

**ASSESSMENT OF A GENRE-BASED APPROACH TO SCIENTIFIC  
WRITING THROUGH THE ANALYSIS OF STUDENT-PRODUCED  
ABSTRACTS**

**AVALIAÇÃO DE UMA ABORDAGEM BASEADA EM GÊNEROS  
PARA A ESCRITA CIENTÍFICA ATRAVÉS DA ANÁLISE DE  
RESUMOS PRODUZIDOS POR ALUNOS**

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**ABSTRACT:** *A course aimed at writing Scientific Research Articles (SRA) in English was offered to Spanish-speaking researchers at a public university in Argentina. It deployed activities described by the Reading to Learn Pedagogy (R2L) (MARTIN; ROSE, 2012). This article assesses the effectiveness of this pedagogy by analyzing students' productions. We compared students' abstracts of SRA written before and after the implementation of R2L's practices, considering the presence or absence of rhetorical sections and the use of evaluative language under the light of the System of Appraisal (MARTIN; WHITE, 2005). Texts written after the course include a larger number of sections compared to the ones written before, and they also exhibit a larger amount of Attitude and Graduation elements. The higher complexity of the texts written after the course suggests that the teaching of scientific genres to English as a Foreign Language students through an R2L-informed approach is effective.*

**KEYWORDS:** Reading to Learn Pedagogy; System of Appraisal; abstracts; scientific writing.

**RESUMO:** *Um curso destinado a produzir Artigos de Pesquisa Científica (APC) em inglês foi oferecido a pesquisadores de língua espanhola em uma universidade pública da Argentina. O curso implementou atividades descritas pela Pedagogia Ler para Aprender (PLpA) (MARTIN e ROSE, 2012). Este artigo avalia a eficácia desta pedagogia, analisando as produções dos alunos. Comparamos os resumos de APC dos alunos escritos antes e depois da implementação dessas práticas, considerando a presença ou ausência de seções retóricas e o uso de linguagem avaliativa à luz do Sistema de Avaliatividade (MARTIN e WHITE, 2005). Os textos escritos após o curso incluem um maior número de seções em comparação com os textos anteriores e, também, apresentam uma maior quantidade de elementos de Atitude e Gradação. A maior complexidade dos textos escritos após o curso sugere que o ensino de gêneros científicos para alunos de Inglês como Língua Estrangeira por meio de uma abordagem informada pela PLpA é eficaz.*

**PALAVRAS-CHAVE:** Pedagogia de Gênero da Escola de Sydney; Sistema de Avaliatividade; resumos; redação científica.

### ***Introduction***

Science occupies a privileged position in society because of the highly socially valued activities in this sphere (MARTIN, 1998). Language is constitutive of scientific practice, as it is through language that it is communicated. Indeed, as Halliday (1997, p. 182) presents it, “science is scientific discourse”. The writing of science is, therefore, essential, since this is the way in which findings of research are shared with an audience. Among the scientific genres, one that has aroused large interest is the Abstract (CUTTING, 2012; GILLAERTS; VAN DE VELDE, 2010; HYLAND; TSE, 2005; SALAGER-MEYER, 1992; SAMRAJ, 2005; SWALES; FEAK, 2009; VAN BONN; SWALES, 2007). Abstracts hold a strategic position as the summary of the Scientific Research Article (SRA onwards), for they briefly present its content and represent its macrotheme (MARTIN; ROSE, 2012). The importance of Abstracts for scientists makes it a genre worth teaching, and genre pedagogies have the potential to do that (MARTIN, 2001).

The school of genre that has been developed within Systemic Functional Linguistics is the so called “Sydney School Genre Pedagogy” (SSGP), which has had a continuous concern over social inequality and the ways in which genre knowledge empowers underprivileged groups of Australian populations. It has influenced the entire educational system with teaching and training programs that have been instituted by the Australian government (FEEZ; JOYCE, 1995). Differently from those contexts, in Argentina only a few individual efforts have been made to contribute to research on academic writing (CARLINO, 2009) and on genre-based approaches (MOYANO, 2005; 2007, 2013). Thus, our work considers the implementation of the SSGP, particularly of the teaching strategies developed in the Reading to Learn Pedagogy (R2LP), in English as a Foreign Language (EFL) scientific writing. Additionally, despite the popularity of EAP and ESP writing courses, which are traditionally implemented in undergraduate and graduate studies in English-speaking universities — as described by Carlino, (2002, 2004) and Wingate (2012) —, this type of instruction is not frequent in the Argentinian and Latin American contexts (MARTÍNEZ, 2011). Therefore, facing this lack of specific training, a scientific writing course was offered to researchers in a public Argentinian university to help them improve their skills.

