

# Is teaching grammar with an intelligent web-based learning language system effective? An experiment with preposition optionality competence

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Máster en Formación del Profesorado de Educación Secundaria y Bachillerato  
Especialidad Inglés



MÁSTERES  
DE LA UAM  
2018 – 2019

Facultad de Educación y  
Formación del Profesorado



MÁSTER EN FORMACIÓN DEL PROFESORADO DE  
EDUCACIÓN SECUNDARIA OBLIGATORIA Y BACHILLERATO

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Fecha de entrega: 17/06/2019

TRABAJO DE FIN DE MÁSTER

CURSO: 2018/2019

## Table of Contents

Acknowledgements .....	i
Abstract.....	ii
Introduction.....	1
Part One: Theoretical Background.....	3
1.    Technology in Second Language Teaching (SLT).....	3
1.1.    What Technology Enhanced Language Learning (TELL) is and its origins	3
1.2.    What is the Digital Competence? .....	5
1.3.    The role of technology in the classroom.....	5
1.4.    The role of the teacher in the classroom .....	6
1.5.    Advantages and disadvantages of TELL .....	7
1.6.    Teaching grammar with the help of TELL .....	8
2.    Corpus Linguistics.....	9
2.1.    Defining the concept of Interlanguage.....	10
2.2.    What is fossilisation?.....	11
2.3.    Error or mistake? .....	12
2.4.    Learner Corpora.....	13
Part Two: Development of a Module for Online Language Learning within Alegro .....	16
1.    Introduction.....	16
2.    The TREACLE project.....	17
3.    Designing the learning module .....	19
3.1.    Selection of the learning area .....	19
3.2.    Identification of critical language concepts .....	20
4.    Determining concept order of difficulty .....	28
5.    Writing the critical concepts' description.....	29
6.    Writing diagnostic probe materials .....	31
7.    The Alegro system in operation .....	34

Part Three: Testing the Effectiveness of the Module within the Alegro system with High School Students.....	37
1. Introduction.....	37
2. Participants' profile .....	38
3. Procedure (how the experiment was conducted).....	39
4. Findings and discussion .....	40
Conclusion .....	49
References.....	52
Appendix A. Pre-test on preposition optionality competence .....	55
Appendix B. Post-test on preposition optionality competence .....	57

## **Acknowledgements**

It is a genuine pleasure to express my deepest gratitude to my advisor and professor, **María Fernández Agüero**. She has been an enormous support during the completion of this master's, especially after Christmas, when I finally had the chance to be one of her students. She is a marvellous teacher and person whose knowledge has guided me through the writing of this thesis. It has been an honour to work side by side, both during my Practicum and in the development of my dissertation.

I would also like to take this opportunity to thank the rest of my **professors** in this master's, who have taught me countless aspects of teaching I was completely unfamiliar with. Besides, they have always been willing to help whenever I needed.

**My parents** also deserve recognition too. I will always be grateful for having them. I would not be where I am today if they had not been there, encouraging me along the way. They have always had kind-hearted words to cheer me up and they have been wise enough to let me know when they considered I was going the wrong way. I am forever indebted to them.

Last but not least, **my friends** have also been fundamental pillars who have always lent me emotional support. Firstly, I need to mention my very good friend **Josh**, whom I have known for almost two years now. He is always there for me, willing to help and motivating me to improve my English. Also, I owe a sincere thanks to two of my classmates, **Cristina and Alba**, who have become such important pieces in my life. Cristina has born witness to the many times I was feeling overwhelmed, and her relaxed demeanour helped me calm down. Alba, too, has been there spreading happiness and being a role model. Had it not been for her, I would have possibly lost track of all the assignments I had to hand in.

**Francisco Nogales López**

## **Abstract**

This thesis has a dualistic aim. The first aim is to explain how I developed a web-based teaching system (Alegro) which is capable of determining the level of competence of students and, accordingly, it offers them linguistic input adequate to that level, focusing on problematic areas. The second aim of this thesis is to describe how I tested the effectiveness of this learning module by comparing the students' performance at the beginning and at the end of the experiment. In essence, the problematic area of interest in this thesis has been preposition optionality – when students wrongly insert or omit a preposition in a sentence. Because of that, I developed a module within the Alegro system dealing with this issue to be used with high school students from IES San Mateo in Madrid. The results show that, on average, there has been an increase in the students' preposition optionality competence.

Keywords: Second Language Teaching; Technology Enhanced Language Learning; Corpus Linguistics; Error Analysis; Preposition Optionality

## **Introduction**

This thesis aims at describing how I tested the effectiveness of a web-based teaching system which intelligently tracks the current level of competence of students and, based on that, gives them teaching material adequate to their level. This system, called Alegro (Adaptive Learning of English Grammar Online), focuses on critical grammar areas that students should pay attention to. With the help of this system, teachers can provide students with the necessary input to learn different aspects of English in a short length of time.

Within the Alegro system, I created a module on preposition optionality (I will further develop this in Part Two of this thesis). Preposition optionality problems occur when a preposition has been wrongly inserted or omitted in the sentence. The rationale behind this study comes from MacDonald, 2016, where prepositions were identified as one of the 20 most critical areas for Spanish learners of English.

Taking all this into account, I have divided this thesis in three main parts. Part One will introduce the theoretical notions needed to understand the topic at stake: technology in Second Language Teaching and Corpus Linguistics. Secondly, Part Two will describe how I developed the learning module within the Alegro system mentioned above. Lastly, Part Three will provide a description of the experiment that I conducted to test the effectiveness of the online learning system with high school students doing their first year of Bachillerato. Besides, I will comment on the results that were gathered and will compare them to those obtained in a similar study (Nogales, 2018) I carried out with students doing the English Studies degree at the Universidad Autónoma de Madrid (UAM). This way, readers can get a better and clearer picture of the possibilities offered by the Alegro system.

To provide a more elaborate explanation of the system's effectiveness, I have postulated three research questions, which will be central in Part Three of this thesis:

1. Does the use of this online learning module actually help the high school students in this study develop competence in respect to preposition optionality?
2. What grammatical concepts in terms of preposition optionality are critical to the high school students in this study?
3. Is this online learning module more effective at a high school level (with students not specialised in English) or at a university level (with students doing a degree in English Studies)?

After answering these three research questions, I will provide a conclusion with a summary of the main aspects in this thesis and suggestions for further research. Besides, I will also comment on a number of implications teachers should take into account if they want to implement systems such as Alegro in their methodologies.

# **Part One: Theoretical Background**

## **1. Technology in Second Language Teaching (SLT)**

It is generally assumed that, in teaching, innovation is key for success. Remaining stagnant does not usually yield positive results. Teachers and students alike should keep up with the pace of modern breakthroughs. If the issue of innovation must be dealt with, it is almost impossible not to think of technology as one of the elements which has gained ground in the sphere of education.

The advantages of technology in class are plentiful. Different authors have addressed this question, and they give a number of reasons that clearly indicates that using computers – as well as other technological devices – to teach languages can bring countless benefits to the learning experience. Right from the Introduction of his book, Stanley (2013) mentions the idea that we live in a globalised world, and that globalisation is made possible through technology and the Internet. In fact, this author asserts that “technology permeates every aspect of our lives” and, of course, this means that education will be very much affected by it too (p. 1). Some of the positive aspects of using technology in the classroom have been explained by Stanley too, which include: looking up information on the spot, having a rich source of real second language (L2) input or making the interaction with students in other countries possible (ibid., p. 1). The advantages offered by using technology for learning will be further discussed in section 1.5.

### **1.1. What Technology Enhanced Language Learning (TELL) is and its origins**

The use of technology for learning has been referred to as Computer Assisted Language Learning (CALL) and, more recently, Technology Enhanced Language Learning (TELL). Mainly, the difference between these two resides in the focus that each has been given. Whereas the former sees technology as a means to teach language, the latter understands this technology “as part of the environment in which language exists and is used” (Walker & White, 2013, p. 9). Kranthi (2017) states that in TELL “the computer simultaneously becomes less visible yet more ubiquitous” (p. 30). This would mean that, taking the CALL approach, computers would be considered as tools to teach the language in more or less the same way that has been done throughout the years (fill-in-the-blank or rephrasing exercises, amongst others), while the TELL approach would do this, but also make use of the language found on the Internet as real language input.

Kranthi (2017) proposes a good definition of TELL, stating that it “refers to the use of computer as a technological innovation to display multimedia as a means of complementing a teaching method language teacher” (p. 31). He continues to explain that TELL is, in fact, a resource for teachers to use to complement their lessons, but it must not become the centre of the class.

To better understand the origins of technology-based learning, I am going to comment on the three different “phases” (Warschauer & Kern, 2000) or “approaches” (Bax, 2003) to CALL that have been distinguished since technology arrived in the classroom. In the first place, according to Warschauer and Kern, between the 1960s and the 1970s there is what is known as “structural CALL,” which particularly focused on the structure of the language (phonology, grammar, etc.). This phase had to do with “drill and practice methods to achieve accuracy” (Walker & White, 2013, p. 2). Bax’s (2003) approach is, in essence, the same, but he calls it “restricted CALL” given the fact that the type of exercises proposed usually require a closed-type answer.

Secondly, from the 1970s to the 1980s, another phase suggested by Warschauer and Kern received the name of “communicative CALL,” where grammar instruction occurs along with a focus on Communicative Language Teaching (CLT) (Szendeffy, 2005; Walker & White, 2013). In relation to this phase, Bax (2003) believes that CLT does not actually occur, and calls his own second approach “open CALL” because students can interact with computers and other learners in a more open-ended way when compared to the first approach (Walker & White, 2013, p. 2).

Lastly, there is a final phase/approach that began in the 1980s and continues up to the present. Warschauer and Kern refer to this phase as “integrative CALL” while Bax gives it the name of “integrated CALL” (Walker & White, 2013, p. 2). The main difference between these two is that Warschauer and Kern only consider computers in order to bring technology to class, while Bax believes that new devices (*tablets* or mobile phones, for instance) can be somehow integrated in the classroom as they are in real life through a process of “normalisation.” According to Bax, the ultimate goal of CALL (now TELL) is that CALL becomes a meaningless “construct because technology is an inseparable part of everyday life and teaching” (White & Walker, 2013, p. 2). Bax (2011) further explains what the process of normalisation means by stating that technological advents tend to cause a strong reaction on people at first because these are thought to have the power for change, but later, when people get used to those advents, these become ordinary tools used in ordinary tasks (White & Walker, 2013, pp. 2-3).

## 1.2. What is the Digital Competence?

One of the initial considerations I had in mind when designing the experiment in this thesis was that technology has to be present in teaching because it has become part of our everyday lives. Because of that, it is of the utmost importance that students learn not only how to communicate effectively in the L2, but also how to deal with technology (White & Walker, 2013, p. 7). Simpson (2005) and Walker (2007) make use of Canale and Swain's (1980) model<sup>1</sup> of communicative competence to develop a version that can reflect the digital knowledge that students should acquire.

This digital competence model includes four different components as it occurs in Canale and Swain's (1980) model (White & Walker, 2013).

- 1) Procedural competence: this has to do with the basics. Students should know how to turn on a computer, laptop, *tablet* or mobile phone, how to access the Internet or to make use of the different *apps* (applications) that there are.
- 2) Socio-digital competence: this is related to the students' capacity to distinguish what tools are pertinent to be used in class. For example, knowing that if they access a specific website this needs to be done in consonance with the contents of the class.
- 3) Digital discourse competence: this means that students need to learn how to make use of the different tools provided by the technological device in order to come up with an outcome (e.g.: a student needing to record a video, upload it to a website and write a text about it).
- 4) Strategic competence: this last type of competence is associated to the students' "ability to repair problems and work around the gaps in technological knowledge and skills" (White & Walker, 2013, p. 9). An example of this type of competence could be knowing how to send an email to someone who is not answering their phone.

