Maps of student genres in engineering: a didactic model for teaching academic and professional Spanish language

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ABSTRACT

Textual genres written by university students have become the focus of attention due to their importance within disciplinary learning (Parodi 2010). This paper has been developed in the field of study called student genres (Navarro 2018) and it uses the analysis of situated genre (Swales 2018, Pérez-Llantada 2015) as its methodological platform. This study has two main objectives: a) to create a map of student genres from a learner corpus of the engineering field and b) to propose a didactic model for teaching academic and professional Spanish language using this map. Hence, linguistic research and description are linked to students' pedagogical needs (Breeze and Sancho Guinda 2017ab) and take into account the actual practice in the communities as well as the writers in these disciplines (Curry and Hanauer 2014). Finally, implications for configuring specific didactics in LSP are discussed.

Keywords*: Discourse genres, writing in STEM, academic and professional Spanish language, genre pedagogy, genre maps, analysis of situated genre*

I. INTRODUCTION

I.1. Student genres in engineering field

This research addresses the field of academic writing in university education, specifically, the genres found in undergraduate academic training, through the description and analysis of a text corpus and of the thinking expressed by academics and students in the context of different stages and trajectories of disciplinary and professional learning. Textual genres written by university students have become the focus of attention due to their importance, and the recognition that they have a wide range of functions within disciplinary learning (Parodi 2010). This paper is concerned with the emergent field of study around "student genres" (Navarro 2018) and seeks to provide more information about teaching languages for specific purposes at the rhetoric-discursive level, reporting innovative practices in teaching Spanish for academic and professional purposes.

Another motivation is to obtain deeper understanding of the dynamics, complexity and nature of the relations between discursive communities and the genres involved. By

probing this area, it will be possible to understand the interconnections and tensions between academia and the profession through the study of the communication patterns in the disciplinary knowledge in specific learning communities. Hence, the study of academic cultures and genres can contribute to our knowledge of the trajectories of learners or new students when learning engineering related genres, and facilitate interdisciplinary collaboration between teachers of Language for Specific Purposes (LSP) and the disciplinary communities in engineering and sciences.

In this context, this research seeks to answer the following question: *How can teachers and researchers in Languages for Specific Purposes take full advantage of contemporary trends in higher education (in this case engagement with professional communities) to develop innovative pedagogies and practices?* In this respect, mapping student genres (Navarro 2014) is proposed using the analysis of situated genres (Dressen-Hammouda 2014, Pérez-Llantada 2015) informed by Swales' notion of textography (1998, 2018). Swales developed this idea from his research from the university herbarium located on the second floor in the biology building: "something more than a disembodied textual or discoursal analysis, but something less than a full ethnographic account" (Swales 1998: 1).

In this way, the analysis of the corpus (identification and definition) is complemented with ethnographic information collected from interviews with teachers and students who are part of the community of practice, as well as curricular documents related to the plan of studies or learning community that is being studied. The purpose of this analysis is to propose a way for this map of student genres to be valuable to develop innovative methodologies as well as collaborative and interdisciplinary practices between teachers of Language for Specific Purpose (LSP) and teachers of the different disciplines of engineering. Viewed from this perspective, the present article is organized as follows: firstly, theoretical statements that support the research are presented. Secondly, the theoretical-methodological platform used is detailed. Thirdly, results are introduced and discussed in the light of the research question above proposed. Finally, a didactic model for teaching academic Spanish in the engineering area is designed and conclusions and pedagogical implications for LSP are provided.

I.2. Classification of student genres

Research carried out in the past decades has revealed that some discursive genres may show a significant intra and interdisciplinary variation (Bhatia 1993, 2004, Parodi 2007, 2008, 2015a, 2015b, Kanoksilapatham 2015, Venegas, Núñez, Zamora and Santana 2015), while other genres may remain very stable and are homogeneous across different scientific fields (Venegas 2006, 2007). In this respect, notions of genre sets and systems (Bazerman 1994), genre colonies (Bhatia 2004), genre families or macro-genres (Martin and Rose 2008) are highly productive. They specify the relations and overlap between genres, circulation field and comprehension and production from different disciplines: "any text is best understood within the context of other texts'' (Devitt 1991: 336).

The concept of set of genres was introduced in research conducted by Devitt (1991, 2004) on the work of tax accountants. She focuses on a limited group of genres, twelve in total, that interact with each other to develop the activities in the tax department where each genre "is aimed at carrying out particular work with specific audiences, such as clients or the tax system" (Andersen, Bazerman and Schneider 2015: 306). Thus, a set is conceived as a group of genres used by a person in his/her role within a community, for example, an undergraduate student. Bazerman (1994) broadened the notion from group to genre system, linking it to the concept of activity system proposed by Russell (1997). This idea is intended to emphasize that the relation between genres is part of a circulation system "where documents were produced in orderly sequences, responsive to each other" (Andersen et al. 2015: 306).

Since Text Linguistics was born, the interest in classifying and organizing text reality has been a recurrent concern for researchers, analysts, and language professionals. Classification of texts written by students during their academic training has become a main research task for a number of research studies recently (Parodi 2010, Gardner and Nesi 2013). In the specific field of Civil engineering, Callut (1990) identifies seven genres particular to this field, described as scientific-technical genres, as seen in Table 1.