As disciplinary experts, the literacy of the participants of the course may be considered quite well-developed. Nevertheless, they are in a position of disadvantage when participating in a highly competitive arena like international publication. Since a large amount of scientific communication is in English (HYLAND, 2006; SWALES, 1997), Spanish speakers feel quite impaired when they need to write in a language that is not their native one (PÉREZ-LLANTADA, PLO; FERGUSON, 2011).

Genre pedagogies have the potential to help writers, for example in the development of genre knowledge when writing for publication (HUANG, 2014), and the improvement of grammar and text organization (MARTÍNEZ LIROLA, 2015). They also contribute to the writers' acquisition of disciplinary knowledge, their critical positioning towards the topics of discussion (MOYANO, 2004), and their possibility to adjust to patterns expected for specific genres (MOYANO, 2007).

In this work, we have deployed the tasks described in the R2LP to the teaching of scientific writing to adult learners in a foreign language. More precisely, the questions that have guided this research are: Is the R2LP effective for the teaching of scientific writing to adult learners in an EFL context? And is it possible to determine such efficacy through a linguistic analysis of students' productions? In this work, we analyze students' Abstracts before and after the implementation of a scientific writing course which deployed R2LP activities. We compare students' Abstracts in terms of rhetorical components and Appraisal resources being used.

The first section of this work introduces some keynotes on the R2LP and on the System of Appraisal. The second section elaborates on the pedagogical implementation of the R2LP for the writing course, while the third one details the methodology for the rhetorical and Appraisal analysis of students' texts. The fourth section exhibits the results, and the last one presents some final considerations.

### ***Keynotes on the R2LP and the System of Appraisal***

#### **The Reading to Learn Pedagogy**

The Sydney School Genre Pedagogy (SSGP onwards) (GREEN; LEE, 1994) has been thoroughly informed by Systemic Functional Linguistics, and shares some concerns with other genre-based theories — like the English for Specific Purposes and the New Rhetoric —, such as the interest in studying linguistic and rhetorical features of genres (HYON, 1996).

Nonetheless, SSGP language-rooted and sound pedagogy principles make it highly attractive and promising for the teaching of genres (MIRALLAS, 2021; DE OLIVEIRA; LAN, 2014; HUANG, 2014; HUMPHREY; MACNAUGHT, 2011, MARTÍNEZ LIROLA, 2015; MORENO MOSQUERA, 2019; MOYANO, 2005; 2007, 2013, among many others).

The SSGP has evolved through three main phases: the *Writing Project and Language as Social Power Project* in the 1980s, followed by the *Write it Right/The Right to Write Project* in the 1990s. Our attention is, nonetheless, placed on the third stage: the *Reading to Learn Project* (MARTIN; ROSE, 2012). In this third generation of the SSGP, two main components have been incorporated and specified: the design of classroom interactions for reading (*Preparing for Reading, Detailed Reading and Sentence Making*), and the development of strategies for writing genres such as stories, factual texts and arguments (*Joint construction, Joint Rewriting and Spelling; Individual Construction, Individual Rewriting and Sentence Writing*), which are presented in a teaching cycle (Figure 1).

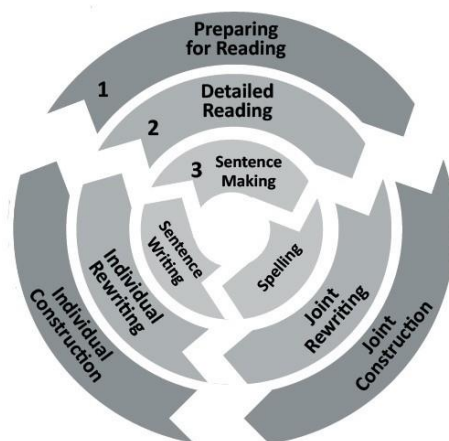


Figure 1 - Teaching cycle proposed in the *Reading to Learn Project*

Source: Martin and Rose, 2012

We will refer to the development of these strategies as we describe the activities carried out in the writing course in section **Erro! Fonte de referência não encontrada.** (for further detail on each stage, we refer the reader to Martin and Rose's *Learning to write/Reading to learn* (MARTIN; ROSE, 2012)).