## 1.3. The role of technology in the classroom

Experts in the field of ICT have largely commented on the different roles that technology should play in SLT. For example, Szendeffy (2005) makes a clear distinction between the roles of "tool" and "tutor." In broad terms, the word "tool" is used to refer to the computer (or any other electronic device) that is used as a means to carry out a specific activity. This is, for instance, to "produce collaborative or creative projects that encourage

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<sup>1</sup> For this model, please review Canale & Swain (1980) "Theoretical bases of communicative approaches to second language teaching and testing."

authentic students-student and student-teacher interaction” (Szendeffy, 2005, p. 10). That is, a student preparing a Power Point presentation to talk about a specific issue in class could be considered using the computer as a tool.

On the other hand, there is the role of “tutor.” Typically, in this type of practice, it is the computer that instructs the student. Indeed, it is assumed that “the knowledge resides in the machine, from where it is delivered to the learner in small chunks with frequent reinforcement” and it usually includes drill-and-practice exercises (White & Walker, 2013, p. 3). It is, nonetheless, one of the aims of this thesis to show that this type of “tutor” programmes can be used as a complement to the classes and not only as a substitute of the teacher. For example, Szendeffy (2005) asserts that the “student’s experience” can be enhanced by asking students to make use of systems such as Alegro (a tutor system as said before) “on their own time or as assigned homework as a supplement to other activities” (p. 10). Of course, teachers are needed in order to learn and in the following section I will discuss some of their roles in the language teaching classroom.

#### **1.4. The role of the teacher in the classroom**

One of the main concerns in the education paradigm is that teachers might feel left out and substituted by machines. Kurzweil’s (1999) commented on this and claimed that “much of the instructional time learners spend will consist of interaction with a computer,” leaving teachers as mere “overseers” of what is happening in the class (Walker & White, 2013, p. 141). However, these authors consider that, whether this will happen or not, will be determined by students, who must decide if “learning languages in a completely virtual environment” is suitable or advisable (ibid., p. 142). In my opinion, I believe that there is more to teaching than just learning content. Students need human interaction to learn about moral values, and this is real interaction, both student-student and teacher-student. There is no denying that computers and technology can facilitate the learning of languages enormously, but this must always be as a kind of supplement and should never overtake the whole learning experience.

One of the reasons why teachers seem to be scared and they feel excluded is that they see their central role in the classroom threatened because, in this day and age marked by technological innovations, they are referred to as “instructors, e-moderators, and tutors” (ibid., p. 146). However, Wong and Benson (2006) feel that this might only be the case of teachers who do not see students as equals, i.e.: they do not have a student-centred

approach and they neglect CLT. Indeed, once teachers accept that students' autonomy should be maximised and that the learning experience should not be limited to the confines of the classroom, they will be prepared to take on a TELL approach, making language learning a more enriching endeavour (White & Walker, 2013, p. 147).

Along the lines of taking a more student-centred approach, Szendeffy (2005) affirms that not only will the implementation of technology in the classroom not replace teachers, but it will also give them a number of extra responsibilities (p. 7). For instance, teachers should organise different "project- or task-oriented activities" where interaction is a central aspect, help students learn to "think critically about problem solving," foster the students' autonomy so that they help each other and use the teacher as a last resort (ibid., 2005, p. 7).

### **1.5. Advantages and disadvantages of TELL**

With everything that I have explained so far, one question remains: what the advantages and disadvantages of TELL are. I explained some of these in section 1, but here I will comment on some others as well as on a number of disadvantages.

In relation to the advantages, for instance, Kranthi (2017) mentions that one of the difficult aspects of teaching is related to individualised learning and how to take care of mixed ability (p. 32). TELL actually gives the teacher more "flexibility" to deal with these two issues. Also, as I mentioned above, TELL does not seek to override the rest of the teaching experience and, because of that, it can be a good supplement to deepen in the contents offered by the coursebook. Another advantage is the possibility to have a student-centred environment, meaning that students can both choose what to learn first and what later and "control the pace of progress" too. Besides, learning can take place outside the classroom, so students can actually prepare questions to ask their teacher in class (Kranthi, 2017, p. 32).

For his part, Szendeffy (2005) also addresses this issue. He makes two fundamental points which seem very difficult to disagree with. Firstly, that the incorporation of technology in the classroom enables students to learn through a multimodal environment – i.e.: they have access to input which is not only reduced to written texts, but they can also listen to audio clips, watch videos or analyse pictures (p. 3). Secondly, technology is helpful since students "can individually adjust the pace of [their] work" to adapt to "different proficiencies [and] aptitudes" (Szendeffy, 2005, p. 3). Besides, Szendeffy (2005), as well as Stanley (2013), comments on the positive aspects of bringing

technology to class and points out that it might be used for “tutorial feedback,” to employ digital tools in the elaboration of school projects, both individually and in groups, or to later publish these projects online (p. 4).

However, there are also negative aspects that teachers need to take into consideration. For example, funding can be a problem. Technology tends to be expensive, so purchasing the necessary equipment might not be one option for every school out there. Furthermore, money should also be spent on training teachers because, as I said before, these need to learn how to best implement technology in their lessons and get closer to the student-centred approach. Lastly, something else that should be considered is that technology, because is an invention created by humans, is not exempt from technological failure. Teachers should be prepared for this and have alternatives in the event that they could not give the lesson they had previously designed (Kranthi, 2017, p. 32).

### **1.6. Teaching grammar with the help of TELL**

As I mentioned in the introduction, this thesis aims at exploring the possibilities offered by Alegro in the teaching of English grammar, specifically prepositions. That is why it would be appropriate to define the term “grammar.” Crystal (2004) asserts that grammar is:

The structural foundation of our ability to express ourselves. The more [people] are aware of how it works, the more [they] can monitor the meaning and effectiveness of the way ... others use language ... all teaching is ultimately a matter of getting to grips with meaning. (p. 14).

Moreover, a distinction tends to be made between “descriptive” and “prescriptive” grammar. The former tends to be associated with the structure of language as such, how it is used by people, whereas the latter is an attempt to lay down the rules of such language, mainly by teachers or linguists (Stanley, 2013, p. 61).

Stanley himself comments on a number of other advantages to justify the use of technology to teach grammar. He first mentions “engagement and motivation.” He also suggests that technology can offer countless alternatives for the teaching of grammatical concepts through different activities and explanations, making it a lot less boring than with traditional means. Besides, there is software that can help students correct spelling mistakes when writing, something impossible when handwriting an essay, for instance. Moreover, students can quickly access descriptions of concepts they are not familiar with right on the spot. Lastly, Stanley mentions that, thanks to the Internet, students can gain

access to plenty of real-language texts, through which they can discover the language themselves finding instances of theoretical constructs seen in class, and raising their awareness in this way (ibid., p. 61).

The last point in the preceding paragraph summarises the rationale behind this thesis. I built the teaching module within the Alegro system means of these “real-language texts,” otherwise known as corpora, which are, in my opinion, valuable assets in language teaching. I will explain the process of construction of such teaching module in Part Two of this thesis, but because Corpus Linguistics (CL) is an important aspect here, I will comment on it in the following section.

## 2. Corpus Linguistics

CL has not been very popular until recent times. Silvia Bernardini (2004) shares this idea and contends that “the actual use of corpora in language [teaching] has for a long time remained somewhat behind [modern] breakthroughs” (p. 15). The reason for this is that CL had been regarded as a time-consuming activity, especially prior to the advent of the Internet when everything had to be done manually. Nevertheless, after online systems came into existence, CL started to gather the attention of linguists and teachers, who believed that language could be more efficiently analysed and taught with the aid of digital systems. In other words, “new technological advances also facilitate new methodologies in the description of the language” (Hasselgård & Oksefjell, 1999, p. xiii).

In broad terms, corpora refer to a compilation of texts that serves as a source for “naturally-occurring texts ... and authentic learning context” that learners who do not have access to the L2 in their daily lives can make use of in order to be in touch with it (Li, 2017, p. 153). Two advantageous tools found in a corpus are: *concordances*, which, as defined by Santamaría García (1995), serve as a way of “[searching] corpora for words and word patterns,” and the KWIC<sup>2</sup> display, offered by these concordances so a keyword is shown in the middle of a sentence (concordance) in as many instances as found in the corpus itself. Of course, this is highly useful if one seeks to look into the language used by native and non-native speakers.

This definition highlights a clear advantage of corpora: their authentic nature. It might appear obvious, but general trend shows that, in traditional education nowadays, most of the examples and exercises that appear in coursebooks are invented. As Sinclair

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<sup>2</sup> Keyword in context

(2004) himself defends, there is no need whatsoever for teachers to come up with fake examples if the real language is out there to be employed. It would be more convenient to take a class and expose it to real cases in which the subject matter they are trying to learn could be appreciated in real context-use. Instructors need to find resources to turn the task of teaching a second language more bearable and entertaining, and this could enhance enormously students' motivation and, in turn, success.

Along the lines of authenticity, there are other advantages that come from using corpora in educational settings. For instance, Santamaría García (1995) contends that the contents presented in textbooks are limited, and so teachers will find themselves at a dead end as soon as students require more information than that which appears in the book. Furthermore, if the instructor opts for a more innovative way of teaching such as using CL, real examples can be retrieved to provide more complete explanations. Thanks to CL, teachers can even prepare their own exercises and explanations, which will be more genuine than those offered by conventional coursebooks. This is not to say that teaching an L2 without CL is entirely wrong, but rather, as aforementioned, that a combination of the two approaches could be more beneficial in the long run. In fact, this type of practices can even maximise students' autonomy to learn, for students can challenge the information presented in their coursebooks with that found in a specific corpus (ibid., 1995, p. 194).

Access to corpora is rather straightforward in this day and age. Anyone who has access to an Internet connection can go and explore their benefits. Two of the most widely known corpora are the Corpus of Contemporary American English (COCA) and the British National Corpus (BYU-BNC). While the former deals with the variety of English spoken in North America, the latter is more focused on British English. Nevertheless, there are many others online. Besides, anyone can create a corpus from the ground up if they want to research into a specific topic by gathering the necessary information that yields conclusive results. Related to CL in teaching, since the language students use in class is of importance, in the following section I will comment on the notion of interlanguage proposed by Selinker (1972).

### **2.1. Defining the concept of Interlanguage**

Selinker (1972) believes that the only aspect that can provide information as to the linguistic competence of students is their language – the language they produce in the L2. Besides, this author concludes that the utterances which these students try to produce are “not identical to ... [those] produced by native speakers of the [L2] had [they] attempted

to express the same meaning as the learner” (p. 214). Selinker describes this type of language and names it “interlanguage,” the language that students produce while in the learning process and which has its own rules (created by the learners themselves) and so it includes errors. According to Selinker, there are three types of “meaningful linguistic situations” which need to be analysed to understand the language of students. These are, firstly, the utterances produced by the learners in their L1; secondly, the utterances produced by the learners in their interlanguage; and thirdly, the utterances produced by the learners in their L2 (Selinker, 1972, p. 215). The study of these three linguistic situations will be useful for two reasons. Firstly, the linguist can discover the underlying reasons for making these errors and, secondly, the teacher can use that information to bring solutions to class.

## **2.2. What is fossilisation?**

A highly related concept to error-making deserves proper explanation. Fossilisation, or “fossilisable linguistic phenomena” has been defined by Selinker (1972) as:

Linguistic items, rules, and subsystems which speakers of a particular L1 will tend to keep in their interlanguage relative to a particular L2, no matter what the age of the learner or amount of explanation [they] receive in the L2. (p. 215)

In other words, there are certain errors which are fixed in the learners’ brains and these will be maintained although the student reaches a higher level of competence since learners are not aware of them. As such, teachers need to carefully deal with fossilised errors. One of the many ways in which they can do this is by incorporating technology in the classroom.

