour (2014), follow the *purpose, method, result, and conclusion* moves (PMRC). Çakir & Fidan (2019) meanwhile, notice that the majority of English abstracts adopt the three-move pattern such as for *purposes, methods, and results* in the written corpora. These results reveal that abstracts written in different languages hold a non-hierarchical move-structure with three or four stable moves. Much research on this filed has gone beyond the structural and linguistic examinations at aiming to understand the context

in which the genre is produced (Pho, 2008) and how academic writers build solidarity with their readers throughout their texts (Hyland & Tse, 2005).

Mur-Dueñas (2011), exploring the lingua-cultural differences of abstracts published in English and Spanish journals, found that topicalizers and endophoric markers were more common in Spanish than in English texts. Poveda (2007) notices that although both texts used hedging strategies to present the information, modal verbs occurred in English abstracts and adverbial expression in Spanish ones. In the same vein, Hu & Cao (2011) observe that hedges were most frequent in English and boosters in Chinese. Loutayf (2017) similarly discovered that 70% of abstracts written by Argentines adopt the impersonal style to avoid negative criticism. On the other hand, Tseng (2011) and Pho (2008) report that the present perfect and present tense were the most frequent categories across the corpora. Kosasih (2018), meanwhile, observed that present and past tense frequently occurred in the entire corpora along with the moves. Correspondingly, Lorés (2014) notice different lexical and grammatical patterns in English and Spanish abstracts. Thus, active voice with textual nouns as subjects occurred in both languages; nevertheless, Spanish texts favor the use of the passive form 'se', which is used to refer to the process without mentioning the agent.

The rhetorical and linguistic differences discussed may be attributed to writers' different lingua-cultural conventions (Connor, 2004); that is, writers preferred rhetorical and textual strategy to respond to local practices and international discourse conventions. Van Bonn & Swales (2007) argue that such rhetorical and linguistic variants are valuable sources to identify not only the socio-cultural influence but also the discursive practices employed in different scientific communities. Despite the impressive research outcomes on the rhetorical organization of abstracts and their linguistic realizations across disciplines and languages, little research or almost nothing has been done in Ecuador. Taking abstracts as the corpus for the analysis, the purpose of this study is to examine the rhetorical organization and their linguistic realizations, including verb tenses, clauses, modals and stance markers that categorize abstracts and abstract moves written in the fields of humanities –*education, sociology* and natural science –*electronics and agronomy* published in NAEJ (North-American and Ecuadorian journals).

METHODOLOGY

The corpus of the study consists of 120 RA abstracts published in peer-reviewed NAEJ, written in the disciplines mentioned, and published between the periods of 2010-2017. The selection criteria used in choosing the journals were their indexation. Both NAEJ is indexed either in a regional or international context. Ecuadorian journals hosted by Ecuadorian

universities are indexed in *Latindex* (regional cooperative online information system for scholarly journals from Latin America, the Caribbean, Spain, and Portugal), as well as in *Elsevier, Dialnet, GoogleScholar, REDIB*, and *e-rivist@s*. North-American journals are indexed in *ERIC, EBSCOhost, Elsevier, American statistical association, SciSearch, SCOPUS, Applied Science and Technology, and GoogleScholar*. Unlike North-American journals, Ecuadorian ones are mixed journals, which devote special sections and space for the disciplines above.

The data set include 40 English RA abstracts published in North-American journals, as American Journal of Education (AJE), Journal of Teacher Education (JTE), American Journal of Sociology (AJS), Sociological Perspectives, Journal of Electronic Materials (JEM), Journal of Electronic Packaging (JEP), Journal of Agricultural and Food Chemistry (JAFC) and Journal of Agricultural Science (JAS). Each of the four disciplines encompasses 10 abstracts. Similarly, the Ecuadorian corpus consists of 40 English abstracts and their original Spanish version (40) published in Ecuador in the following journals: INNOVA Research Journal, Alteridad, Axioma, UTCiencia, Revista Tecnológica ESPOL, Amazonica, Analitika, Procesos, Perfiles, Avances, Ingenius, and La Granja. All four disciplines comprise of 10 abstracts each.