## **A brief note on the System of Appraisal**

Since the data of this work was analyzed through the system of Appraisal, it is necessary to make reference to the semantic domain it describes. Appraisal explores interpersonal evaluative meanings at the discourse semantics level as users express relations of power and solidarity, their subjective presence in texts, and the stances they adopt towards both the content they present and those with whom they communicate (MARTIN; WHITE, 2005). It involves three domains. First, Attitude is concerned with feelings and emotions of things, people and behaviors, and is divided into Affect, which is related to positive and negative feelings; Judgment, which describes speakers' attitudes towards the behavior of others; and Appreciation, which evaluates semiotic and natural phenomena. Second, Graduation grades phenomena, and it involves Force, whose domain is of measurable categories, which can be intensified or quantified, and Focus, which assesses entities according to degrees of prototypicality and categorical boundaries (HOOD, 2010). Finally, Engagement deals with sourcing attitudes and the play of voices (MARTIN; WHITE, 2005), and entails resources to express monoglossia or heteroglossia. Only the systems of Attitude and Graduation were used for the analysis of Abstracts produced by students.

### ***Pedagogical implementation of the Reading to Learn Teaching Cycle***

An 8-class writing course (32 hours) aimed at producing SRA in English was taught to Spanish-speaking researchers at a public university in Argentina. The course was instructed in Spanish, since the audience was constituted by a group of 24 university teachers and researchers who, according to a survey implemented before the course, were used to reading and writing in English but were less fluent in their oral skills; i.e. listening or speaking. Under these conditions, it would have been impractical to use English as the language of delivery since this would have created an unnecessary barrier for students to get involved in the class. All the materials and contents, however, were in English. Materials included slides from previous courses, which were adapted to suit the R2LP teaching cycle, and worksheets with exercises designed by the teachers. The linguistic contents of the course were organized around the Abstract and the SRA, and around the contextual elements that have an impact on the lexicogrammatical choices that users make. Students were asked to collect a small corpus of 10 SRA that they were using for their own research. There were 24 students in the course, 15 women and 9 men who were between 25 and 51 years old (the average was 35 years old).

They worked in the fields of Electronics, Chemical Engineering, Geology, Physics and Computer Sciences. Most of them held Specialization, Master, and/or PhD degrees, while some of them were working to obtain their doctoral degree. All of them had previously published SRA, and more than half of them had done so in English. They were all competent readers of English in their disciplines, and had learned it either in language academies or with private teachers.

Activities suggested by the R2LP were adjusted for the specific context in which it was implemented and the genre studied. Students were provided with background knowledge to understand Abstracts (*Preparing for Reading* phase) (MARTIN; ROSE, 2012) as their social function was discussed, along with their frequent (both obligatory and optional) constituents. Students' various disciplines were considered. Then, a sample Abstract on Physics was provided to students for them to read with the teacher's guidance (*Detailed Reading*) (MARTIN; ROSE, 2012). Although not all students attending the course belonged to the field of Physics — since it would not have been possible to find a text that suited all of the students' research interests —, the text could be read and understood by everybody with the aid of their Physics-expert peers. As the reading took place clause by clause, students identified Abstract components (introduction/antecedents, objective, methodology, results, discussion and conclusions), and the language used to express them. Simultaneously, and with a focus on lexicogrammar, the teacher led the students' attention to the use of verb tenses, voice, and modality. Teachers and students re-wrote an Abstract whose verbs had been removed (*Joint construction*) (MARTIN; ROSE, 2012) and which needed reformulations related to voice. The teacher read the original text aloud and typed the new version, as this was projected on a screen for everyone to see. The whole class jointly participated in the construction of the text and discussed the possibilities for semantic differences in tenses, modals, and voice in order to improve the text (*Joint rewriting*) (MARTIN; ROSE, 2012). In pairs and small groups, students identified Abstract components. After this, the teachers provided Abstracts connected with the students' research topics and disciplines. This time, the students were asked to identify components and verb tenses on their own. Throughout the course, they worked extensively on the whole SRA, including the Title, the purpose of the study, and the Methods, Results, and Discussion sections. Lastly, the students wrote an Abstract, which constituted their final evaluation (*Individual Construction, Individual writing*).

In addition to the teaching of the Abstract as a genre *per se*, interpersonal meanings were introduced to the students so as to provide them with linguistic resources that enabled

them to take a stance as writers of their own texts. These included language that expresses graduated meanings (modal verbs and modal expressions of probability, possibility, usuality and obligation; comment adjuncts, adverbs used to emphasize or soften meanings; and epistemic verbs that signal more or less certainty, among others). Activities were usually carried out during the *Detailed reading* stage of the R2LP sequence, and involved organizing sets of resources into clines of more or less certainty, usuality or obligation, and discussing their meanings in texts and contexts.