Moreover, Selinker mentions a number of “fossilisable structures,” varying from phonetic aspects to syntactic ones. An example of fossilisation in the English interlanguage of Spanish learners is the rhythm of utterances in English, which tends to pose difficulties (p. 215). Another well-known case is the disagreement between subject and verb when it comes to using the noun “people.” The Spanish equivalent, *gente*, is a singular noun, therefore followed by a singular verb. However, in English, *people* is a plural noun which must be followed by a plural verb. As regards the issue of fossilisation, Selinker also makes it clear that fossilised errors can easily reappear under a series of circumstances: when students are under pressure, for instance, or if they are trying to

learn challenging and new structures, or not paying attention to what they are saying (p. 215).

### 2.3. Error or mistake?

Even though learning can take place without the aid of teachers, they can accelerate the learning process by paying attention to the students' weaknesses and focusing on them. *Errors* serve to identify problematic areas since they tend to be systematic. Corder (1967) draws a comparison between second language learners and children acquiring a language for the first time. This author comments on the fact that whenever a child makes a language error, this will not be considered as an improper use of the language, "but rather as a normal childlike communication which provides evidence of the state of [their] linguistic development at that moment" (Corder, 1967, p. 165). Similarly, students trying to learn an L2 will undeniably go through the same process of error-making, and Corder announces – re-using Brown and Fraser's (1964) words – that "the best evidence that a child possesses construction rules is the occurrence of systematic errors" (ibid., p. 165), and so this will also be true in the case of the older second language student.

The word *systematic* has been employed to define any type of error made by students that is repeated whenever they produce the structure in the same context (referred to as *errors* by Corder), but, of course, not all errors are systematic. When trying to communicate a message in any language, it is often the case that people commit errors which are, so to speak, normal in their speech – non-systematic; Corder (1967) refers to this latter type as *mistakes*, and they are the outcome of different reasons: "memory lapses, ... tiredness ... and strong emotion" among others (p. 166). Corder also contends that these mistakes are noticeable and quickly corrected by the speaker. Due to their nature, mistakes cannot be taken into consideration if one seeks to determine the "transitional competence<sup>3</sup>" of the learner (ibid., p. 166). Thus, it will be systematic errors and not mistakes which will serve to determine the students' needs since they provide the necessary information as to the current level of competence of the learner in the L2.

According to Corder (1967), the study of systematic errors has three main positive outcomes: firstly, the teacher can properly assess the student's learning evolution towards the linguistic goal; secondly, the linguist can identify the underlying reasons behind the errors made by the student to understand "how language is learned or acquired, what strategies ... the [student] is employing in [their] discovery of the language;" and thirdly,

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<sup>3</sup> The current knowledge of the language a particular user has at a particular moment.

errors themselves are invaluable in SLT for their identification helps students develop their linguistic competence.

#### **2.4. Learner Corpora**

As I mentioned above, LC can be useful in order to look into the type of language produced by students and, by doing this, come up with systems such as Alegro to later help these students improve their competence. LC have been defined as “electronic collections of spoken or written texts produced by foreign or second language learners in a variety of language settings” (Granger, Hung & Petch-Tyson, 2002, p. vii). Just as CL had been regarded as a not-so-useful field until recently, LC had also received scant attention until the 1980s since researchers perceived the process of data collection as a highly time-consuming endeavour. However, the arrival of current software paved the way for the development of fruitful systems for analysing the language in LC (Granger, 2002, p. 7). Many studies have demonstrated the benefits of CL and LC by producing unprecedented results. For instance, Li (2017) compares the teaching of collocations in English with two groups of students, one making use of corpora and another employing traditional methods (coursebooks, dictionaries, and the like) and concludes that those learners who used corpora showed greater improvement (a larger number of collocations and more accuracy in their use).

One of the ways in which SLT can be carried out is by creating linguistic content useful for students, and that linguistic content comes, as said before, from analysing the learners’ language. Moreover, I mentioned that errors provide the richest source of information in this regard. One of the many advantages of LC is that, since they have been produced by students in their interlanguage, the systematic errors they make can serve different purposes. Furthermore, the teacher can use them to pinpoint the current level of competence of each student and bring adequate materials to class, and also students can benefit from them for error correction. Besides, the exposure to errors can improve motivation and help the learning process. Joyce and Burns believe that “by noticing the gap between their own and target language forms, learners are also better able to accelerate their acquisition” (Joyce and Burns, 1999; quoted in Meunier, 2002, p. 134).

Before I move on to the following section, there are two concepts in L2 teaching which are worth explaining: the inductive and the deductive approaches to grammar presentation and practice. The former consists in introducing the theory to students first

(through the coursebook), to later test their knowledge of the topic by completing exercises. This is connected to the idea of a more traditional way of teaching. The latter, however, means that students are exposed to examples of the language item by means of corpora, and they have to reach conclusions as to what the rules and generalisations that might apply in a specific case are (Santamaría García, 1995, p. 193). Thus, this is more related to CL and LC.

#### **2.4.1. Error Analysis in Learner Corpora**

As I have repeatedly said, errors provide a significant amount of information for effective SLT. This is why in this brief section I will present the following concepts: *Error Analysis (EA), data collection, error detection, location and description*. EA is a discipline of applied linguistics that mainly focuses on the motivation and the consequences for error-making; basically, to understand and pinpoint the reason behind them (James, 1998, p. 5).

In his book, James proposes two methods for the collection of errors made by students. Firstly, he mentions the “broad trawl” method, by which students are tested to see where they are more prone to error-making. This will reveal what general linguistic areas are more problematic for students (prepositions and adverbs, for instance). Later, once these problematic areas have been identified, students can be tested on more specific linguistic aspects (preposition optionality and place adverbs, for example). This second method has been given the name of “targeted elicitation” (James, 1998, p. 19). The author explains different ways in which linguists and teachers can put into practice both the broad trawl and the targeted elicitation methods. In regard to the former, two examples are proposed:

- 1) the use of “longitudinal studies,” which are more “natural” and imply testing the same population over time to see whether a specific technique specially designed for the improvement of English is effective or not .
- 2) the use of “cross-sectional studies,” which are more “manipulative” and relate to testing two different populations to later compare the results.

James (1998) describes the process of error collection as including three stages. The first stage is that of “error detection,” basically pointing out the presence of an error in the sentence. The second stage involves locating the error. This is a step further since the erroneous word or set of words need to be identified. Despite the fact this might seem easy, it can become a complex issue because, as Burt & Kiparsky (1972) state, “some [errors] are diffused throughout the sentence” (quoted in James, 1998, p. 93). The third

and last stage involves error description. This is, by far, the most important part because it consists in explaining the underlying reason(s) behind the error and it has to be done with a “well-developed system,” featuring easily-understood grammar, which anyone can understand – especially young learners (ibid., 1998, pp. 91-95).

# **Part Two: Development of a Module for Online Language Learning within Alegro**

## **1. Introduction**

As outlined at the beginning of this thesis, this experiment was divided in two stages. As part of the first stage, I developed a course module for an online learning system, which is called Alegro (Adaptive Learning of English Grammar Online). Alegro is a system that intelligently tracks the current level of competence of the student and adjusts the type of exercises it offers to that level by targeting problem areas, thus suiting the specific needs of each student. The module that I developed within the learning system revolves around the topic of incorrect use of preposition optionality – i.e. to teach students whether a preposition is wrongly included or omitted in the sentence. In terms of the second stage, once I had developed this learning module within the system, the final version of Alegro was presented to the students. The students in this experiment had to use the module on preposition optionality for three weeks at home so that I could test the effectiveness of the system I had previously created. This second stage shall be further explained in Part Three of this thesis.

Thus, Part Two will focus on the first stage and will serve to explain how I developed the learning module within the system. Nevertheless, it needs to be mentioned that I had already created the learning module within Alegro for a different experiment (Nogales, 2018). Last year, I did the Master's in English Applied Linguistics and conducted a similar experiment. For such master's, I developed the learning module and tested its effectiveness with university students from the English Studies degree at the UAM. Since I had already developed this module, I thought it would be a good idea to make use of it and test its effectiveness, once again, with some of the high school students from my Internship. In Part Two I will describe how I developed the teaching module because readers need to understand how the system works before learning about the experiment described in Part Three. Part Two will be divided as follows:

Firstly, in sections 2 and 3.1 I will talk about the TREACLE project. I needed to know what grammatical concepts were worth being taught to students. The TREACLE project includes a number of texts written by students that had been previously analysed by a group of researchers (O'Donnell et al., 2009) who determined that preposition optionality was one of the most critical areas students face when learning English. Thanks

to the TREACLE project, I knew preposition optionality was an area of English worth using for the experiment. However, the TREACLE project was not highly specific in explaining the underlying reasons behind the errors found and, thus, that was my first task: tagging the preposition errors as thoroughly as possible.

In section 3.2. I will comment on how I tagged the texts coming from the TREACLE project. For this, I created an error-scheme (a scheme including all the different types of errors made by students organised hierarchically). In order to tag these errors, I used the UAM Corpus Tool (UAM CT henceforth). With the UAM CT, I could select each error and tag it accurately with an appropriate code. Thanks to tagging all the preposition errors, I could analyse their frequency to determine what errors were more critical. Since I used codes to simplify the tagging process, the errors are not easy to understand by people who have not been involved in this experiment. Because of that, I will provide an explanation for all of them.

In section 4 I will describe the order of difficulty of these concepts. This is important because teachers need to know what concepts are easier for students and, accordingly, teach those concepts first and leave the most difficult ones for later.

In sections 5 and 6, I will comment on how I used the critical errors (or critical concepts) to write descriptions and sentence probes with the help of the Alegro Editor. These descriptions were explanations for each critical concept and the sentence probes were sentences I created, sometimes including errors and sometimes without them. This was done because I later put all this information into the learning module that students would use (the Alegro system as such). There, they would have to decide if a given sentence probe was correct or wrong.

In section 7, I will explain how the Alegro system as seen by the students works. I will focus on the different tools offered by the software and its characteristics. Moreover, I will describe what the students' task using the learning module in the experiment was.

## **2. The TREACLE project**

A number of researchers joined together in the TREACLE project, a project started in 2009 by the UAM and the Universitat Politècnica de València (UPV) with two main objectives: the first objective was to create a tool that would “*profile* the specific *grammatical skills* of Spanish university learners of English at various proficiency levels, and [...] develop proposals for re-designing curriculum and teaching materials focused

on the real needs of the students” (O’Donnell et al., 2009, p. 371; emphasis my own). The second, more related to this thesis, was to:

Provide a web-based language learning system which dynamically adapts materials and exercises presented to the student by reference to the student’s current performance within the system and [their] proficiency profiles. (ibid., p. 373)

As has been suggested, this tool focused mainly on “grammatical skills,” leaving aside other aspects of the language such as lexis and phonetics. In addition, the project also highlighted the need for the profiling of the students’ competence, i.e. determining the current level of each learner in terms of their knowledge of English.

In order to carry out this profiling task, a number of researchers (O’Donnell et al., 2009) analysed a LC of texts written in English by Spanish students according to what was right and what was wrong (errors) by using modern technology within corpus analysis. The “grammatical structures” were divided into three possible groups: those which had already been acquired, those which were in the process of being acquired, and those which had not been “yet attempted” by the student (O’Donnell et al., 2009, p. 371).

The LC that was used for the TREACLE project consisted of texts that had been collected years earlier by both the UAM and the UPV separately, both corpora being ultimately annotated as part of the TREACLE project. As regards the UAM, Paul Rollinson compiled the WriCLE corpus between 2005 and 2008 with compositions from students in first and third year of the English Studies degree at the UAM. It consists of 719 essays and roughly 710,000 words – 43 essays were discarded because their authors had an L1 different from Spanish. To learn which the level of competence of the students was, the Oxford Quick Placement Test was used (UCLES, 2001). Concerning the UPV, they had been compiling their corpus since 2004, but have used a part of it for the TREACLE project, the so-called “UPV Learner Corpus,” which includes 150,000 words. The students here belonged to degrees that were taught in Spanish, meaning the English they studied was English for specific purposes (O’Donnell et al., 2009, pp. 373-374).