Hyland's (2000) hierarchical five-move model was used to explore the rhetorical organization (namely moves) of RA abstracts. Due to the fact that abstracts are condensed texts, and a moving pattern may occur within one or more sentences (Lau, 2004; Pho, 2008), linguistic signals such as *in a recent work…, the present study explores…, the purpose of this investigation is…, the article analyzes data from…, the data for this research…, the findings reveal…, the results of the study suggest…, the article concludes…*, were used as referent to differentiate one move from another. With this in mind, the study adopted a top-down and bottom-up approach to recognize moves and set up the boundaries between moves. The top-down approach focused on the content of the RA abstracts while the bottom-up approach looked for linguistic signals to categorize the moves. Following Hyland (2003), a move was considered as obligatory if it occurred in at least 60% of the articles, less than 60% was categorized as optional. Thus, the most frequent moves were taken as conventional patterns whilst the infrequent ones as non-obligatory.

Following Ai & Lu (2013), the unit analysis of the linguistic realizations of abstracts consisted of sentences and clauses. Due to the fact that a sentence may have more than one clause, as independent and dependent clauses that are joined by a coordinating or subordinating conjunction, in the present study, while identifying the linguistic realizations of abstracts, a

moving structure was analyzed into clauses, as in example 1. The linguistic analysis focused on (a) *verb tense*, namely present–past–perfect tense, passive voice, (b) *clauses* such as coordinated and subordinated, (c) *modals*, particularly auxiliary and non-auxiliary, and (d) *stance markers*, particularly hedges and boosters.

Table 1. Model of abstract: functions (Hyland, 2000, p.67)

Move	Function
1. Introduction	Establishes the context of the paper and motivates the research
2. Purpose	Indicates purpose, outlines the aim behind the paper
3. Method	Provides information on design, procedures, data analysis, etc.
4. Product	Indicates results and the argument
5. Conclusion	Points to applications or wider implications and interpretations scope of the paper

(1) The results of the fixed effects models indicate significant associations, though they are generally modest in magnitude. (M5) [edu – NS]: Complex, present.

 Clause 1: The results of the fixed effects models indicate significant associations,

 Clause 2: though they are generally modest in magnitude.

The researcher, namely human coder supports the reliability of the coding of the procedures discussed, which consists of a double round of coding with an interval in between. Once each move was clearly set down and differentiated from one to another, the coding was compared to see to what extent the move structure and its linguistic realizations match and establish the final results.

FINDINGS AND DISCUSSION

Findings

The cross-linguistic and disciplinary analysis of the English and Spanish abstracts published in NAEJ showed variation in their rhetorical and linguistic realizations. Table 2 reports that the majority of the RA abstracts in the four disciplines and two languages adopt a hierarchical three-move structure such as for *purposes (M2)*, *methods (M3)*, and *products (M4)* to construct the information content. *Introductions (M1),* unlike conclusion moves, were sometimes used in all the abstracts, that is, *conclusions (M5)* with the 34% of occurrence were the least frequent moves throughout the whole corpora. The infrequent occurrence of the introduction move matches the results of previous research studies (Lau, 2004; Kafes, 2012).

Further analysis also indicates that introductions in the field of humanities occurred in the discipline of education, particularly in non-native English texts ─NNET and Spanish texts

(SPNT) compared to the sociology ones, which occur just in native English texts ─NET (see Table 2). Additionally, M1 reported being frequently used in the discipline of agronomy in both languages while in electronics, it only appeared in NET. When comparing the four disciplines between fields, English agronomy texts (NNET- NET) written in the field of science followed the five-move Model: *M1-M2-M3-M4-M5*. SPNT on Education and agronomy published in the areas of humanities and science respectively had the frequent occurrence of the moves M1-M2-M3-M4 in comparison with sociology and electronics texts.