Table 1. Discursive genres in engineering.

Scientific-technical genres in engineering
1) Technical brochure

2) Technical memoranda
3) Contact
4) Technical manual
5) Product specification
6) Report
7) Tender basis

Conrad (2017), in research on the *Civil Engineering Writing Project Corpus* based at Portland State University, identified at least ten discursive genres written by students and practitioners of civil engineering. Genres selected in this project applied to the teaching of the disciplinary writing are listed in Figure 1:

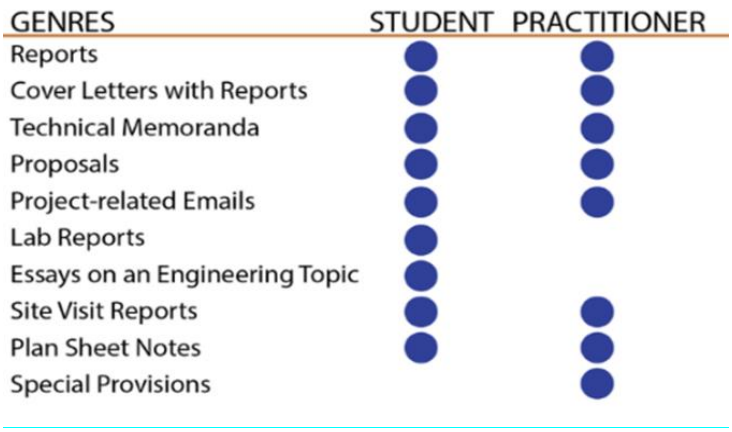

Figure 1. Identified genres in the *Civil Engineering Writing Project Corpus* (Conrad 2017)

As observed, some of the genres identified by Callut (1990) such as proposals, technical memoranda and reports are found in the map drawn by Conrad (2017). In addition, four report types are highlighted in the list: reports, cover letter with reports, lab reports and site visit reports. This demonstrates the importance of the 'Report' in the field of engineering.

Genre instances linked to the work and professional world of engineering are also underlined: tender basis, projects, e-mails, plan sheet notes and regulations. Finally, the 'essay about engineering topics' emerges as an exclusive academic genre that can have a wide circulation. It is written by engineering students only, showing the continuity of

its high educational value in education in USA, even after high school years and freshman level in university (Harvey 2009).

All the reviewed research studies point to the importance of making reading and writing maps in university education. By doing this, it is possible to access the preferred discursive genres in different areas and the ones used for transmitting, producing and spreading specialized knowledge and tools for learning in the different fields. This research seeks to better understand the discursive genres of academic training in Spanish, specifically in a sub discipline of civil engineering. In this respect, the aim is to deepen the findings stated above in the links established with the practice of writing, organization of the curriculum, challenges and obstacles in the process of academic and disciplinary literacy. Consequently, these results will provide empirical data sustained in linguistic corpora to guide and provide feedback on teaching efforts in academic reading and writing in the institutions studied, and with projections to promote pedagogical devices in other contexts, either within Chile or in Latin America as a whole.

II. METHODOLOGY

II.1. Analysis of situated genre

Research is based on a qualitative multi-stage approach that considers a concurrent triangulation (Creswell & Creswell, 2018) of the methodological strategies that will be conducted in order to accomplish the objectives. These are: Stage 1: interview analysis, Stage 2: corpus analysis and Stage 3: data integration and didactic proposal. This study has a descriptive exploratory scope, a non-experimental and cross-sectional design (Pagano 2012), that is to say, *ex post facto* single-time design: research developed in a determined time frame (2016-2019). It will be a basic-applied approach (Perry 2010), focused on exploration and description. Qualitative techniques (Creswell, 2014) and methods of ethnographic nature are used to cover the complexity of the teaching-learning process in academic writing. The situational variables chosen are the discursive genre, as a relevant written communicative activity for acquiring and confirming

knowledge, curriculum as a key academic and social organizer, and computer science civil engineering as a subdiscipline.

The qualitative element of this research will provide perspectives from the participants in the discourse community in detail (academics and students) in order to enrich the genre studies field. A qualitative phase helps to listen to the participants, that is, to incorporate an emic perspective (Creese 2010) or obtain insights from inside the communities. It provides valuable contextual information that allows for understanding the phenomenon studied in a comprehensive way, related to the practice in the university classroom in Computer Science Civil Engineering in three Chilean universities: *Pontificia Universidad Católica de Valparaíso, Universidad Técnica Federico Santa María and Universidad de Chile.*

This last factor helps us to give meaning to the wider production of academic genres in the practice of the writing and production of knowledge, as well as pedagogical interaction in the micro and in the macrocurricular level focusing on the singularity (Stake 2008) of the subject of study. This study, given the above, considers three approaches to genre studies, focusing on academics, students and texts, that is, the product. An informed ethnographic approach (Gardner 2008) is assumed, using some ethnographic research tools (Sheridan 2012). In the following Table 2, techniques and instruments for collecting information and participant selection criteria are specified:

Table 2. Tools and selection criteria for interviews and focus groups.