Of the combined UAM-UPV corpus, some researchers (O’Donnell et al., 2009) annotated exhaustively a subsection of 116,000 words for errors, applying the principles of Error Analysis outlined in Part One. 16,000 errors were recognised, of which 7413 were grammatical errors. This error-annotated corpus was the basis of the work outlined in the following sections.

### 3. Designing the learning module

#### 3.1. Selection of the learning area

In this section I will explain why preposition optionality is important and why it was used as the subject matter in this experiment. First of all, the concept *preposition* needs to be defined. As Edmunds (2005) states, prepositions are “a closed-class group ... highly grammaticised.” This author continues to explain that “prepositions do not have direct counterparts in other languages” (p. 22). This means that learning how to use prepositions in a language different from the mother tongue is not an easy task. Moreover, Romaine (1995) comments on the fact that given the difficulty of prepositions as a grammatical class, they are not only a difficult aspect of language for second language learners, but also for speakers in their own native language (quoted in Edmunds, 2005, p. 22). In fact, the author adds to this and contends that a number of studies have been carried out on “language acquisition” showing that prepositional usage is complex to improve, especially when it comes to English and Spanish. Besides, Edmunds announces that preposition errors have not been common in second language research (ibid., p. 22).

Because of the conclusions reached by the TREACLE project aforementioned I chose prepositions (and preposition optionality) as the key linguistic area for this study. In broad terms, the researchers mentioned above (O’Donnell et al., 2009) error-tagged the corpus of texts by Spanish University learners of English, identifying over 16,000 errors. A principle design consideration in the Alegro system was that the system should focus the learner’s attention on ‘critical language areas’: areas of the language which most frequently cause problems for the learner (MacDonald, 2016). This is why this analysis aimed at exploring those problematic areas in the learning of English by Spanish learners (MacDonald, 2016, p. 104). The initial results after manually-annotating the TREACLE corpus showed that those areas where students made more errors were, in decreasing order, *grammar errors* (7413), *lexical errors* (3345), *punctuation errors* (2089), *pragmatic errors* (1542) and *phrasing errors* (1270) (ibid., p. 104).

As can be seen, grammar errors, which occur “where a grammatical rule has been broken” (MacDonald, 2016), involved the higher number of errors. As this area seemed prone to error-making, the researchers decided to analyse what the most common types of grammar errors were. The conclusions yielded three critical grammar areas:

- 1) *Np-errors* (noun phrase errors), totalling 3334 instances, around three times more errors than the rest of the categories (e.g., *determiner-inserted-not-required*).

- 2) *Prep-phrase-errors* (prepositional errors), with 1233 instances (e.g., *prepositional-choice*), becoming an area within grammar worth exploring.
- 3) *Verb-phrase-error* (those errors related to verbs), with 1173 cases (MacDonald, 2016, pp. 112-113).

These researchers found that preposition errors were on the top 12 grammar errors, equalling a 22% out of the total – a significant number. Moreover, within preposition errors they distinguished two types: *prep-choice-error* – 823 instances – and *unnecessary prepositions* – 205 instances (ibid., pp. 112-113). In the light of these results, I chose these two types of preposition errors for the experiment. For this thesis, these two critical language areas were named *preposition-inserted-not-required* and *preposition-omitted-but-required* errors. Taken together they can be referred to as problems of preposition optionality.

### **3.2. Identification of critical language concepts**

A second consideration within the Alegro system is that students should be given learnable concepts that can help them overcome their problems. It is not sufficient that the teacher tells students that it is sometimes wrong to insert a preposition, and sometimes wrong not to. Students to be given clear instructions as to when it is correct or wrong to do so.

As such, as part of the similar experiment mentioned above (Nogales, 2018), my first task was to examine the preposition optionality errors in the TREACLE corpus, one by one, to identify underlying reasons for these errors. As with other critical language areas in the project, a given surface error such as wrongful insertion of a preposition can have many underlying causes. Because of that, I used a special layer (preposition errors) to tag all the errors found in the TREACLE corpus. I went through all these errors and further tag each one, where possible, by an explanatory category. By the end of this phase of work, I had assigned an explanatory category to all these errors. If I could not clearly categorise one error, this would be assigned the category “other-reason.” These explanatory categories served to identify what I called *critical language concepts*: those errors made by the learners in a systematic way. Of those explanatory categories revealed by the study, I selected the most frequent ones for actually putting into the learning system. In order to create these explanatory categories, the UAM CT was used (O’Donnell, 2008).

The UAM CT works in the following way: once the system is accessed, the user needs to select a project. Figure 1 shows the project in this study. As can be seen, the project includes a number of texts (in the case of this thesis, coming from the TREACLE project). Users are then presented with a “main window” including all the files in the project – the texts written by the students – and, for each file, there are a number of layers which can be used to annotate each text in terms of different criteria (O’Donnell et al., 2009, p. 375). This main window as well as the layers can also be seen in Figure 1. O’Donnell gave the layers the names:

- 1) *Document*: providing information as to the personal data of the writer of the text (age, proficiency level, mother tongue, gender and university year).
- 2) *Error*: to manually conduct the error annotation of all types of errors made by the learner.
- 3) *Prep-error*: to manually conduct the error annotation of those errors which have to do with prepositions.
- 4) *POS*: each text is automatically tagged in terms of parts-of-speech; and *mood*: an automatic grammatical analysis of each sentence.

Out of these layers, I used the *prep-error* layer to annotate all the errors in the texts coming from the TREACLE project. This provided valuable information for the creation of teaching material on prepositional errors that I would later include in the module on preposition optionality within the Alegro system.

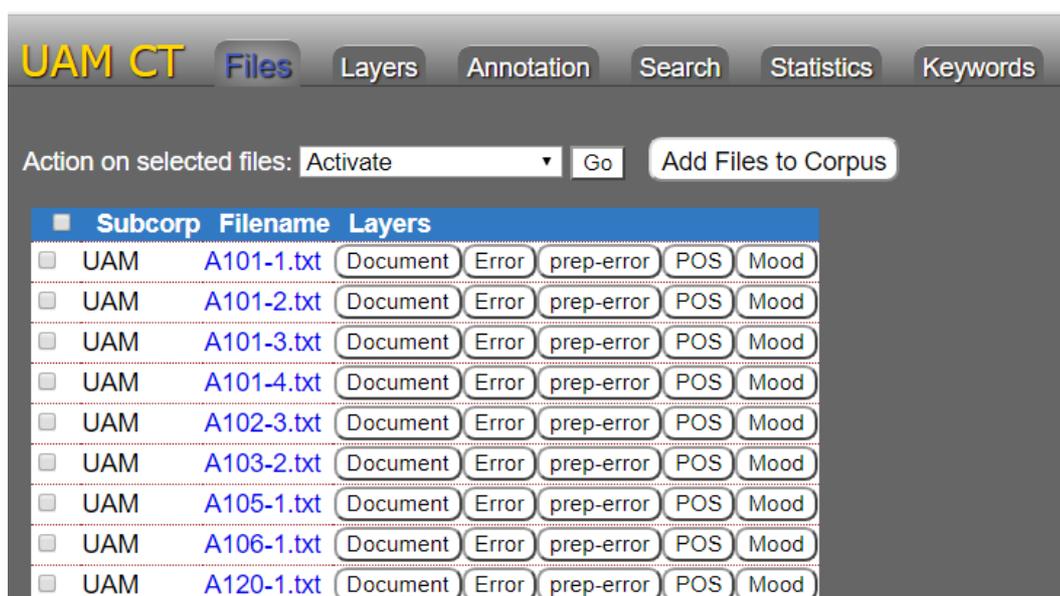


Figure 1. How the project in this study is displayed once accessed on the UAM CT

The process of error annotation was briefly introduced in section 3.4.1 in Part One of this thesis. In essence, I examined each text carefully in search of errors (in this case, prepositional errors) and, upon finding one, I coded this error following a thorough hierarchy which I had previously created. Nevertheless, there were errors that I had not thought of in advance and, therefore, I had to come up with a name for those just in case other errors of the same type appeared. This hierarchy exists because tagging an error becomes a lot simpler when one goes from a very general aspect of the language to more specific issues. For instance, a first step might involve choosing between “lexical error” as opposed to “grammar error” for a given segment (ibid., pp. 378-379). Once this general differentiation has been made, users can go to more specific types of errors: from “grammar error” to “preposition” or “verb-related” errors, for example. Or they could go even further by saying that a “preposition error” has to do with errors of “complementation” or “optionality.”

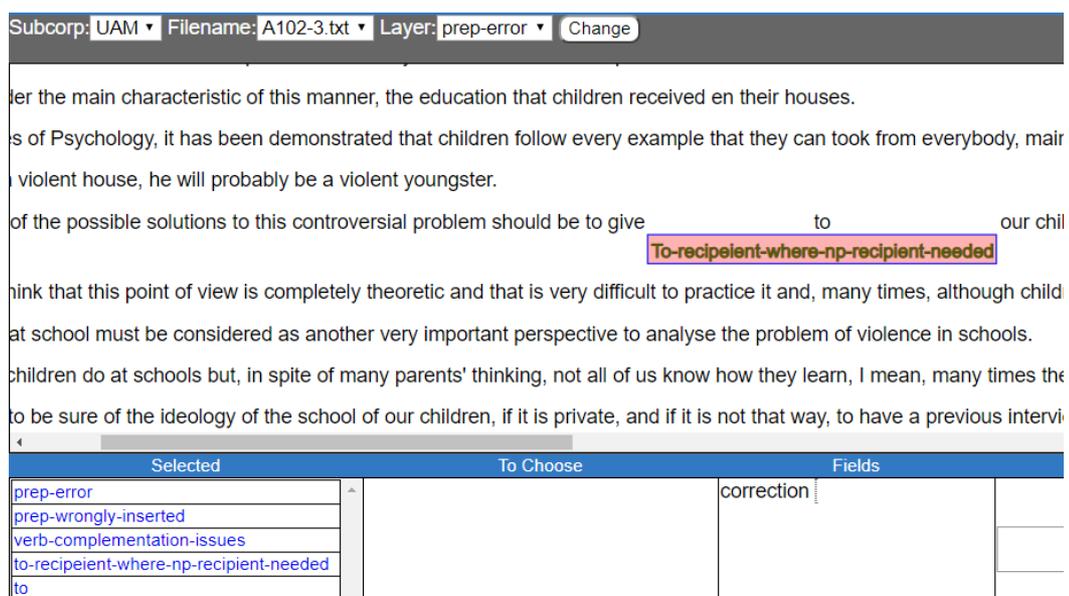


Figure 2. Error coding of a case of prepositional error

In order to illustrate this hierarchy, Figure 2 presents an example of the preposition “to” as the faulty segment. It was easier for me to say that the error in Figure 2 had to do with the critical concept *to-recipient-where-np-recipient-needed* following the hierarchy aforementioned:

1. Firstly, I had to realise that the error had to do with prepositions: *prep-error*.
2. Then, I needed to notice that the problem was related to having added a preposition that should not be there: *prep-wrongly-inserted*.

3. Next, I had to understand that the problem had to do with having chosen the wrong verb complementation: *verb-complementation-issues*.
4. Afterwards, I could easily reach the conclusion that a noun phrase (NP) should have followed the verb instead of the preposition “to.”
5. Finally, I could correct the faulty sentence as follows: “... to give our children...”