Table 2. The occurrence of the moves in both fields across the four disciplines

	HUMANITIES						SCIENCE					
Moves	Education			Sociology			Electronics			Agronomy		
	NNET	NET	SPNT	NNET	NET	SPNT	NNET	NET	SPNT	NNET	NET	SPNT
1. Introduction	60%	40%	70%	50%	90%	50%	40%	60%	40%	70%	80%	70%
2. Purpose	100%	90%	100%	95%	100%	100%	90%	100%	100%	80%	95%	80%
3. Method	100%	100%	100%	65%	100%	70%	90%	100%	90%	100%	95%	100%
4. Product	80%	100%	80%	60%	100%	60%	90%	80%	90%	100%	100%	100%
5. Conclusion	10%	40%	30%	30%	50%	30%	10%	30%	10%	60%	70%	40%

Data in linguistic features in English and Spanish sub-corpora showed the occurrence of each linguistic category in English and Spanish abstracts thus; the present tense was the most frequent linguistic feature. Hedges and past tense reported being the second and third highest features that frequently occurred in the majority of the RA abstracts, either in Spanish or in English texts. Unlike hedges and past tense, boosters and subordinate clauses were the fourth and fifth-highest frequent linguistic categories used among abstracts written in both languages. The perfect tense, coordinate clauses, non-auxiliaries, and passive voice seem to be the least frequent linguistic elements throughout the English and Spanish sub-corpora. Further analysis revealed that present and past tense, and hedges were the typical linguistic pattern used in abstracts when introducing the scope of the research. In effect, the genre analysis reports that from 120 RA abstracts gauged, 248 times (26%) the present tense was used in the texts, distributed across NET, NNET, and SPNT. Additionally, the past tense was constructed 124 times (13%), and hedges occurred 155 times (16%). Moreover, boosters significantly appear 107 times (11%) in the whole corpora.

The data analysis of the frequent use of the verb tense in each move shows that the present tense was the preferred tense in M1, M2, and M4, and that the past tense was frequently used in M3 in abstracts written in SPNT. Among the 80 abstracts analyzed (40 in English and 40 in Spanish), method sections show the highest occurrence of the present tense in SPNT and NNET. Passive voice, on the contrary, frequently occurs in M3 in the NNET. Further analysis

revealed that SPNT and NNET seem to be less informative and less organized compared to their NET counterparts. However, even though that English and Spanish languages, linguistically and culturally, in terms of linguistic base and language identity are quite different, these linguistic and cultural differences do not mean that Spanish speakers are not able to produce informative and well-structured information as natives do. The discrepancy arises when the first language (L1) features are translated into foreign language writing systems. The bold and underlined words discuss the wordiness and lack of concreteness throughout one of the sociology English translated versions.
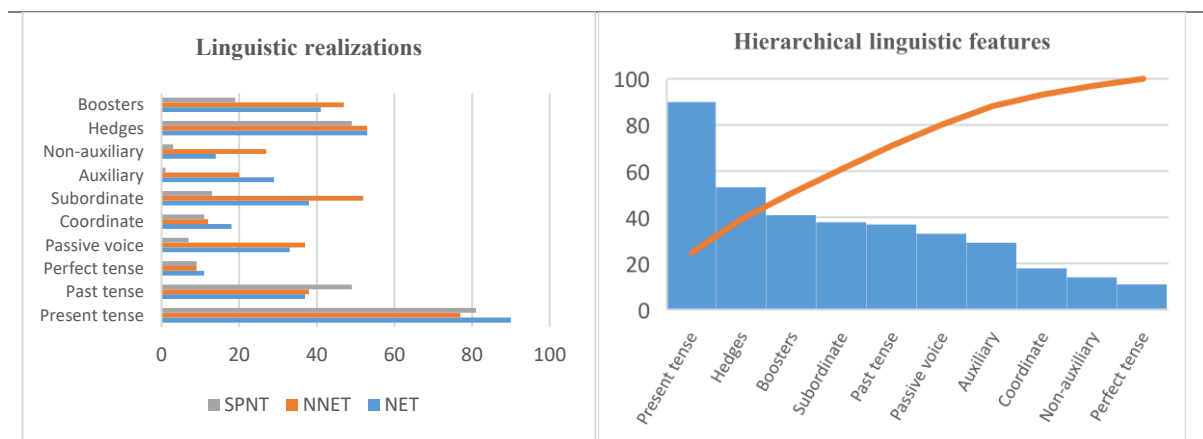