Data collection tool	**Selection criteria**	**Number**
1) In-depth interviews	Academics/faculty members of each study program where teaching is developed in the capstone cycle.	- 4 academics per studies program - 1 head teacher or director - 3 academics of the cycle Total participants: 14 academics
2) Focus group	Students in the capstone cycle (seven to twelve semester accordingly).	- 5 to 8 students per program study, from each university Total participants: 37 students.
Total participants in interviews and focus group		**51 participants**

Guideline questions for the in-depth semi-structured interview are shown in Table 3:

Table 3. Protocol with main questions and probes for interview and focus group.

In-depth and semi-structured interview questions	
Main question	*What do students write in the capstone cycle in Computer Science civil Engineering?*
Probes	*What texts are requested to be written?* *How are they called?* *What is the structure of these texts?* *Who are the recipients?* *What are the differences with other texts?* *What topics do they cover?* *What are the most difficult texts to write? Why?* *What are the difficulties of these texts?*

II.2. Learner corpus HÉLICE 2017

In order to describe student genres written by students of the capstone cycle of computer science civil engineering as part of the requirements of the specialization courses, a learner corpus was developed, called HÉLICE 2017. This multigenre corpus includes 467 texts from three study programs in civil engineering from the three afore-mentioned prestigious Chilean universities (Quacquarelli Symonds 2019), written from 2015 to 2019. It contains 1,413,437 words, exceeding the minimum of one million recommended for specialized corpora (Pearson 1998, Rea Rizzo 2010).

This description will contribute to understanding the formative role of these genres in the teaching-learning context in the classroom of computer science civil engineering. Thus, through an ascending-descending approach, as a starting frame the proposal of Parodi et al. (2008, 2010, 2015a) will be used. These genres were identified in a corpus of 467 texts from 2016 to 2019, and later characterized and defined under criteria such as communicative purpose, discursive organization, semiotic mode, circulation context, relation between participants and learning objective. For this an Identification of Discursive Genres Matrix (MIGD in Spanish) was developed using Parodi et al. (2008).

A non-probabilistic purposive sample (Pagano 2012) by convenience (Corbetta 2006, Pagano 2012) was obtained for the corpus. Given they are occluded genres (Swales 1996), and difficult to gather, a collection strategy was followed consisting of asking the

students of the capstone cycle for the largest possible number of pass-grade written assignments (>=5.5)[i]. Therefore, the corpus was formed by the students' selection of their own work in these courses; effectively, this presents some characteristics of self-compiled corpora (Lee and Swales 2006). Additionally, a small portion of the assignments were collected in the academic office or requested by e-mail to each academic. In this sense, it is a learner corpus (university capstone students). The courses of this cycle in each study program is detailed in Appendix 1. A total of 103 students provided texts for the student text corpus, and each student contributed an average of 5 texts.

III. RESULTS AND DISCUSSION

III.1. Genres in the disciplinary discourse: genre system in the capstone cycle in Computer Science Civil Engineering (ICI)

III.1.1. Description by the teacher and student discourse

Each of the academic and disciplinary cultures possesses a potential genre group or genre system (Martin and Rose 2008) recognizable by their own members. In this section, a summary of discursive genres selected by academics and students from the practice communities of ICI will be presented. As genre analysts have outlined (Parodi et al. 2019), in order to tag genres written by student engineers, it is necessary to reconcile a wide range of terminology used to describe the texts, as in the case of the paper and the article or report, among others.

Genres identified in the capstone cycle of ICI that students must write as part of the disciplinary training and integration are included. Through the interviews and focus groups, 32 genres emerged, ascribed to the training stage as observed in Table 4.

Table 4. Student genres described by academics and students with code and number.

Nº	Code	Genre	Nº	Code	Genre
1	AIC	Research article	18	ICA	Case report
2	CAS	Case of use	19	INF	Technical report
3	CER	Exam	20	LIC	Tender basis
4	COD	Code	21	MAI	Implementation manual

5	COM	Commentary	22	MAP	Procedure manual
6	CU	Questionnaire	23	MET	Methodology
7	DEFO	Oral defense graduate project	24	MOD	Model
8	DT	Technical description	25	PW	Webpage
9	ESC	Scenario of use	26	PN	Business plan
10	EA	State of the art	27	POS	Poster
11	FOR	Forum	28	REQ	Requirement
12	TFG-a	Progress report of graduate project	29	ERP	Problem solving
13	ILAB	Lab report	30	RES	Abstract
14	IPP	Internship report	31	TAIC	Paper translation
15	IPRO	Project report	32	TFG	Undergraduate Project report
16	INV	Research report			
17	IAL	Algorithm report			

As seen in the Venn diagram in Figure 2, academics identified a greater number of genres (30 in total) whilst students identified 18 genres. From these 18 genres, 15 of them were identified by academics and only three were exclusively named by students: Code (COD), algorithm report (IAL) and research report (INV). This conforms to the extensive discussion in the literature about the low degree of transparency when teaching genres to students (Shaver 2007, Graves, Hyland and Samuels 2010, Navarro 2013, Navarro et al. 2019).