I called this hierarchically-organised coding system the “error scheme.” In this experiment, the error scheme is a list of all the possible preposition optionality errors (or critical areas) that I found in the TREACLE project organised hierarchically. I created the error scheme with a pedagogical purpose: to create teaching content with the help of the critical concepts that I could put into the preposition optionality module within the Alegro system. Before going any further, I will present and explain the error scheme created for the purposes of this experiment (see Figure 3).

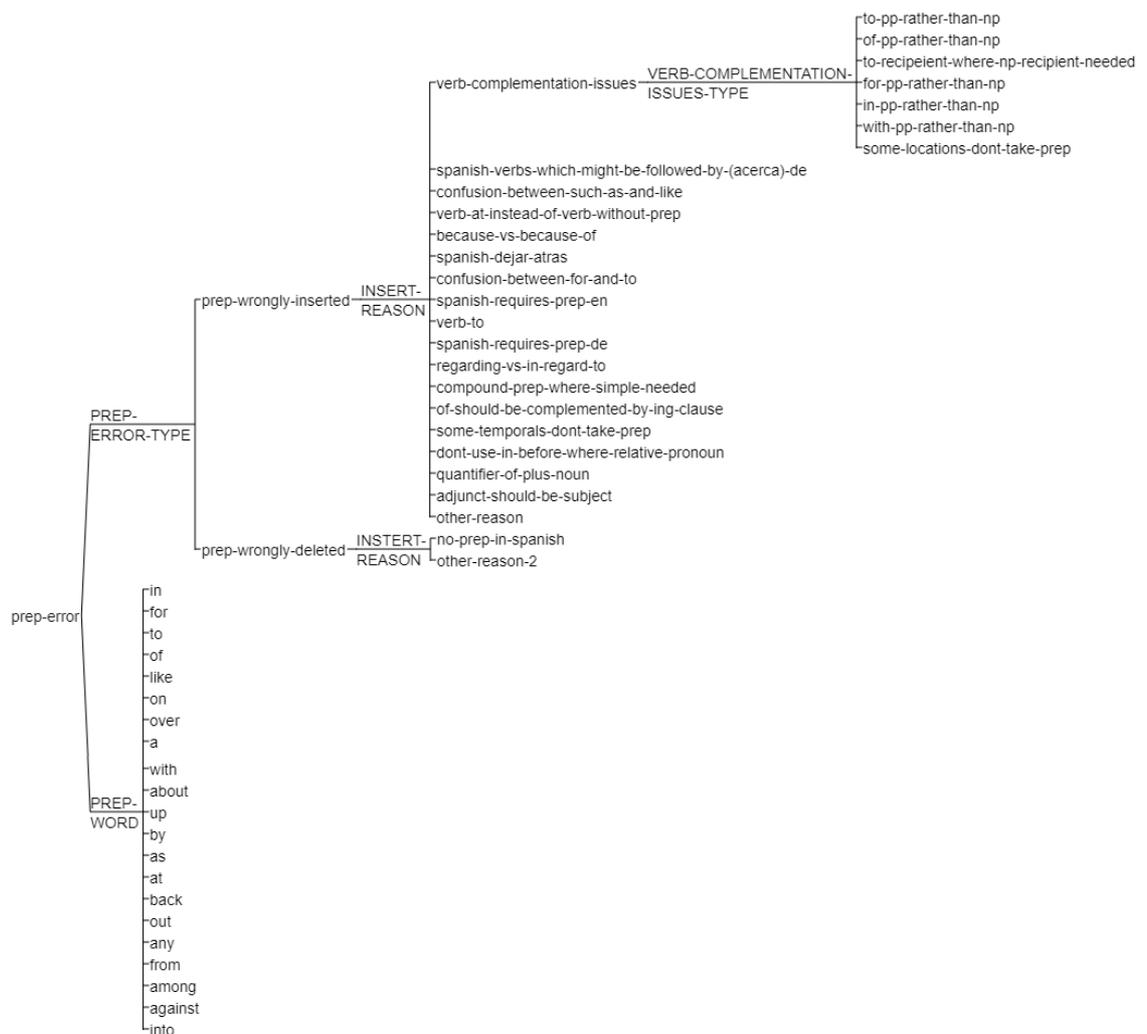


Figure 3. Error Scheme based on common prepositional errors found in the corpus

The scheme begins with the concept *prep error*, which encompasses the rest of the subconcepts as an umbrella error code. This initial concept branches off into two categories: *prep-word* (including all the prepositions students have wrongly used) and *prep-error-type* (including the main two types of errors made by students). Within *prep-error-type*, the main two types of errors are *prep-wrongly-inserted* and *prep-wrongly-deleted*. The former occurs when a preposition which should not have been used appears in the sentence. In the case of the latter, a preposition which should have been used does not appear in the sentence. Table 1 presents the number of occurrences of both types. As can be seen there, there are very few instances of the second type and for this reason little attention was paid to it in this project. Nevertheless, the number of occurrences of *prep-wrongly-inserted* is high, and that is why I did most of the work in this experiment attending to this group.

<b>PREP-ERROR-TYPE</b>	<b>Raw Numbers</b>	<b>%</b>
<i>Prep-wrongly-inserted</i>	223	83.2
<i>Prep-wrongly-deleted</i>	45	16.8
<b>TOTAL:</b>	<b>263</b>	<b>100%</b>

Table 1. Frequency of errors related to the *prep-error-type* groups

Even though the first group is the one which yielded more significant results, not all of the concepts proposed were critical and, thus, not all of them were taken into consideration. Thus, I focused mainly on those concepts which had a high frequency of appearance in the students' texts. Table 2 presents information pertaining to the frequency of occurrence of all the errors regarding the group *prep-wrongly-inserted*. It is important to mention, too, that only those elements which repeatedly appeared in the discourse of the students provided compelling information and became critical. This point was dealt with above when it was pointed out that only systematic errors provide evidence as to the current level of competence of the students (as explained in Corder, 1967).

Thanks to the data in Table 2, I could learn what concepts tend to be more critical for students. The critical concepts (i.e. the concepts that present a higher degree of difficulty for the student) appear in bold in Table 2. The critical concept *verb-complementation-issues* (briefly explored before) presents the highest number of occurrences (totalling 83 instances in the corpus, 31% of the total). The next critical concept with a high frequency of errors occurring is *compound-prep-where-simple-*

*needed* (13 occurrences, 4.9% of the cases), closely followed by *because-vs-because-of* (11 occurrences, 3.9% of the instances), *quantifier-of-plus-noun* (8 occurrences, 3.0% of the total) and, in last position, *regarding-vs-in-regard-to* (only 2 occurrences). In relation to the concept *regarding-vs-in-regard-to*, despite its low frequency in the corpus, I could observe that another structure (“concerning + noun” vs. the wrongly used “concerning to + noun”) occurred often, so I treated both structures as one. Besides, the concept *other-reason* has a high number of occurrences, but this is because those errors have to do with different linguistic problems and could not be grouped into only one category, meaning that, given their non-systematic behaviour, I did not pay attention to them.

<b>PREP-WRONGLY-INSERTED</b>	<b>Raw Numbers</b>	<b>%</b>
<b><i>Verb-complementation-issues</i></b>	<b>83</b>	<b>31.0</b>
<i>Verb-to</i>	1	0.4
<i>Spanish-verbs-which-might-be-followed-by-(acerca)-de</i>	2	0.7
<i>Confusion-between-such-as-and-like</i>	1	0.4
<i>Verb-at-instead-of-verb-without-prep</i>	4	1.5
<i>Spanish-dejar-atrás</i>	1	0.4
<i>Confusion-between-for-and-to</i>	4	1.5
<i>Spanish-requires-prep-en</i>	5	1.9
<i>Spanish-requires-prep-de</i>	10	3.7
<b><i>Because-vs-because-of</i></b>	<b>11</b>	<b>3.9</b>
<b><i>Regarding-vs-in-regard-to</i></b>	<b>2</b>	<b>0.7</b>
<b><i>Other-reason</i></b>	<b>13</b>	<b>4.9</b>
<b><i>Compound-prep-where-simple-needed</i></b>	<b>2</b>	<b>0.7</b>
<i>Of-should-be-complemented-by-ing-clause</i>	1	0.4
<i>Dont-use-in-before-where-relative-pronoun</i>	8	3.0
<b><i>Quantifier-of-plus-noun</i></b>	<b>2</b>	<b>0.7</b>
<i>Some-temporals-dont-take-prep</i>	5	1.9
<i>Adjunct-should-be-subject</i>	61	22.8
<b>TOTAL:</b>	<b>216</b>	<b>80.6%</b>

Table 2. Frequency of errors related to each concept within the *prep-wrongly-inserted* group

In terms of the *verb-complementation-issues* category, I broke it into different concepts, all dealing with how prepositions and verbs interact within the sentence. I did this in order to facilitate the students' understanding of each concept. The high school students presented in Part Three of this thesis would not have been able to distinguish all the types of errors within *verb-complementation-issues* by themselves. The different concepts coming from *verb-complementation-issues* can be further appreciated in Table 3.

<b>VERB-COMPLEMENTATION-ISSUES-TYPE</b>	<b>N</b>	<b>%</b>
<i>To-pp-rather-than-np</i>	57	21.3
<i>Of-pp-rather-than-np</i>	2	0.7
<i>To-recipient-where-np-recipient-needed</i>	7	2.6
<i>For-pp-rather-than-np</i>	2	0.7
<i>In-pp-rather-than-np</i>	5	1.9
<i>With-pp-rather-than-np</i>	6	2.2
<i>Some-locations-dont-take-prep</i>	4	1.5
<b>TOTAL:</b>	<b>83</b>	<b>31.0%</b>

Table 3. Frequency of errors related to each concept within the *verb-complementation-issues* group

The highest number of occurrences within the critical concept *verb-complementation-issues* is related to *to-pp-rather-than-np* (57 cases, 21.3% of the total). Besides, the concepts *of-pp-rather-than-np*, *for-pp-rather-than-np*, *in-pp-rather-than-np* and *with-pp-rather-than-np* all involve, essentially, the same type of error with varying preposition (totalling 15 instances, 5.5%). *To-recipient-where-np-recipient-needed* equals a 2.6% of the cases (7 occurrences), and, lastly, *some-locations-dont-take-prep* with 4 occurrences, totals a 1.5% of the cases. I give a detailed explanation of each of these concepts down below.

1. *Verbs-not-followed-by-with-prep*: this concept is related to the addition of the preposition *with* after a verb which, in Spanish, includes such preposition, but it is an incorrect use of the language in English. This type of error would lead to a sentence

such as: *my friend wants to marry with her fiancée\**. Common verbs in relation to this concept are: *marry, end* or *pay*.

2. *Compound-prep-where-simple-needed*: this error is related to the addition of an extra preposition which is used in Spanish, but not in English. Three noticeable cases that were found in the corpus are: *in against (of)\*, near of\** and *inside of\**, mirroring the Spanish: *en contra (de), cerca de* and *dentro de*.
3. *Because-of-followed-by-NP*: some students in the corpus showed an erroneous use of the structure *because of + noun phrase* since it is easily confused by low-competence students with *because + clause*. Therefore, structures such as *because of I like it\** or *because my friend's insistence\** occur.
4. *Some-quantifiers-do-not-take-prep*: this concept refers to two types of structures lacking a preposition in English that is present in Spanish. On the one hand, there are quantities referring to currencies: *4 millions of Euros\** and, on the other, there is the quantifier *most*: *most of students\**. Nevertheless, the preposition “of” could follow “most” if a determiner preceded the noun “students,” although with a different meaning: a certain amount out of the total.
5. *Concerning-is-followed-by-NP*: students tend to add the preposition “to” after words such as “concerning” or “regarding” when no preposition should follow. This might be because in Spanish, the translation *en relación a* does include the preposition “to.” Also, the confusion might come from the existence of a similar expression in English: *in/with regards to*, also including such preposition.
6. *Dont-use-to-recipient-after-verb*: this concept deals with the error of adding (or not) the preposition *to* with some ditransitive verbs in English whose construction depends on the object that follows the verb. If an indirect object (typically a person) follows, no preposition is needed; if a direct object (typically something other than a person) follows, a preposition is needed to introduce the indirect object. For example, the sentences: *I gave my mum a book* or *I gave a book to my mum* are correct, but saying: *I gave to my mum a book\** or *I gave a book my mum\** is, by all means, erroneous.
7. *Adverbial-destination-doesnt-take-prep*: this type of error is related to spatial adverbs such as *here, there, somewhere, anywhere, inside, outside, back, forward, out, away, up, down, home* and *abroad*. When using travelling verbs (*go, come* or *return*, among others), the students in the TREACLE corpus wrongly added the preposition *to* before the spatial adverb, which is done in Spanish, but not in English. Some examples of this erroneous use are: *we went to home\** and *we travelled to abroad last year\**.