### ***Collection of student-produced Abstracts and Analysis***

Two different sets of abstracts were collected: one written before and one after the course. At the beginning of the course, participants were asked to voluntarily submit an Abstract that they had produced on their own and that had not suffered any intervention from other collaborators. These texts were produced up to six months before the course began. Since not all of the 24 students in the course had written Abstracts in English, 11 texts (Corpus A) were submitted for analysis. After the implementation of the course, 11 Abstracts (Corpus B) written by the same authors were collected. These texts corresponded to the final evaluation of the course.

The two corpora were analyzed using the UAM CorpusTool (O'DONNELL, 2008) in terms of rhetorical components and Appraising elements of Attitude and Graduation. First, rhetorical sections in the corpora were identified and tagged considering *title*, *introduction* and/or *theoretical framework*, *objective*, *methods*, *results*, *discussion*, *conclusions* and/or *applications for future research*, and *keywords* (Figure 2).

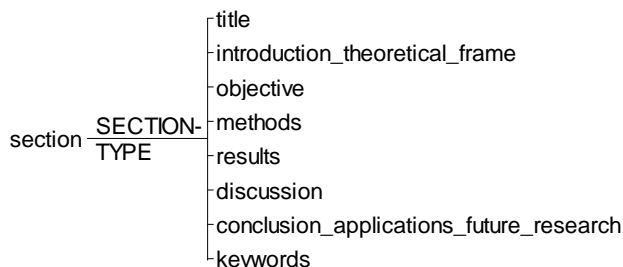


Figure 2 - System of analysis for Abstract rhetorical components\*

Source: O'Donnel, 2008

\*All systems were generated with UAM CorpusTool

Counting rhetorical components involved either their presence or absence in the Abstracts, so if one component was recurrent in the same text, it was counted only once.

For the Appraisal analysis, the corpora were manually analyzed considering the systems of Attitude (

Figure 3) and Graduation (

Figure 4) (MARTIN; WHITE, 2005). The tagging of data was assisted with UAM CorpusTool (O'DONNELL, 2008).

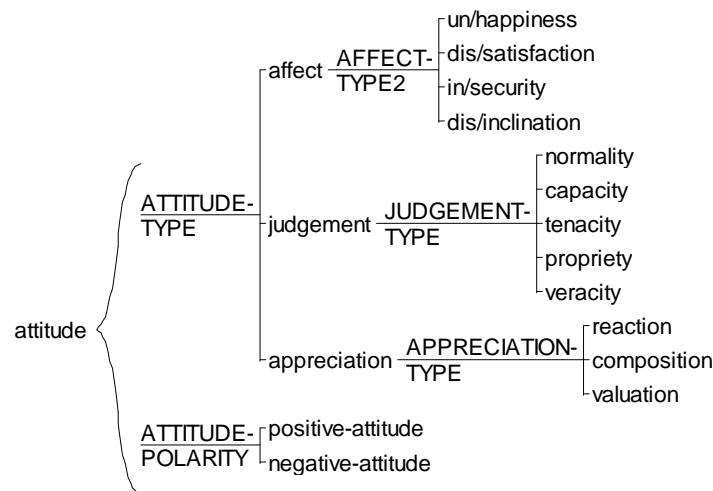


Figure 3 - System of Attitude implemented in the analysis

Source: adapted from Martin and White, 2005

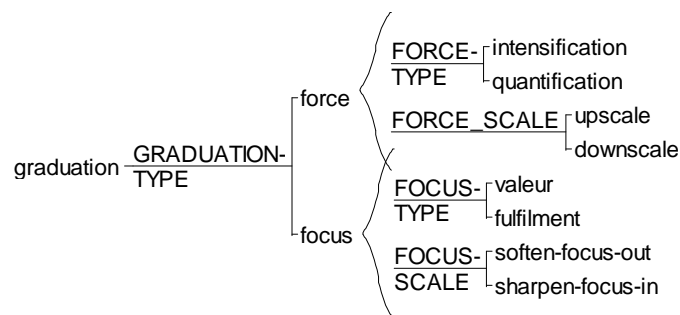


Figure 4 - System of analysis for Graduation in Abstracts

Source: adapted from MARTIN and WHITE, 2005; HOOD 2010, 2012

The corpora were also described in terms of the use of appraising resources considering the entities that the evaluative language referred to (HOOD, 2010, 2012; THETELA, 1997). Entities are referential semiotic elements (HUNSTON; SINCLAIR, 2000; THETELA, 1997), processes (MARTIN, 1997), propositions or proposals (HOOD; MARTIN, 2007) that are the writer's target of appraisal. To illustrate this notion, we present



(1), in which “metric space approach” is the entity<sup>1</sup>, and it is appraised by “promising”, “immature” and “well-established”.