Figure 1. Linguistic features in English and Spanish sub-corpora

/... impunemente, a través de los **_micromachismos_** (mM), que es el término con el que se conoce a las cotidianas agresiones **_machistas_** de baja intensidad.../ (Slgy, SPNT)

[...], impunity a Through the (mM) **_micromachismos_**, which is the term that is known to everyday...that is known to everyday Low Intensity **_macho_** aggression... M1 (Slgy, NNET - EngTransVersion)

/...La **_habilidad_** empresarial fué establicida como una variable dependiente, y como variables **_independientes_**.../ (Slgy, SPNT).

The entrepreneurship **_hability_** was stablished as a dependent variable, and as **_independants_** variables.... M3 (Slgy, NNET - EngTransVersion)

Research outcomes indicated that SPNT published in Ecuadorian journals, in the two fields (33% in science and 30% in humanities) outperformed English texts the use of the *present tense* when communicating their research findings. The genre analysis so far also revealed that in NNET, boosters were regularly used in M4, in the fields of science and humanities. Meanwhile, hedges in M2 and subordinate clauses in M1 recurrently occurred in abstracts written in the field of humanities. Conclusions were the moves reporting the least use of the linguistic categories, particularly in those of SPNT, which marked 13 and 11 times of occurrence in both fields. Passive voice was rarely used in SPNT; however, few of them report the use of the inactive form 'se', which is used to refer the process without mentioning the

agent (see examples 1 and 2). This result is in line with those of Lorés (2016), who found the presence of this linguistic category in sociology texts. The usage differences concerning verb tense, clauses, and stance markers following Lau (2004) might be due to the nativeness or non-nativeness of the authors. It is, in great part, because conventional norms and the context of the publication directly influence the preferred rhetoric and writing style.

1. ***Se presenta*** *una variedad de propuestas existentes en la bibliografía sobre modelación, optimización y pruebas para dispositivos solares tipo termosifón, considerando la posible aplicación en el diseño de dispositivos que se adecuen a la geofísica de la zona ecuatorial. (Elect M2)*

   The paper presents *existing proposals in the literature on modeling, optimization and Thermosiphon solar devices testing, considering the possible application in the design of devices that fit the equatorial geophysics. (EngTransVersion M2)*

2. *En la actualidad casi toda la electricidad que se consume en Galápagos **se genera** en centrales equipadas con motores de combustión interna. (Elect M1)*

   *Currently, almost all the electricity consumed in the Galapagos **is generated** in plants equipped with internal combustion engines. (EngTransVersion M1)*
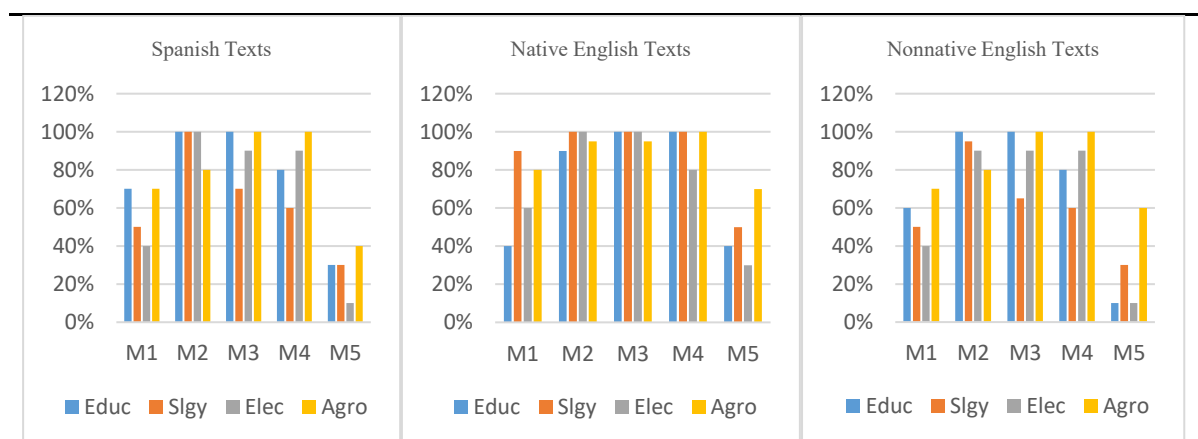