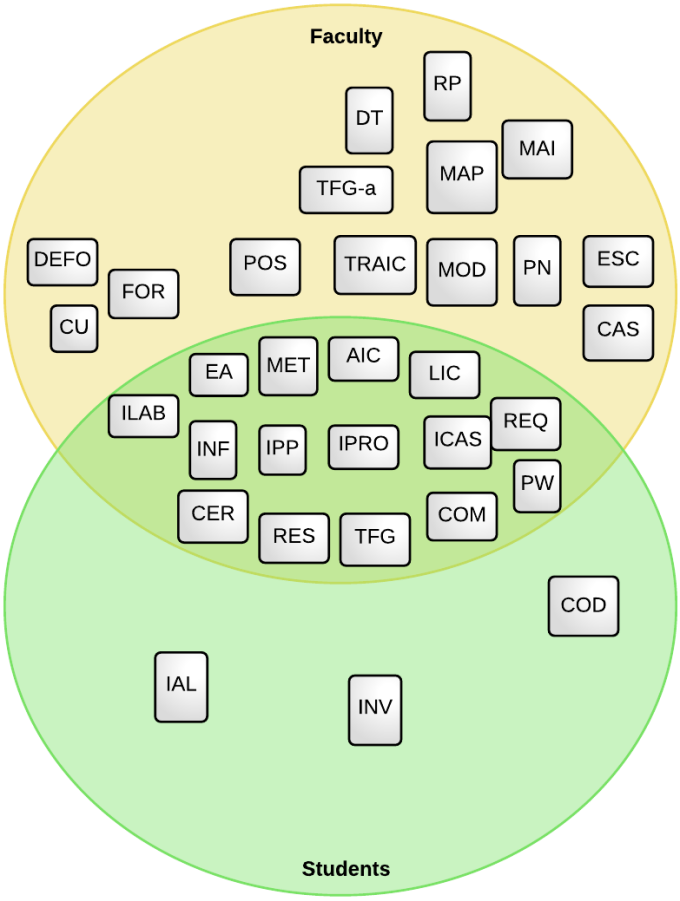

Figure 2. Genres identified by teachers and students of Computer Science Civil Engineering program studies.

Within the genres shared by both groups, the research article (AIC) is outlined as it behaves as a macrogenre and can eventually subsume training genres such as state of the art (EA) and methodology (MET), given their relation with prototypical sections of an AIC (Venegas 2006, Sabaj 2012). Thus, different specific varieties of reports are described: technical report (INF), internship report (IPP), project report (IPRO), lab report (ILAB), including the oral report as part of a genre chain (Swales 2004). In effect, the report is articulated as a macrogenre (Parodi et al. 2018) or family of genres that gathers specific genres together. In the economics and business field, descriptions of these genre forms for Spanish language are found, such as the Monetary Policy Report (Parodi et al. 2015, Vásquez-Rocca and Parodi 2015, Vásquez-Rocca 2016) and the Financial Stability Report for Spanish and German (González and Burdiles 2018),

while research on the civil engineering field is more scarce (Marinkovich, Sologuren and Sahwy 2018, Sologuren 2019; Sologuren and Castillo 2019).

Another of the student genres mentioned by students and teachers is the dissertation, bachelor's degree thesis or thesis, according to the name assigned by the academic unit, or Undergraduate Graduation Project (TFG or "Trabajo fin de grado"). A member of the faculty commented:

> "I usually ask my students not to be satisfied with what they wrote, but I ask them to think about other work that can result from what they already did. I, at least, demand that they write" (P06_DCC_05-1)

Thus, research writing emerges in the curriculum as a key component for developing complex thought. Therefore, the TFG becomes a macrogenre (Venegas 2010) inside which it is possible to find subgenres or genre resources that can be parts of a genre or can act independently such as EA and MET. From there it is possible to see the necessity of describing student genres on their own, because "there is no systematic engagement between a potential genre expert and his/her own training 'version'" (Ávila and Cortés 2017: 165-166). In effect, student genres mutate dynamically depending on the perceived pedagogical necessities and according to social teaching motivations and knowledge credentials (Dias et al. 1999, Ávila and Cortés 2017, Bazerman 2017).

In Figure 1 it can be observed that teachers and students recognize two curricular genres (Anson 2008): exam (CER) and abstract (RES). In relation to the first genre, one of the interviewed academics who identified it quickly commented:

> "That's what they read, but they write very few documents, in general, as far as I know they answer exam questions and it's not uncommon when asked something they answer something completely different because they didn't understand the question, and that's a problem because they sometimes know the answer" (P02_INF_06-3)

From the perspective of the teacher, this genre would be one of the most frequent, and one where students show comprehension and approach production problems. It seems to be a projection of general school genres (Parodi et al. 2015). In the same way, the abstract genre (Parodi, Ibañez and Venegas 2014) emerges as a genre resource that is highly valued from the textual production field. It is considered for the development of

the ability to synthesize and for its enabling function when it is a supporting genre oriented to the realization of other genres guided by academic purposes of knowledge acquisition, such as the poster (POS):

> "That's different, the ability to synthesize is not well developed, like writing and speaking, and if you give the task of producing a poster they will write everything that comes to their minds, that's why they need to be given the format" (P07_ICI_009-10).