(1) [Corpus B. Student 22] Although **promising**, the *metric space approach* is still **immature** in several aspects that are **well established** in traditional databases.

Entities in the corpora were identified in connection to Attitude to further explore how the notions of evaluative language refer to semiotic elements in scientific texts.

The quantification of lexicogrammatical realizations expressing Attitude and Graduation has been expressed per 1000 words in order to determine the real Evaluative Density (ED henceforth) of these elements, and to make data derived from different corpora sizes possible, since Corpus A is made up of 2531 words and Corpus B contains 3594 words. ED is the result of the number of appraising instances by 1000 divided by the number of words in the corpus (SHIRO, 2003):

$$ED = \frac{\textit{number of appraising instances} \times 1000}{\textit{number of words}}$$

In this equation, the *number of appraising instances* corresponds to the total of appraising elements in the corpus under analysis; the *number of words* is the total number of words in the corpus; and the number 1000 is the normalization value.

## ***Results and discussion***

### **Rhetorical components**

As to the rhetorical components, Figure 5 shows an overall increase in the number of sections employed in Abstracts *after* the course.

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<sup>1</sup> For notation, entities have been identified in italics while appraising language is in bold.

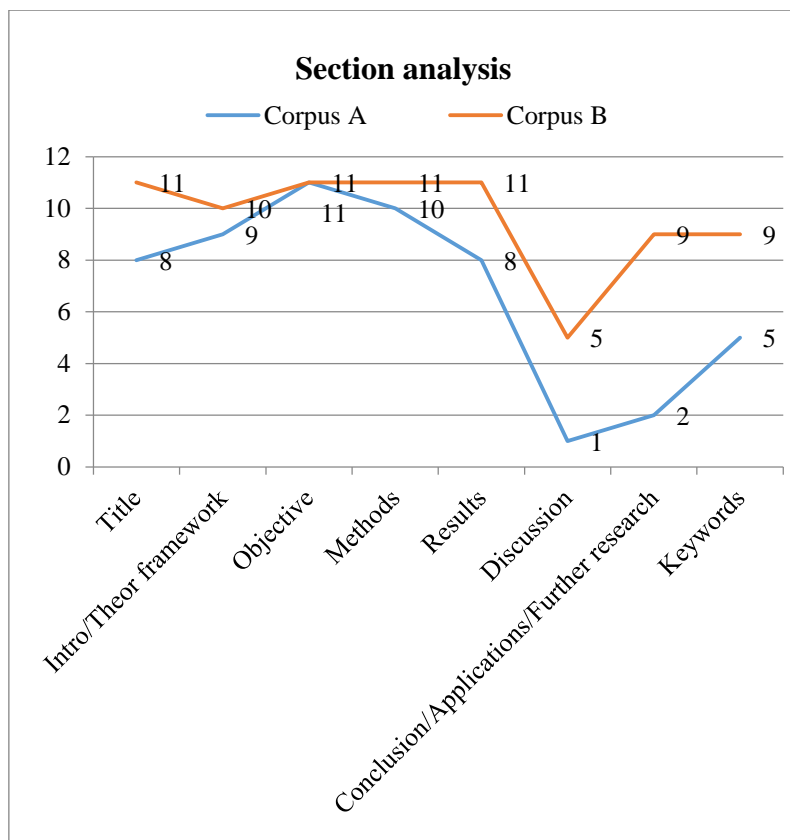


Figure 5- Sections in Abstracts *before* (Corpus A) and *after* (Corpus B) the course

Source: produced by the author

Except for the Objective, which was present in all Abstracts in both versions, there is a clear tendency for students to write more sections after the course (Corpus B). The higher number of components in Corpus B is evidence of an increase in genre awareness (JOHNS, 2011). Title and Results appeared three more times in versions following the course; Discussion and Keywords were present in four more Abstracts in subsequent versions, and Conclusion/Applications for future research show the highest incorporation, with seven more Abstracts written after the course including this element. These findings are in agreement with those of Huang's (2014), in which Discussion, Conclusions and Applications sections displayed great improvement in the SRA of a non-native learner of English.