8. *Verbs-not-followed-by-to-prep*: this concept is related to the addition of the preposition *to* after a verb which, in Spanish, includes such preposition, but it is an incorrect use of the language in English. This type of error would lead to a sentence such as: *the campaign affects to us all\**. Common verbs in relation to this concept are: *affect, help, face, attend, hurt, reach, see* or *exploit*.
9. *Verbs-not-followed-by-in-prep*: this concept is related to the addition of the preposition *in* after a verb which, in Spanish, includes such preposition, but it is an incorrect use of the language in English. This type of error would lead to a sentence such as: *I always dreamt of becoming in an engineer\**. Common verbs in relation to this concept are: *become, influence, enter, mount* or *trust*.
10. *Verbs-not-followed-by-of-prep*: this concept is related to the addition of the preposition *of* after a verb which, in Spanish, includes such preposition, but it is an incorrect use of the language in English. This type of error would lead to a sentence such as: *I couldn't remember of the password\**. Common verbs in relation to this concept are: *remember, notice, doubt, regret* or *abuse*.

In essence, all these concepts were deemed appropriate for exploration and analysis. In the following section, I will comment on the order of acquisition of these critical concepts.

#### **4. Determining concept order of difficulty**

I defined the Alegro system as a web-based teaching system that intelligently tracks the current level of competence of the student and targets their problem areas, giving exercises which include those aspects that the system believes the student is ready to learn. This is very much related to Vygotsky's (1978) notion of "zone of proximal development," which he defines as: "the distance between the developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance" (pp. 85-86). In other words, the zone of proximal development is defined as the zone amidst what is known and what the student is ready to learn. Similarly, Krashen's Natural Order Hypothesis states that "grammatical structures are acquired in a predictable order," but this order is not necessarily the same one in all students (Krashen & Terrel, 1988, p, 28). As can be seen, Alegro coincides with this notion for it intelligently adapts itself to each student's needs, not following a specific order for all of them.

Thanks to the annotation process done with the help of UAM CT (and also thanks to the 42 high school students who initially took a pre-test as part of the experiment that I will describe in Part Three), I could create a hierarchy in terms of the difficulty of acquisition of the critical concepts. I later put this information into the Alegro system so that the system itself is capable of detecting which the zone of proximal development is for each student by examining their level of competence, providing teaching contents accordingly. This is of the utmost importance since, in curriculum design, it is essential to establish which contents should be taught first and which should be delayed given their difficulty. I will now present the hierarchy that was developed for this experiment in increasing order regarding the level of difficulty in acquiring the critical concepts:

1. *Verbs-not-followed-by-with-prep.*
2. *Compound-prep-where-simple-needed.*
3. *Because-of-followed-by-NP.*
4. *Some-quantifiers-do-not-take-prep.*
5. *Concerning-is-followed-by-NP.*
6. *Dont-use-to-recipient-after-verb.*
7. *Adverbial-destination-doesnt-take-prep.*
8. *Verbs-not-followed-by-to-prep.*
9. *Verbs-not-followed-by-in-prep.*
10. *Verbs-not-followed-by-of-prep.*

This order of difficulty varied when compared to the students who took part in the similar experiment carried out with university students (Nogales, 2018). This will be seen in the *Findings and Discussion* section in Part Three of this thesis. In the following section, I will describe how I used the Alegro Editor to create the teaching content that I later put into the Alegro system.

## **5. Writing the critical concepts' description**

For the next step in the creation of the teaching module I had to write explanations for each critical language concept to be presented to students when they are studying within the Alegro system. I did this with the help of the Alegro Editor. The Alegro Editor is a software that I used to create all the pedagogical content that would later appear on the final version of the Alegro system (see section 7) for students to work with. I will explain now how I did this. In order to better understand how the Editor works, Figure 4 will come in useful.

As can be seen, the Editor is rather intuitive and user-friendly, and it is divided in four main tabs: in green, *modules*, in blue, *topics*, in purple, *concepts* and, lastly, in pink, *questions* (the *questions* tab will be described in the following section). The first three sections are grouped so that one is contained within the other. Therefore, *concepts* is found within *topics* and this, in turn, within *modules*.

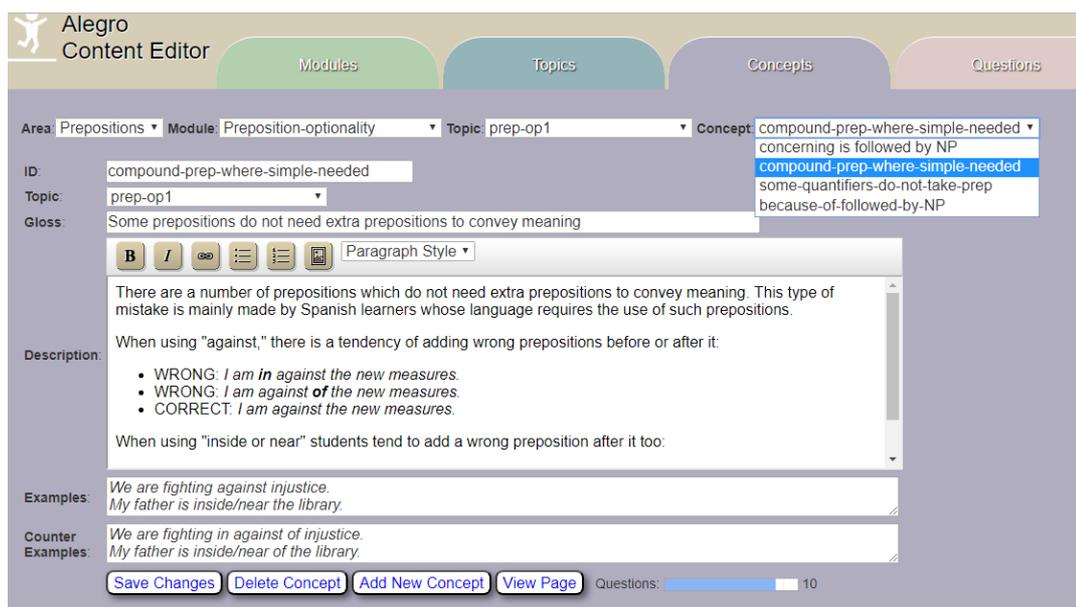


Figure 4. Alegro Editor's layout

As seen in Figure 4, within the tab *concepts* there are a number of boxes (*area*, *module*, *topic*, and *concept*):

- *Area*: this box shows which linguistic area I was working with. Since this experiment focused on prepositions, the *area* box shows that the issue to be dealt with is prepositions. However, others are included, such as *NP* or *clause*.
- *Module*: the *module* box shows which aspect within prepositions I was working with. For this thesis, I chose preposition optionality. Again, other types of problems concerning prepositions can be found (*preposition complementation* and *preposition choice*, for instance). The issue of preposition optionality, as mentioned before, has to do with those instances in which a preposition is wrongly omitted or added in a sentence.
- *Topic*: this box identifies one of two possible types of errors: errors where a verb is involved (the former *verb-complementation-issues*) or where verbs do not play a significant role. I called the first type *verb-relate-prep-optionalty* and gave the name of *prep-op1* to the second type.

- *Concept*: this box shows the different types of errors included in each of the two categories from the previous box (*topic*). All these concepts are the same as those mentioned in Tables 2 and 3 in section 3.2. However, I changed the name of some concepts (those marked with an asterisk) to make them more comprehensible:
  - Within *verb-relate-prep-optional*, the following concepts can be found: *verbs-not-followed-by-to-prep\**, *verbs-not-followed-by-with-prep\**, *verbs-not-followed-by-in-prep\**, *verbs-not-followed-by-of-prep\**, *dont-use-to-recipient-after-verb\** and *adverbial-destination-doesnt-take-preposition\**.
  - Within *prep-opl*, the following concepts can be found: *concerning-is-followed-by-NP\**, *compound-prep-where-simple-needed*, *some-quantifiers-do-not-take-prep\** and *because-of-followed-by-NP\**.

As an illustration of how one of these concepts is displayed on the Editor, Figure 4 shows the concept *compound-prep-where-simple-needed*. As can be seen, there is an *ID* (the name/code of the concept), a *gloss* (a brief summary of the concept at stake), a *description* (an in-depth explanation of the concept), and some *examples* (correct use of the preposition related to the concept) and *counter-examples* (incorrect use of the preposition related to the concept).

## 6. Writing diagnostic probe materials

As I said in the previous section, apart from the tabs *modules*, *topics* and *concepts*, another one called *questions* appears on the Editor too. The *questions* tab was the last step in the creation of the teaching content that I later put into the module on preposition optionality within the Alegro system. With the help of the *questions* tab, I could write a set of sentence probes that would later serve to test whether the students had acquired the concepts or not. These sentence probes involved different examples and counterexamples for each of the critical concepts. Specifically, at least 10 examples and counterexamples were added for each concept. I had to do this because the final product – the module on preposition optionality within the Alegro system (see section 7) – was fed with information coming from the Editor, meaning that I had to create enough pedagogical content to satisfy the students' needs. Figure 5 shows how the *questions* tab is displayed within the Editor.

The *questions* tab can be searched according to the different critical concepts, or can show a list of all the questions within the database. I could explore the questions related to one specific concept by using the *apply filter* button or add further questions

for that concept with the *add question* button. Figure 5 shows all the questions regarding the concept *because-of-followed-by-NP*.

I gave each question an ID and a sentence probe. Moreover, I could edit this sentence probe as many times as I deemed appropriate and even delete it if needed (see Figure 6). What is important about these questions is that they show confirmed or broken concepts, i.e. they show when a concept has been appropriately used, or when there is an error in the sentence, respectively. Furthermore, more than one concept can be involved in the question and, therefore, students need to pay careful attention to each one. For instance, Figure 6 shows that, even though the concept *because-of-followed-by-NP* is confirmed by the sentence, the concept *some-quantifiers-do-not-take-prep* is broken.