The interrelation of the written and the oral mode and the importance given to orality is also manifested in the Poster genre (POS). It is defined as "a multimodal communicative genre, with text, graphics, colour, speech, and even gesture used to convey meaning" (Kress and van Leeuwen 2001). It is often labelled as a less prestigious genre among the constellation of academic genres (Swales 2004) and it is perceived as second-class (MacIntosh-Murray 2007) compared to oral presentations (Swales and Feak 2000). However, the situation is changing nowadays because posters "are an increasingly important part of scientific conferences and constitute a valid and interesting alternative to paper presentations at conferences" (D'Angelo 2010). Now, the relevance of the sociodiscursive practice of innovation (Sabaj 2017, 2019) is added, as well as entrepreneurship, especially in engineering, that has promoted new genres and the revaluing of discursive practices that help the display and development of an idea from conception until completion.

Finally, among genres recognized by both groups, there is a set of student genres colonized (Bhatia 2002) by the professional discourse (Bolívar and Parodi 2015) or defined in another way, namely as genres belonging to non-academic professional discourse (Navarro 2012), of an instructional or educational nature. They are the genre forms named here as tender basis (LIC), webpage (PW), requirement (REQ) and commentary (COM). Meanwhile, LIC can be classified as an imported genre (Parodi 2014, Bolívar and Parodi 2015) widely shared within the engineering discipline (Callut 1990 for an early classification of the types of texts in engineering, REQ and COM). They are genres that future computer science civil engineer will have to produce when working.

Table 5. Genres, requirements and comments emerged by academics and students of ICI.

REQ	Selection criteria
"Yes, I think we know how to identify the requirements the best and, therefore, to know how to express them better and write them in a document" (E11_DCC_21-24). "Reports titled under a required specification and a required design. They have a narrative portion and many graphics of nomenclature portions that we use to identify systems" (P09_INF_004-1) "Our program studies work with too many softwares, they have requirements we need to meet and we are experts reading a document, to take the requirements of the software asked and then write it in a report under a requirement 1, requirement 2 and explain and explain it again in detail" (E12_DCC_21-25).	"It is ironic because in programming we are taught alt command to comment a code and we write a commentary and the commentary doesn't affect you what the program has to do or the person reading it, it helps us, but when we write it down in the test, I say this because I didn't think about it or because I did it so, we are not given point, not because we are commenting if I want the code, then why do they teach us that if they don't want that" (E10_ICI_22-6). "For example, in a code we write a commentary about the function it receives, stays there and what it does and everything explained in few lines so later one week reading codes" (E09_ICI_23-8). "For example in computer science, in programing there is a topic that… commentaries, I don't know, I have a program and I should have commentaries, then what commentary level should I have, to be understood, because if no one will use this program why I am commenting, but maybe in the future somebody will have to change something here or they will use it as a base for another one, then I should leave commentaries" (P07_INF_004-5).

For REQ, teachers and students agreed to point out the disciplinary relevance of this resource as part of the typical work in computer science civil engineering, emphasizing a narrative, explanatory and descriptive element in the explanation. For its part, COM is also a typical genre in computer science. Students E09 and E10 in Table 4 explain the utility of this genre form in programming, but they express a mismatch in the teaching and evaluation of this genre. For teachers, commenting involves considering the development of future programming experts, as observed in Table 2,the idea being that their programming notes can be used, improved and adapted by other professionals of the field.

III.1.2. Student genres in the HÉLICE-2017 learner corpus

For Bhatia (2004, 2016) genre theories can be defined in different ways, since they have an ongoing life in "the real world of discourse". In this sense, we face a challenge in the process of analysing the interrelations and connections between different genres. In fact, relations and connections between genre forms is for Swales (2016) one of the most important current topics for LSP. In this context, it is necessary to consider the notions of macrogenre and microgenre as relevant analytic categories to understand the complex relations between genres. A macrogenre is defined as "a genre unit of higher hierarchy formed by genres" (Venegas, Zamora and Galdames 2016: 252) where varied genres can be included. Additionally, a microgenre can work as an element of a macrogenre, as 'embedded' in terms of Martin and Rose (2012), as part of a genre (Breeze 2016) or as functional rhetoric segments (Cotos and Chung 2019).

Based on these ideas, my results from the identification, delimitation and characterization of student genres from a double perspective (typological and topological) will be expounded and discussed in the following sections.

The analysis results in the identification of 33 GEFICs, as seen in Table 3, meaning that there is great diversity in this subdiscipline of civil engineering. Figure 3 shows the genres identified and the percentages of texts that belong to each genre.