Example (2) has been taken from Corpus A, written before the course, and (3) from Corpus B, after the course. Both texts were produced by the same author, and they illustrate the improvement of the students' writing. Rhetorical components have been identified between parentheses to facilitate visualization.

(2) [Corpus A. Student 18.] (title) [Acoustic Beamforming Using a Microphone Array]

(objective) [This project implements a beamforming filter using a linear microphone array, to extract desired speech signals in an interference-dominant, noisy environment.] (introduction / theoretical framework) [Such operations are useful to enhance speech signal quality for perception or further processing. Sound source localization in real time can be employed in numerous applications such as filtering, beamforming, security system integration, etc.] (methods) [Since the algorithms employed in this field require fast processing we use a System on Chip (SoC) for their implementation and evaluate different configurations in order to choose the most efficient one. We analyze the software description of the sound localization algorithm to find the functions that can be parallelized; in particular, we calculate the location of a sound source with GCC and perform the filtering with the DSB algorithm. Data is acquired using a linear microphone array at 48 kHz.]

In (2), four components can be identified: Title, Objectives, Introduction/Theoretical framework and Methods. The following is an improved version of the previous one, which the student decided to re-write for the evaluation of the course.

- (3) [Corpus B. Student 18.] (title) [Acoustic Beamforming Using a Microphone Array]  
(introduction / theoretical framework) [Time-invariant beamforming is used to detect and estimate the signal-of-interest at the output of a sensor array by means of optimal spatial filtering and interference rejection. This technique is useful to enhance speech signal quality for perception or further processing and can be employed in numerous applications such as filtering, beamforming, security system integration.] (objective) [In this study, three designs based in the algorithm Generalized Cross-Correlation with Phase Transform (GCC-PHAT), were used to measure the performance of this technique using hardware acceleration on Cyclon V FPGA with ARM cortex of an Altera Arrow SoCkit.] (methods) [Data were acquired using a linear microphone array at 48 kHz. We investigated the effect to replace software functions by hardware accelerators and the final throughput in the design. Performance metrics were calculated to obtain information about which functions should be optimized [sic] or parallelized] (results) [and it was found that the Discrete Fourier Transform (DFT) could be improved. The results from this study show that, on average, the throughput obtained in the hardware implementation was the 46% with 6 to 10 microphones max., due to capacity the FPGA, whereas in the software design was obtained the possibility to work with up to 12 microphones. On the other hand, in the design that uses hardware acceleration the throughput was the 36% with 6 to 22 microphones.] (discussion) [That suggests that the hardware accelerations can reduce the workload of the processor, enabling adding more microphones to perform beamforming.] (conclusions/applications) [Lastly, the experimental results provide that with a few straightforward code optimizations, the ARM can sharply improve the computational bandwidth and memory throughput of a software algorithm.]  
(keywords) [Keywords: Time-invariant beamforming, GCC-PHAT, hardware acceleration, throughput microphones, FPGA, SoCkit]

In (3), four sections were incorporated: Results, Discussion, Conclusions/Applications and Keywords. It is worth mentioning that students with less expertise in scientific writing (HUANG, 2014) —specifically PhD students— incorporated up to four components in their Abstracts, whereas more experienced writers incorporated only one. This suggests that if novice students are presented with explicit descriptions of genres, they can very quickly incorporate rhetorical elements of which they may have been unaware before (HUANG,

2014). This finding is in agreement with other studies carried out in the context of academic writing in Spanish in Argentina (MOYANO, 2005; 2007; 2013). The detailed discussion about the components of the SRA seems to have generated awareness, which led to improvements in the students' productions of Abstracts, which is evidenced by the incorporation of a higher number of sections. Components such as Objectives, Theoretical framework or Methodology showed little increase, as it seemed students were aware of their obligatory nature. Sections that presented the highest increase were those which discuss and interpret raw data, such as the Discussion, and those which state the prospective applications of results, like Conclusions/Applications. These sections contribute to the writer guiding the reader on the implications of the results, and are strategic in persuading readers, since they enhance the numerical data that researchers present.

## Appraisal Analysis

### *Attitude*

The use of Attitude resources in Corpus B is higher when compared to Corpus A for all three subsystems: Affect, Judgment and Appreciation, with the latter displaying the highest increase. Figure 6 shows the number of instances for each subsystem, the normalization per thousand words, and the difference in normalization between Corpora A and B.