Content Editor					
		Modules	Topics	Concepts	Questions
Show: because-of-followed-by-NP		Apply Filter	Add Question	Summary	
ID	Sentence	Confirmed Concepts	Broken Concepts		
<a href="#">Edit</a> <a href="#">Delete</a>	prep-op-012 ✗ I left my sunglasses inside of the car because the cloudy weather.		compound-prep-where-simple-needed because-of-followed-by-NP		
<a href="#">Edit</a> <a href="#">Delete</a>	prep-op-014b ✗ Most of flights have been cancelled because of bad weather conditions.	because-of-followed-by-NP	some-quantifiers-do-not-take-prep		
<a href="#">Edit</a> <a href="#">Delete</a>	prep-op-016 ✗ Because the budget, we are only allowed to expend 1 million of Euros.		some-quantifiers-do-not-take-prep because-of-followed-by-NP		
<a href="#">Edit</a> <a href="#">Delete</a>	Prep-op-019 ✓ There were a few complaints because of the students' bad behaviour.	few-for-count because-of-followed-by-NP Existential Subject comes after the verb			
<a href="#">Edit</a> <a href="#">Delete</a>	Prep-op-020 ✗ Both Lucy and Tom went to the party because their good grades.	both-goes-with-and both-is-plural	because-of-followed-by-NP		
<a href="#">Edit</a> <a href="#">Delete</a>	Prep-op-022 ✓ My boss paid the salary to my aunt last week because her good work.	dont-use-to-recipient-after-verb	because-of-followed-by-NP		
<a href="#">Edit</a> <a href="#">Delete</a>	Prep-op-031 ✗ Most of students drop out because their lack of interest.	abstract-plural-no-determiner	because-of-followed-by-NP some-quantifiers-do-not-take-prep		
<a href="#">Edit</a> <a href="#">Delete</a>	Prep-op-032 ✗ Concerning the lottery, we won 3000 of Euros because of our good luck.	concerning is followed by NP because-of-followed-by-NP	some-quantifiers-do-not-take-prep		
<a href="#">Edit</a> <a href="#">Delete</a>	Prep-op-033 ✓ Susan has the knack of making me feel better because of our long-established relationship.	of-followed-by-ing-verb because-of-followed-by-NP			
<a href="#">Edit</a>	Prep-op-...				

Figure 5. The *Questions* section in the *Alegro Editor*

Some examples of sentence probes are presented below:

1. Where a concept has been broken:
  - My fiancée married with me.
  - Because your efforts, the children were saved.
  - I sent to John the present.
  - Mary is coming to home now.
  - I left my glasses inside of the glove box.
2. Where a concept has been complied:
  - A gave my mum a cake.
  - They were arrested because of their race.
  - The king is abusing his powers.

- I went abroad last year.
- The church is near the park.

In order to test the concepts' acquisition, I included these sentence probes (and many others) within the teaching module on the Alegro system.

Figure 6. Edition of a question in the *questions* tab within the Alegro Editor

Figure 6 shows how questions can be edited on the Editor:

1. Firstly, I wrote each sentence probe in the appropriate box (under ID).
2. Then, I had to decide whether the sentence was correct or wrong. This was done by selecting *correct* or *wrong* next to the sentence probe. If there was one broken concept, I would categorise the sentence as wrong, even if there was one (or more) confirmed concepts. In this way, the Alegro system (what students actually see and use) can determine when students give a correct or incorrect answer.
3. Afterwards, I had to add as many compiled and broken concepts as there were in the sentence probe in the two boxes as shown in Figure 6. It was important that I did this because, in the example provided in Figure 6 (once put on the Alegro system), if students said this sentence was correct, the system could determine that they have acquired the concept *because-of-followed-by-NP* (“because of bad weather conditions” is perfect English) but, at the same time, that they have not assimilated the concept *some-quantifiers-do-not-take-prep* (“most of flights” is wrong and should have been phrased as “most flights”).

As mentioned above, I added 10 sentence probes per concept. There needed to be a balanced number of broken and confirmed concepts (five in each category). This was important because, as aforementioned, I put all this information into the teaching module

on preposition optionality on the Alegro system (i.e. these are the questions students would later see on the system).

## 7. The Alegro system in operation

When students access the Alegro system, there is an introduction where they are explained its three main functions: *review*, *study* and *test*. In this thesis, the module *preposition optionality* is what I attended to. The *review* section shows the current level of competence (as regards the critical concepts that I added to the module) of each student. In this case, all of the concepts had to do, as aforementioned, with preposition optionality. This can be appreciated in Figure 7, which is a screenshot of the Alegro system as shown to one student.

Alegro Grammar Learning

Introduction Review Study

This page shows the concepts in your course, and your level of acquisition of these concepts. Study those concepts which have the most red color showing.

Key: Not Acquired Acquired Unknown

**Area: Prepositions**  
**Module: Preposition-optionality**  
Topic: Nonverb-related-prep-optionality

Don't use compound prepositions in some contexts	Red bar	Study
"Most" and currencies do not take a preposition	Red bar	Study
"Because" must always be followed by the preposition "of" when complemented by a NP	Red bar	Study

Topic: Verb-related-prep-optionality

Don't use a "to" recipient when placed directly after the verb	Red bar	Study
When starting a sentence with "concerning", a noun phrase must follow	Red bar	Study
Don't follow some verbs with 'to' plus noun-phrase	Red bar	Study
When the destination you are going to is realised as an adverb, don't put a preposition before it	Red bar	Study
Don't follow some verbs with 'with' plus noun-phrase	Red bar	Study
Don't follow some verbs with 'in' plus noun-phrase	Red bar	Study
Don't follow some verbs with 'of' plus noun-phrase	Red bar	Study

Figure 7. Review section on Alegro

As can be seen in Figure 7, there are two *topics* within the module *preposition optionality*: *non-verb-related-optionality* and *verb-related-optionality*. Both topics include a number of critical concepts, which are those that I gathered from examining the texts in the TREACLE corpus. Each critical concept is accompanied by a bar which has red and blue colour. The blue part is related the level of acquisition of the concept, whereas the red colour symbolises the opposite. Figure 7 shows that, for this student, all the concepts are far from being acquired.

Students can select the concepts they want to focus on by clicking on the button “study,” which leads to the *study* section. The *study* section is similar in appearance and content to the Alegro Editor: it shows a gloss, a description of the concept, and examples

(see sections 5 and 6 above on the Alegro Editor). Each student can use it to review those grammatical aspects that have not been mastered yet. Once they have spent some time (in the experiment described in Part Three students were asked to use the system for three weeks at home) reviewing the concept, the last step is to check that the student has acquired it, and that is where the *test* section comes into play. This section displays a number of sentence probes (the questions that I created with the help of the Alegro Editor) that the student has to categorise as correct or incorrect. These sentence probes will keep appearing until the student has categorised all of them appropriately.

The screenshot shows the interface of the Alegro system. On the left, a concept card is displayed with the title "When starting a sentence with 'concerning', a noun phrase must follow" in purple. Below the title is a cartoon character of a man with a white beard and a black robe, holding a pointer. A "Test me!" button is located below the character. At the bottom of the card, it says "(Your acquisition: 100%)".

On the right, the main content area contains the following text:

Sometimes we start a sentence by telling the reader what topic we are talking about:

- *Concerning your job application, we will contact you soon.*
- *Regarding his health, you should stop giving him coffee.*

No preposition is needed between "concerning" or "regarding" and the noun phrase. Spanish learners of English often go wrong here, as they translate "en relación a" as "concerning to", which is wrong.

Note, however, that it is correct to say "In regards to":

- *In regards to your job,...*

Examples:

- *Concerning the budget, we have no money left.*

Below this, a section titled "Correct or incorrect?" contains a sentence probe: "Concerning his offer, we are in the disadvantage of not knowing what is going to happen next." followed by "Correct" (with a green checkmark) and "Incorrect".

Below the probe, it says "Correct! You have demonstrated you understand the following concepts:"

- When starting a sentence with "concerning", a noun phrase must follow.
- If placing a verb after "of" this should be in its ing form.

Figure 8. *Study* and *test* sections on Alegro

As said before, the *study* section layout is rather similar to the Alegro Editor. The gloss of the concept appears in purple to the left and, to the right, the description of the concept and the examples appear. Under the button "test me," the system shows the level of acquisition of the concept by the student which, in Figure 8, equals a 100% of acquisition. Upon clicking "test me," the system displays a box underneath ("correct or incorrect?"). This is where the student has to select whether the sentence probe features an erroneous prepositional use or not. Upon doing so, the system tells students if their choice was correct or not, as well as providing an explanation of the concepts that have been confirmed or broken.

Not only can the students' knowledge of a specific concept be tested, but they also have the possibility of being tested on all concepts at once. This is done by clicking on

the tab *area* within the *study* section. This leads to the general area of preposition optionality where all the concepts regarding that area will be tested as can be seen in Figure 9. As opposed to having chosen a concept in advance, there are no glosses or descriptions here, but rather the student will be thrown sentence probes randomly. The procedure is the same, the student selects “correct” or “incorrect” and the system acts accordingly.

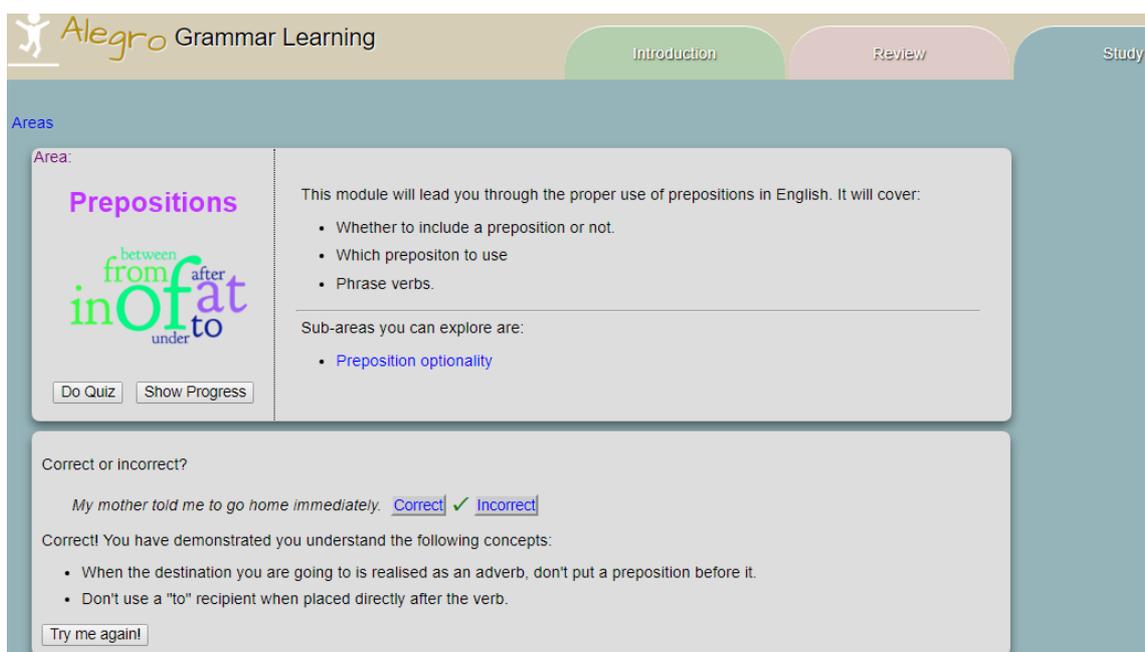


Figure 9. Study section without having chosen a specific concept

So far, I have explained how I developed the learning module on preposition optionality within the Alegro system. Besides, I have also described how students can use the Alegro system as such. Part Three of this thesis is related to the experiment that I carried out to test the effectiveness of such module with students from secondary education in Madrid.

# **Part Three: Testing the Effectiveness of the Module within the Alegro system with High School Students**

## **1. Introduction**

In this section I will introduce the experiment I carried out with high school students to test the effectiveness of the preposition optionality module within the Alegro system whose development I have explained in Part Two of this thesis. Firstly, I will outline the profile of the students who took part of the experiment. Afterwards, I will comment on the procedure which I employed in order to gather the data (including a pre-test and a post-test that were administered to identify the students' knowledge concerning the critical concepts described before). Later, I will explain the findings that I collected from the experiment. In so doing, I will answer the three research questions postulated in the introduction of this thesis.

- 1) Does the use of this online learning module actually help the high school students in this study develop competence in respect to preposition optionality?

I will give an answer to the first research question by paying attention to the overall improvement by students after having used the preposition optionality module for three weeks at home. Moreover, I will draw a comparison between those students who have a higher level and those whose level was lower.

- 2) What grammatical concepts in terms of preposition optionality are critical to the high school students in this study?

In order to answer research question number two, I will comment on the results I obtained after analysing the improvement by students in terms of each critical concept.