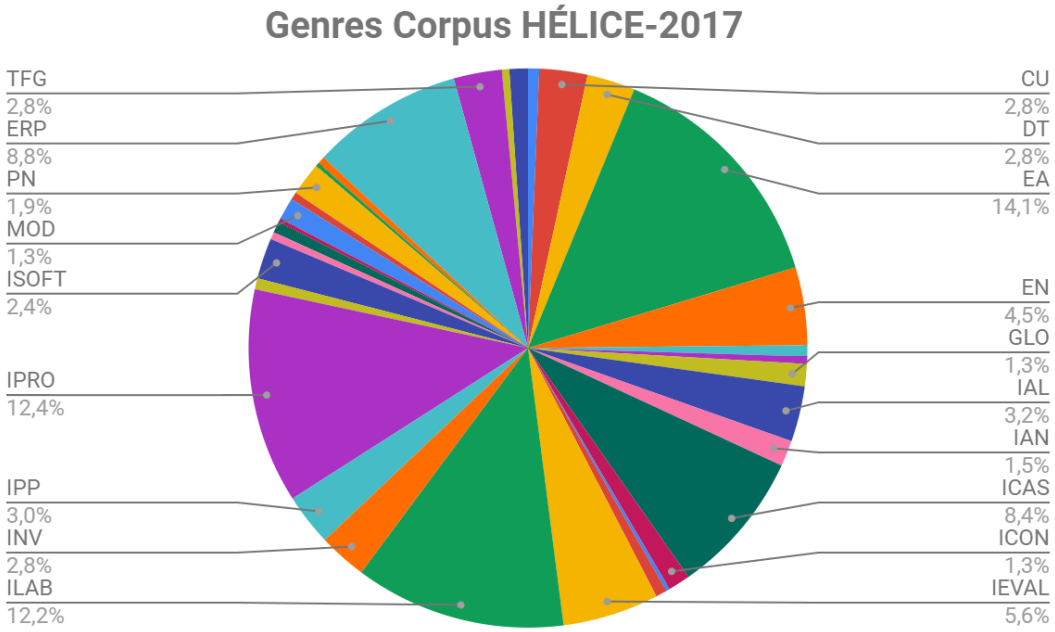

Figure 3. Configuration of HÉLICE-2017 multigenre corpus.

Table 6 contains the 33 student genres in Computer Science Engineering with the access number to the text corpus and the identification code:

Table 6. List of the 33 discursive genres identified from the text learner corpus HÉLICE-2017.

Nº	**Code**	**Genre**	**Nº**	**Code**	**Genre**
1	IPRO	Project report	18	IEV	Evaluation report
2	PN	Business plan	19	EA	State of the art
3	GLO	Glossary	20	IAN	Business analysis report
4	LIC	Tender basis	21	TFG-a	Progress report of TFG
5	ERP	Problem solving	22	TFG-p	Exam proposal report
6	TFG	Undergraduate Project report	23	MET	Methodology
7	ISOFT	Software report	24	EN	Essay
8	ILAB	Lab report	25	ESC	Scenario of use
9	IPP	Internship report	26	FI	Card of state
10	ICAS	Case report	27	IDIAG	Knowledge evaluation
11	CU	Questionaire	28	PENT	Protocol of interview
12	CAS	Use of case	29	EF	Financial statement
13	MOD	Model	30	ICON	Consultancy report
14	IAL	Algorithm report	31	IRREFLEX	Reflexive report

15	DT	Technical description	32	ITERR	Field report
16	RES	Abstract	33	IEV	Evaluation report
17	INV	Research report			
18	IEM	Market research report			

The overview of the genre composition of this corpus shows the appearance of the report macrogenre with an appreciable variety of genre instances (15), the emergence of professional oriented genres, and other mostly didactic ones. In addition, genre resources linked to processes of scientific research and to genres of discourse on economics are noted. In this respect, the genre conformation of this corpus is similar, as expected, to that for the academic discourse in civil engineering and industrial chemistry engineering (Parodi 2008), physics and chemistry (Parodi 2012, 2014) and economics (Parodi et al. 2015). Other genres linked to social sciences, information sciences and other disciplinary specific genres from the computer science field have also emerged.

Furthermore, genre forms in the professional world surface, displaying a diverse intertwine (Flowerdew 2003, Bolívar and Parodi 2015) between academic discourse and professional discourse. In this perspective, we find overlaps with innovation (Sabaj 2017) and entrepreneurship (Varas 2017) discourses. This wide diversity of identified genres shows the interdisciplinary nature and considerable hybridization in this subdiscipline of civil engineering.

The results of my characterization of student genres in computer science civil engineering make it possible to group genres into seven macrogenres or genre families as defined in Table 7.

Table 7. Macrogenres identified from text corpus and the definition.

Nº	**Macrogenre or genre family**	**Code**	**Genre**
1	Technical report	MGITEC	Genres that belong to this category share the macropurpose of *writing* the state of a procedure, an experiment work, a development or a project. Genres that belong in this category are the following 15 student genres: *IPRO, ISOFT, ILAB, IPP, ICAS, IAL, INV, IEM, IEVAL, IAN, IDIAG, ICON, ITERR*