System	Corpus A		Corpus B		Norm diff*
	Inst	Norm	Inst	Norm	
Affect	1	0.34	3	0.72	+0.38
Judgment	15	5.16	37	8.94	+3.78
Appreciation	46	15.81	117	28.26	+12.45
Total	62	21.31	157	37.92	16.61

Figure 6 - Attitude in Corpora A and B

Source: prepared by the author

\* Normalization differences are presented as positive or negative differences between Corpus A and B

As expected for the genre under study, Affect is the subsystem which displays the lowest number of instances, with only one in both corpora. If Judgment is taken into consideration, it is more frequent (ED 5.16 for Corpus A and 8.94 for Corpus B) than Affect, with an increase of 3.78 in the use of this resource in Corpus B. In example (4), the writer

invokes Veracity, as her algorithm was verified through a specific procedure.

- (4) [Corpus A. Student 3.] [The proposed algorithm] uses a redistribution power operator which tries to keep feasible the found solutions and it **is validated** using eight problems with different characteristics taken from the specialized literature.

The entity appraised — which invokes Veracity — is the researcher’s own doings, as an effort to render truthful information by using an exhaustive number of problems taken from the literature to validate her findings. Also, within the system of Judgment, students used resources of Capacity in relation to the potential of the methodology to contribute to the objective, as shown in (5) and (6).

- (5) [Corpus A. Student 25.] *Genetic algorithms* are a class of meta heuristics **capable** of achieving high quality solutions for combinatorial problems.
- (6) [Corpus B. Student 3.] The results from this study show that *IA\_DEDP* **is able to** reach lower costs using fewer number of objective function evaluations than its competitors.

In (5) and (6), the evaluation is on agentless elements of the research process: “Genetic algorithms” and “IA\_DEDP”. Expressing a positive capacity of the methodologies contributes to a positive prosodic evaluation of the research process as a whole, and of researchers themselves. When compared to Affect, Judgment is used more frequently — which seems appropriate—, since researchers judge entities more frequently than they express emotions in scientific writing.

Considering Appreciation, the ED of Corpus A is 15.81, while that of Corpus B is 28.26, with an increase of 12.45. In keeping with the findings of other pieces of research (HERRERO RIVAS, 2017; HOOD, 2010), the clear preference of scientists to encode Attitude as Appreciation becomes evident in the corpora under analysis in this work. This type of evaluation reflects the institutionalized nature of scientific discourse to express the worth or social value of things and objects. Students frequently evaluated the object of study and the results obtained. Examples (7), (8) and (9) show Appreciation in terms of Reaction, Composition (Complexity) and Valuation, respectively:

- (7) [Corpus A. Student 6.] Moreover, it was noticed that the specimens studied, differ in at least two groups of very **remarkable** *differences* which are observed in the arrangement and size of teeth.
- (8) [Corpus B. Student 6.] The high-resolution images and GE tools system allows [sic] the recognition and mapping of different land features with a large level of detail. *Its editing tools geometries* are **simple** to use and therefore constitute an efficient tool for mapping at scales of detail.

- (9) [Corpus A. Student 11.] The results obtained through experimentation show that SA was **the best** performing metaheuristic.

Example (7) expresses the value “remarkable”, which refers to a reaction that has been detached from the experiencer and attached to the object of study, as if the differences between the two groups of specimens had this intrinsic property. As for Composition, example (8) presents the ease with which “editing tool geometries” may be used, which in this case is expressed through “simple”. Example (9) shows an instance of Valuation, the most frequently used resource in the Appreciation system: the results are “the best” that could be obtained by employing the methodology described. Since Appreciation is the most frequently used resource in both corpora, we may state that these students made an appropriate use of evaluative meanings in relation to the register and genre of the texts they wrote.

### *Graduation*

Corpus B shows an overall increase (+25.64) in the use of Graduation resources (ED 55.55) when compared to Corpus A (ED 29.91). Figure 7 displays the number of Force and Focus instances found in both corpora, the normalization for the ED for each corpus, and the difference in normalization between them. Students prefer to use Force resources (ED of 18.91 and 34.54 for Corpus A and B respectively) rather than Focus (ED 11.00 and 21.01).