Figure 2. Move occurrence across disciplines in English and Spanish sub-corpora

The results of the move occurrence across disciplines in English and Spanish sub-corpora showed that although English and Spanish abstracts of NAEJ in the four disciplines reported fewer occurrences of the linguistic categories, present tense with the 25% of incidence was the predominant feature across disciplines. Nonetheless, further analysis revealed that the present tense with 37% of regularity was used more in native English sociology abstracts when announcing the moves M2, M4, and M5. Hedges and boosters with 16% and 17%, respectively, were regularly used in education texts written in NNET, particularly when discussing the research findings (M4). The perfect tense, passive voice, clauses, and modal verbs did not occur in agronomy texts written in Spanish; however, these features occurred in the majority of NET and NNET. Auxiliaries in education, as well as, passive voice and coordinate clauses in

electronics were infrequently used in abstracts written in Spanish. NNET, namely education and agronomy with 110 and 113 times of occurrence, had the most frequent use of linguistic features. The past tense was partially used to enlighten the new findings in education and sociology texts whilst in electronics and agronomy ones, this feature was commonly used to describe the methods (M2) and discuss the results (M4). NNET abstracts reported using more modal verbs than NET texts.

Discussion

The results discussed are in line with those of Martín (2003), where the rhetorical moves of SPNT in the field of humanities reported following a conventional pattern, but with a rhetorical variation in the purpose move (M2). Unlike Martin's findings, the present study shows that M5 and M1 had different frequency of occurrence across disciplines, in other words, introductions and conclusions are the moves that significantly vary compared to M2 in Martin's work. From the data analysis, it is inferred that purpose was the first highest frequent move with 94% of occurrence. Method (M3) was the second-highest frequent move with 93% while the product (M4) with 87% was the third common move in the four disciplines and two languages. The move variation seems to be the result of the authors' different discourse community practices and discourse conventions of the language (Connor, 2004). For instance, whilst in the field of humanities, M2 in SPNT is the first highest frequent move (100%), in science; it is the second frequent one with 90% of occurrence.

The parallel analysis of the SPNT and their English translated version shows that SPNT significantly varied the occurrence of linguistic features when presenting the gist of the original abstracts into their English translated versions. For example, while the present tense in the Spanish sub-corpora accounts for 33%, in the English one, it covers 21% of occurrence. Similarly, passive voice, subordinate clauses, and boosters are more common in the English translated version rather than in Spanish texts. Perfect tense rarely occurs in both sub-corpora. The linguistic variation may be attributed to the different lexical and grammatical choices derived from the different linguistic and cultural conventions. These research outcomes are in line with those obtained by Tseng (2011), and Hu & Cao (2011) who found cross-linguistic and disciplinary variation in almost over the majority of 90 RA abstracts.