			*a*nd *IRREFLEX*. In addition, this family takes into account the microgenre: EF
2	Plan	MGPLAN	The genre resources that belong to this genre family share as a communicative macropurpose *persuading* a professional audience about a determined proposal in a work context. Genres that belong to this category are: *PN* and *LIC.*
3	Requirement	MGREQU	This macrogenre integrates genres that share the communicative macropurpose of *guiding* a specialized audience about the criteria to start or to hold a process. Macrogenres that belong to this category are: *CAS, ESC* and *FI.*
4	Model	MGMOD	Genres that belong to this collection share the communicative macropurpose of *representing* a procedure, a phenomenon or an entity to emerge the meaning within a determined process. Macrogenres that belong to this category are: *MOD* and *DT.*
5	Methodology	MGMET	This genre family is formed by discursive genres which communicative macropurpose is to describe the procedures developed by the academic writer in a determined research or innovation project. The represented microgenres in this category are: *MET a*nd *PENT.*
6	Didactic Exercise	MGEJED	The macrogenre is formed by genres that share the communicative macropurpose of *instructing* about a specific disciplinary topic. They are genres that "display didactic resources with a clear emphasis on teaching/learning processes" (Parodi et. al 2015: 183). This intends to favor an autonomous learning of the students and to strengthen the knowledge of disciplinary key concepts. Discursive genres that belong to this genre family are: *CU, GLO* and *RES.*
7	Undergraduate Project Report	MGTFG	Genres in this category answer to a "Research written report of evaluative accreditative nature, submitted by university students as the dissertation, a requirement to obtain a such as a Bachelor degree, a Master's degree

			or a Ph.D., and it must be presented and orally defended before a commission of experts to be approved" (Venegas 2010: 13). The shared communicative macropurpose is *persuading* about a particular research or development. Genres that belong to this genre family are: *TFG-p* and *TFG-a*.

Moreover, it is possible to understand from this text analysis how each macrogenre is situated on a continuum from a prominently professional academic nature to a professional non-academic nature that connects training with work areas (Figure 4).

Figure 4. Continuum of macrogenre conforming disciplinary discourse in undergraduate studies for Computer Science Civil Engineering Program.

It can be observed on this continuum that the predominance is given by intertwining and overlapping (Flowerdew 2003, Bolívar and Parodi 2015) between what is known as 'academic' discourse (+academic) and 'professional' discourse (+NO academic) showing hybridization as a characteristic phenomenon of the genres produced by students of computer science civil engineering. In effect, three out of the seven genre families are located in the middle of the continuum: MGITEC, MGMET and MGMOD. This occurs because the genre resources do not correspond exclusively to either of the poles, but the genres conforming them are either related to a strictly academic field, a strictly professional field or they are hybrid genre instances that facilitate the disciplinary learning.

MGTFG is situated at one end of the continuum, representing the final episode of the program studies in which the author submits a text that evaluates his/her knowledge of the field (Montemayor-Borsinger 2014: 268). On the other end, the MGREQU family gathers those defining genres of the work sphere of any computer science civil engineer and that characterize their daily duties.

As seen in Figure 3, the MGPLAN family is situated slightly further away from the NO academic end. Although it contains strongly professionally oriented genres, its focus on academic training has assisted in surfacing situated variations of the genre, which: "plays a key role in entrepreneurship and is used in educational settings" (Navarro 2015b: 150). Additionally, closer to the academic end, the MGEJD family appears in the university undergraduate training of this discipline gathering curricular genres (Christie 2002), genres that for this author are realized in a regulatory register related to instructions and educational objectives to be covered, and an instructional register connected to curricular content and cognitive abilities to be developed. In this sense, they respond to the sociosemiotic process (Mathiessen 2007, 2015) of enabling, which, in a secondary degree of delicacy, established in the register cartography (Mathiessen 2007), considers instruction and regulation.

III.3. Didactic model for teaching academic and professional Spanish in civil engineering

A group of phases and criteria is proposed from this mapping, thus facilitating the articulation of a model to teach academic Spanish language and to develop a didactic proposal based on textual genres which are important for training and for professional performance, including genres which are actually used in the scientific, academic and professional fields of civil engineering.

Phase 1: Diagnostic knowledge evaluation of requirements and difficulty in writing different genres in the capstone cycle of civil engineering study programs.

This phase aims to understand the characteristics that academics and students identify in genres that must be written as part of the different courses in order to efficiently achieve the informative-evaluative function of academic discourse. Moreover, it is intended to

evaluate the main difficulties experienced by academics and students during the academic writing process of each genre.

Phase 2: Description of discursive genres in the civil engineering field

The focus of this phase is to describe genres based on lexical grammar, semantic-discursive, rhetoric and stylistic features (Manrique, Zapata and Venegas 2019), and at the same time, to relate the student genre map to the communicative purposes of the genres, the key courses in the curriculum and the functions for which the genres are used.

Phase 3: Collaborative and interdisciplinary work with teachers in the engineering field (Bauerle, Hatfull and Hanauer 2014).

This phase is based on a group of steps that may help the curricular insertion of discursive abilities in Spanish in courses on computer science civil engineering.

1) Validation of the genre description together with academics of the engineering field in order to develop a verification process with the specialist (Bhatia 2002) and to enrich the possible use of the genre.

2) Presentation and analysis of genres organized in macrogenres, genre families or colonies (Bhatia 2004, Luzón 2005) considering the communicative macropurpose and the disciplinary learning unit where it is inserted. At this stage it is also important to consider more or less specialized possible contexts in which each genre is used. From the results obtained, an explicit teaching of the seven identified and defined macrogenres is proposed, so that the students will strengthen their genre knowledge, and they will be ready to approach emerging genres that enter the system or genre colony.