System	Subsystem	Corpus A		Corpus B		Norm Difference
		Inst	Norm	Inst	Norm	
Force	Intensification	36	12.38	79	19.08	+6.70
	Quantification	19	6.53	64	15.46	+8.93
	Upscale	44	15.13	99	23.91	+8.78
	Downscale	11	3.78	44	10.63	+6.85
	Total	55	18.91	143	34.54	+15.63
Focus	Valeur	14	4.81	42	10.14	+5.33
	Fulfilment	18	6.19	45	10.87	+4.68
	Sharpen	21	7.22	64	15.46	+8.24
	Soften	11	3.78	23	5.56	+1.78
	Total	32	11.00	87	21.01	+10.01
Total		87	29.91	230	55.55	+25.64

Figure 7 - Graduation in Corpora A and B

Source: prepared by the author

Regarding Force, Intensification was used more frequently (ED of 12.38 for Corpus A

and 19.08 for B) than Quantification (ED of 6.53 for A and 15.46 for B) in both corpora. We can also observe that upscaling force was employed with a higher frequency than downscaling resources, which is a recurrent practice in academic writing (HOOD, 2010). Examples (10) and (11) display instances of upscaling Intensification and Quantification, respectively.

(10)[Corpus B. Student 20.] For the purposes of **better** *defining low contrasted units and automate the mapping*, color compositions and supervised classification Landsat 8 images were subsequently used.

(11)[Corpus B. Student 2.] A *transfer or charge* from the carbon **in all cases** and a reception of charge of hydrogen was observed.

In example (10) shown above, the writer appraises the methodology to define “low contrasted units” by upscaling the degree of intensity of “define” through “better”. In (11), the Force of the proposition is expressed in relation to amount, for the author states that the carbon transfer was carried out “in all cases”. These contribute to the scaling of qualities and verbs, and amounts to reinforce the idea of completeness. Lexicogrammatical realizations tend to increase Force, and in agreement with previous descriptions of academic discourse (HOOD; MARTIN, 2007), students resorted to these choices to construe their statements as highly authoritative.

In relation to Focus, there was a slightly higher preference to express Fulfilment (ED of 6.19 for Corpus A and 10.87 for Corpus B) more frequently than Valeur (ED of 4.81 for Corpus A and for 10.14 B). The tendency to sharpen rather than soften meanings is in agreement with the preference for “tuning up” in the system of Force. Examples (12) and (13) present instances of sharpening Fulfilment and Valeur, respectively.

(12)[Corpus B. Student 18.] Performance metrics were calculated to obtain information about which functions should be optimized [sic] or parallelized and it was **found** *that the Discrete Fourier Transform (DFT) could be improved*.

(13)[Corpus B. Student 6.] Further detailed analysis including postcranial and cladism studies will provide a **more precise** *classification* within this large and complex group of fish.

In (12), the completion of the process is expressed in the verb “found”, asserting the final state of the metrics’ results. In the case of (13), worth in terms of specificity is expressed in the term “more precise”, which evaluates the classification of fish. Writers express a sharpening of the boundaries of categorical meanings, which is closely related to scientific activity. As the main aim of science is to provide an accurate description of reality, it is relevant that students use resources for specifying entities and grading them according to

prototypicality and preciseness (HOOD, 2010).

### ***Final considerations***

R2LP's sustained theoretical framework of learning and implementing detailed tasks provide strong foundations for the design of scientific writing courses like the one presented here. We carried out a rhetorical and Appraisal analysis of Abstracts produced by students and compared versions written before and after implementation of the R2LP in the teaching of scientific writing to EFL students. The linguistic analysis indicates that texts written after the course include a larger number of sections compared to the ones written before, with the incorporation of argumentative sections, such as the Discussion and the Conclusion. Moreover, the analysis on Attitude and Graduation shows that students tended to use Appraisal resources more frequently in texts produced after the R2LP writing course. Not only were these resources more abundant, but they were also appropriately used in texts, functioning in the scientific community for which they were intended.

Rhetorical and linguistic findings suggest the efficacy of the R2LP methodology for teaching scientific writing in EFL, which is in agreement with the implementation of genre-based teaching of academic writing in Spanish in the local context (MIRALLAS, 2021; MARTÍNEZ, 2011; MOYANO, 2004; 2005; 2011; 2013) and for academic and scientific writing in English in the wider international sphere (DE OLIVERA; LAN, 2014; HUANG, 2014; HUMPHREY; MACNAUGHT, 2011; JOHNS, 2011; MARTÍNEZ LIROLA, 2015; MORENO MOSQUERA, 2019). This work provides evidence of the feasibility of the R2LP to help writers of science in EFL, which is a context different from where it originated. Our results are promising to further implement courses similar to this one, which draw on highly literate audiences with specific needs (MARTÍNEZ, 2011), who are avid of language resources and need to master English for specific scientific and publication purposes.

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