The non-parallel linguistic analysis between NET and NNET reported that boosters (47 times, 13%) and subordinates (52 times, 14%) appear more often in the RAA published in non-native English speaking journals than in those of native ones (41 times, 11% - 38 times, 10%). Nonetheless, NET exceeded NNET in the frequent use of the present tense (see Figure 1). Past

tense and hedges appear to have a similar frequency of occurrence in both NET and NNET sub-corpora. The results are consistent with Hu & Cao (2011), who notice that hedges were frequently used in NET than in their non-native English counterparts. The genre-related similarity in this study is that boosters markedly occurred in English abstracts written by NNA. Despite the fact that non-native RA abstracts, particularly those of Ecuadorian authors follow English writing conventions, further analysis suggests that there are stylistic aspects, as word choice that needs to be polished when translating from one language into another.

When comparing the linguistic realizations of moves in English abstracts written in the fields of humanities and science, the texts written in the field of science reported less frequency when using the present tense (17%) compared to those of the humanities (29%). However, the frequent occurrence of past tense (15%), subordinates (13%) and passive voice (11%) was higher in the science texts rather than in the field of humanities. Although hedges and boosters showed a similar tendency of usage in both fields, their frequent occurrence was different within the humanities (15%) and science (14%) sub-corpora. In effect, boosters in the field of science were non-obligatory. Hedges in M2, in the field of humanities, is used more often in NNET (29%) than in NET (18%) whilst in science their usage is parallel (12%). Additionally, result sections in both fields reported having the highest occurrence of using all the linguistic features throughout the English texts. Conclusion moves of NNET, written in humanities and science fields indicated the least use of the linguistic categories investigated. These cross-disciplinary and linguistic variations might be the cause of several factors, for instance, different lingua-cultural conventions, disciplinary practices, and the context of publication, which may define authors' rhetorical preferences and writing style.

CONCLUSIONS

The present study showed rhetorical and linguistic variation in the sets of the RAA written in both languages across disciplines. For instance, NET while introducing their articles, emphasized in the *introduction, purpose, method, and product* sections. NNET and SPANT adopted the *purpose, method, and product* structures as a rhetorical pattern to introduce their research papers. This study confirms the claim that although academic abstracts could include the five-structural elements when communicating the gist of the complete article (Hyland, 2000), that suggestion is not always the case (Swales & Feak, 2016). It is because the authors' lingua-cultural conventions influence the English and Spanish texts when following discursive community practices. Research outcomes revealed that the current RAA written in English and

Spanish did not follow a hierarchical five-move model across the four disciplines. Nonetheless, just agronomy abstracts adopted a five-move schema.

Research sheds light on that rhetorical and linguistic diversity of abstracts, depends on (1) social context in which the texts are constructed, used and published, 2) the adoption of the international generic formats and forms to the discourse conventions of the journal in which the paper is published, and 3) different discourse conventions —*style of academic writing within disciplines*— practiced within national or international academic communities. As a result of the authors' lingua-cultural divergence, it seems that abstracts in the three written contexts communicate the gist of the entire paper by adapting their practices and displaying the writing style of the lingua-cultural conventions practiced in each discourse community.

English abstracts use more hedges than Spanish ones to communicate the new knowledge in such a way readers and the scientific discourse communities, on the one hand, have space for refutation, and, on the other side, find the focus of the argument to debate. From the results, it is quite unclear to what extent NET and NNET adopt particular discourse conventions to communicate the scope of the complete article. However, it seems that NNET follows an English conventional style to transmit the information towards an international or national audience; nevertheless, SPNT tends to maintain its own local discourse community practices. This difference could be the reason that the textual organization of the English translated version, in some cases, significantly varied from their original RA abstracts.

Finally, it is inferred that authors adjust their research articles to the prevailing disciplinary conventions in which they wish to publish. Writers also face the necessity to adapt their written texts to meet current disciplinary practices and conventions. These results strengthen the idea that the written discourse is socially produced within discourse communities. Although the way in which academics write the texts allows readers to know how the information of those texts is or was constructed, the unclear writing style makes their interpretation difficult, so the possibilities of indexing and citation decrease. Consequently, more broadly, research is needed to determine if the composing patterns respond to the authors' preference or discourse conventions.

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