3) Design of writing tasks with the collaboration of LSP teachers and professors of engineering that help students to display their genre skills, paying attention to the communicative purposes in the diverse discursive communities where these genres are used and analysis of lexicogrammar and rhetoric-discursive features.

4) Specification of the relations between discursive genres, and, in particular, pedagogical activities promoting analysis and development of genre chains that involve the development of discursive trajectories not only displaying writing skills, but also oral and reading skills, such as the business plan (PN), tender basis (LIC) or internship report (IPP).

5) Comparison of different genres with similar communicative purposes, for example, knowledge evaluation (IDIAG) and evaluation report (IEVAL), in order to observe the communicative and linguistic differences produced in terms of communicative function, writing objective and target audience. In addition, it is relevant to observe how they are integrated, and how different genres and microgenres from the corpus can be used, e.g., the abstract (RES), state of the art (EA), problem solving (ERP), the case of use (CAS), scenario of use (ESC), model (MOD), financial statement (EF). These can behave as embedded genres or parts of a genre (Breeze 2016).

IV. CLOSING COMMENTS

Progressive analysis of genres that are situated in and connected to the community of practice and the learning community allows for a gradual development of more comprehensive rhetoric knowledge. This knowledge will be fundamental to successfully address multiple communicative contexts and problems that engineering students will face throughout their undergraduate years, as well as in their future work, either in the industry or in other organizations.

Additionally, the use of a sound theoretical background and the incorporation of research resources (such as the learner corpus HÉLICE-2017) are likely to assist students in discovering the academic and specialized Spanish language used in computer science civil engineering, so they can become language 'detectives' (since "every student [is] a Sherlock Holmes" (Johns 1997: 101)). This learning process will equip them with a more nuanced metadiscursive awareness and strategies of text metaproduction. Their heightened level of awareness of texts and textuality is bound to

enhance writing quality in a given subdiscipline, being an element of great importance for transmitting and proving knowledge.

In this sense, and trying to answer the research question: *How can teachers and researchers in Languages for Specific Purposes take full advantage of contemporary trends in higher education (in this case engagement with professional communities) to develop innovative pedagogies and practices?* LSP teachers may use reading and writing maps as a valuable input to negotiate processes with academics, to increase students' rhetorical sensitivity (Guerra 2016), and to help them build knowledge about professional discourse and its diverse forms since: "They also build bridges between higher education and the real world, by motivating learners with authentic documents from their fields of expertise and improving their information literacy and communicative abilities" (Breeze and Sancho-Guinda 2017: 215).

Finally, and as a projection, one of the future challenges lies in organizing the transition from the discursive genres produced during the formative stage in the Faculty of Engineering, to incorporate specificities about all the subdisciplines such as geology, and produce didactic resources for the curricular insertion of genres in the reports written in each key course of the engineering field. This process will contribute to developing a situated and contextualised support system, as well as providing more informed feedback on academic and professional writing. This will also lead to an update of the curricular tools in engineering education. Owing to the above initiatives, a refined model of text production will emerge that considers all the stages and strategies necessary for genre-based didactics in the STEM field.

Notes

[i] According to the university grading system of Chile.

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APPENDIX 1

Table 8. Courses in applied engineering.

Nº	Code	University 1	Code	University 2	Code	University 3
1	ICI5240 Sem 9	Artificial intelligence	ILI225 Sem 7	Software Engineering	CC5401 Sem 9	Software Engineering II
2	ICI5440 Sem 9	Human factors in software projects	ILI255 Sem 7	Introduction to computer theory	CC5402 Sem 10	Software Project
3	ICI5540 Sem 9	Database workshop	ILI256 Sem 7	Computing networks	CC4102 Sem 8	Algorithm design and analysis
4	ICI5341 Sem 10	Distributed systems	ILI264 Sem 8	Systems and organizations	CC4302 Sem 8	Operating systems
5	ICI5544 Sem 10	Business engineering	ILI285 Sem 7	Scientific computing I	CC4303 Sem 8	Networks
6	ICI6440 Sem 11	New technologies in organization	INF293 Sem 7	Operation research	IN3301 Sem 9	Project evaluation
7	ICI6441 Sem 11	Administration of computing projects	INF322 Sem 8	Interface design	CC5901 Sem 9	Professional internship
8	ICI6442 Sem 11	Business intelligence	INF295 Sem 8	Artificial intelligence	CC5601 Sem 10	Preparation and evaluation of projects TI
9	ICI6540 Sem 11	Bachelor's degree seminar	INF343 Sem 8	Distributed systems	CC6908 Sem 10	Introduction to Thesis project
10	ICI6541 Sem 12	Thesis project	INF266 Sem 8	Administrative systems	CC6909 Sem 11	Thesis project
11	ICIPRAC Sem 10	Internship 2	INF228 Sem 10	Workshop of computing Project development	CC5206 Sem 10	Elective class
12	ICI5542 Sem 9	Computer Project design	INF309 Sem 10	Thesis project 1		
13	ICI6003 Sem 12	Elective class	INF310 Sem 11	Thesis project 2		

14	ICI5142 Sem 10	Research of advanced operations	ICN270 Sem 7	Information and financial mathematics		

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