- 3) Is this online learning module more effective at a high school level (with students not specialised in English) or at a university level (with students doing a degree in English Studies)?

To answer the third research question, I will compare the results obtained by the university learners in the similar study aforementioned (Nogales, 2018) and those I collected from the high school students here.

## 2. Participants' profile

The participants in this study all come from the two first-year Bachillerato groups I had the chance to teach during my Internship at a secondary school in Madrid, called IES San Mateo. During this Internship, which lasted from the 11<sup>th</sup> March to 11<sup>th</sup> April, I carried out the experimented here presented. At IES San Mateo, there are four groups (A, B, C and D), which are combined for the subject of English as can be seen in Table 4 below.

<i>Groups</i>	<i>Boys</i>	<i>Girls</i>
<b>1CD</b>	<b>9</b>	<b>9</b>
<b>1AB</b>	<b>3</b>	<b>21</b>

Table 4. Combination of groups for the subject of English

This combination of groups corresponds to the level of English of the students. Thus, for the first year of Bachillerato, 1AB had roughly a C1 level of English according to the CEFR (Council of Europe, 2001), followed by 1CD with a B2+ level. As can be seen, all groups had an exceptional command of the English language when compared to other schools. This is because IES San Mateo is part of the “Programa de Excelencia.” Because of this, as I will discuss later, the results gathered from this experiment cannot be easily extrapolated to all first year Bachillerato students in Madrid.

Out of the 42 students presented in Table 4, only 19 completed the whole experiment. Table 5 shows a list of these students, although I have altered their names to preserve their anonymity.

<i>Name</i>	<i>Group</i>	<i>CEFR</i>
<b>Marco</b>	1CD	B2+
<b>Antonio</b>	1CD	B2+
<b>Pedro</b>	1CD	B2+
<b>Mercedes</b>	1CD	B2+
<b>Patricia</b>	1CD	B2+
<b>Marina</b>	1CD	B2+
<b>Silvia</b>	1CD	B2+
<b>Olga</b>	1CD	B2+

<b>Macarena</b>	1CD	B2+
<b>Diana</b>	1AB	C1
<b>Paula</b>	1AB	C1
<b>Rodrigo</b>	1AB	C1
<b>Aitana</b>	1AB	C1
<b>Sofía</b>	1AB	C1
<b>Jose</b>	1AB	C1
<b>Luisa</b>	1AB	C1
<b>Carmen</b>	1AB	C1
<b>Fernando</b>	1AB	C1
<b>Jara</b>	1AB	C1

Table 5. Profile of the students in the experiment

As can be seen in Table 5, nine out of the 19 students belonged to the group 1CD, which had slightly less competence (B2+) than the other 10 students belonging to 1AB (C1). In this way, I could ensure parity between the two groups. Besides, 13 students were female, and 6 were male. Lastly, in connection with the groups, I need to mention that the students in 1CD were enrolled in the Humanities and Social Sciences branch within Bachillerato, while those in 1AB opted for the Sciences branch.

### **3. Procedure (how the experiment was conducted)**

As I said before, I conducted the experiment here presented during my Internship at IES San Mateo, lasting from the 11<sup>th</sup> of March to the 11<sup>th</sup> of April. Prior to the internship, I informed my mentor at the high school and she consented to it. As such, the study consisted of three parts. Firstly, I administered the students a pre-test, followed by a period of three weeks using the preposition optionality module on the Alegro system at home and, lastly, I gave them a post-test to test the effectiveness of such system.

Because this experiment was not compulsory, not all of the students in the two courses of first year Bachillerato participated (only 19 out of 42 took part in the study). However, all of them did the initial pre-test (for the pre-test, see Appendix A), meaning that I could gather data as to what the most critical concepts for this population of students were – I will explain this in the following section. The pre-test consisted of 20 questions

testing the 10 concepts (two questions per concept) which I initially determined to be the most critical for this learner group (see sections 3.2 and 4 of Part Two). As I explained, these 20 questions were all sentence probes where the student had to say if a given sentence was correct English or not (for example, the sentence probe *I want to marry **with** her* should be categorised as incorrect). This pre-test was done by the 42 students during the first 10 minutes of one of their classes. I explained to the students how to complete the pre-test. Besides, I also gave them instructions so they would know how to continue with the experiment at home. I put the data I gathered onto a spreadsheet to analyse later. On average, 5.3 out of the 20 answers given by the students were wrong, and no one answered all the questions correctly.

After the initial pre-test, 19 of the students coming from the two groups of first year Bachillerato devoted three weeks at home to using the Alegro system and, after such time, they took the post-test (for the post-test, see Appendix B). Because of this, I could examine their results at the end of the experiment to determine their improvement on preposition optionality. In this case, due to time constraints the post-test was done in writing on a piece of paper, but again I put the data I gathered on a spreadsheet to be analysed.

I transformed the results (in terms of the 20 questions from the pre-test and the post-test) into percentages to show the degree of acquisition of the concept associated with each question. Where the student got both questions related to a concept wrong, I marked these as 0% acquisition. Where they had one of them right, I marked the questions as having mixed (50%) acquisition. Where they got both questions right, I marked the questions as having 100% acquisition. The results yielded a number of conclusions which I will explain in the following section, *Findings and Discussion*.

#### **4. Findings and discussion**

In this section I will provide an answer to the three research questions. To begin with, I will focus on the first research question: “does the use of the online learning module actually help the high school students in this study develop competence in respect to preposition optionality?”. To answer it, I will consider a number of aspects. Firstly, I will comment on the general trend as for the 19 students as a whole. Next, I will pay attention to the results in terms of each group and level of English according to the CEFR (Council of Europe, 2001).

<i>Student</i>	<i>Group</i>	<i>CEFR</i>	<i>Pre-test</i>	<i>Post-use</i>	<i>Post-test</i>	<i>Improvement</i>	<i>Minutes</i>
Marco	1CD	B2+	45%	100%	85%	40%	20.42
Antonio	1CD	B2+	60%	100%	95%	35%	16.56
Pedro	1CD	B2+	80%	90%	85%	5%	10.23
Mercedes	1CD	B2+	75%	100%	100%	25%	15.3
Patricia	1CD	B2+	75%	100%	95%	20%	11.1
Marina	1CD	B2+	80%	100%	95%	15%	33.9
Silvia	1CD	B2+	75%	100%	95%	20%	30.9
Olga	1CD	B2+	75%	100%	90%	15%	22.8
Macarena	1CD	B2+	80%	91,40%	100%	20%	17.7
Diana	1AB	C1	85%	100%	95%	10%	5.4
Paula	1AB	C1	90%	100%	95%	5%	5
Rodrigo	1AB	C1	85%	100%	100%	15%	20.9
Aitana	1AB	C1	95%	100%	100%	5%	20.3
Sofía	1AB	C1	90%	90%	100%	10%	17.1
Jose	1AB	C1	85%	100%	95%	10%	17.8
Luisa	1AB	C1	95%	100%	100%	5%	13.4
Carmen	1AB	C1	95%	100%	100%	5%	15.8
Fernando	1AB	C1	85%	100%	100%	15%	29.23
Jara	1AB	C1	85%	100%	95%	10%	16.73
<b>OVERALL</b>			81%	98%	96%	15%	17.92

Table 6. General overview of the student's performance in the experiment

The data in Table 6 portrays the improvement of each student in percentages, showing their performance at the beginning (with the pre-test) and at the end (post-test). Besides, in order to interpret these results I have also taken into consideration the time spent in the system (in minutes) by the students. Thus, each student has been classified according to their group, their competence of English, their score in the pre-test, their performance while using the module on preposition optionality (post-use), the score they achieved in the post-test after exposure to the Alegro system and the time-spent. In this way, readers can better understand and appreciate the students' evolution.

Overall, it can be said that the experiment yielded a highly positive outcome, for there has been a mean 15% increase in proficiency after an average of 17.92 minutes of using the module on the Alegro system. This means that, for these specific two groups,

the use of the preposition optionality module has resulted in success. There has been general improvement to a greater or lesser extent (from 5% to 40%) depending on each student. Moreover, 8 out of the 19 students ended up with 100% competence in terms of preposition optionality by the end of the experiment. However, looking into some specific instances will provide a more insightful analysis. One of the most remarkable cases is Marco's, who by the end of the experiment achieved 40% improvement. What is curious about his case is that Marco spent 20 minutes on the system, while other students who devoted more time to it did not get such good results in terms of improvement. However, his final score after the post-test was 85%, and not the desired 100%. Nevertheless, Marco's is one of the most positive results in this study.

At the other end of the scale, I need to mention the cases of Pedro and Paula. Both of these students achieved only 5% improvement after the experiment. In the case of the Pedro, he went from 80% to 85%, and Paula managed to end with 95% competence in preposition optionality. The reason for this might be the scant amount of time spent by both of them on the system: 10.23 minutes in the case of the former and 5 minutes in Paula's case. Of course, if they had spent more time using the module they might have ended up with 100% competence at the end.

The same goes for Diana, whose improvement was slightly better than Paula's, but still did not get the 100% competence at the end. Again, this might be attributed to the fact that she only spent 5 minutes on the module. Marina and Silvia are also peculiar cases. In their case, they achieved 15% and 20% improvement respectively. Nevertheless, their competence at the end remained at 95%, which seems even more curious since they both spent over 30 minutes using the system, which is quite a long time. A lack of understanding of the system might account for this, or perhaps these two students might have needed extra support on the part of the teacher.

Lastly, Luisa and Carmen are two outstanding examples as well. Both of them used the module between 13 and 15 minutes, and both of them improved their competence by 5%. However, they could not have gotten better results because at the initial pre-test they scored 95% already, meaning that there was no room for more improvement. Luisa's results might be explained by the fact she is a very good student. Carmen, on the other hand, is the daughter of an American, meaning that she is bilingual. In fact, her 95% performance at the beginning of the experiment might have been the result of a misclick while doing the pre-test and in reality she had a 100% competence from the beginning.

In spite of all this, as I said before, the results were on average highly positive. Indeed, it can be concluded that there is a correlation between the time spent on the system and the improvement experienced by the students in relation to the module on preposition optionality within the Alegro system. This can be better interpreted with the help of Figure 10.

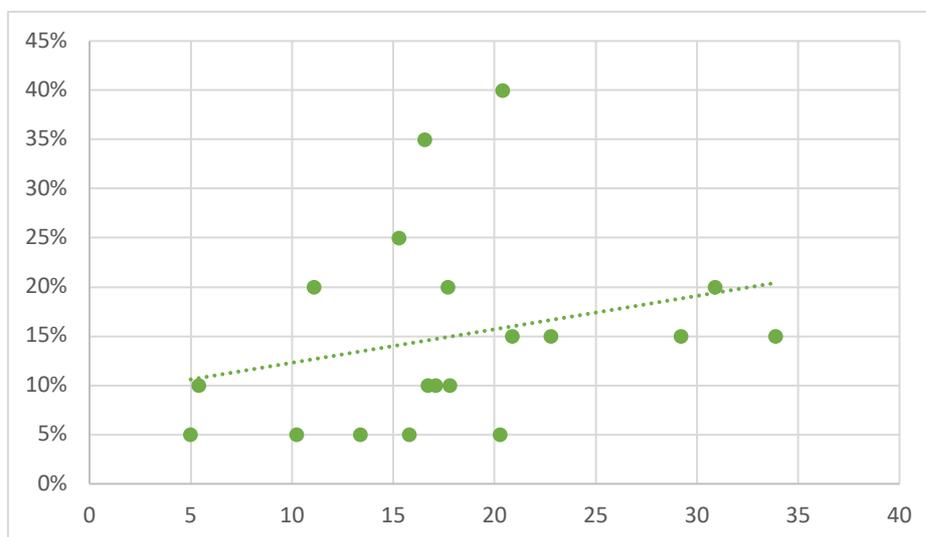


Figure 10. Correlation time spent/improvement by the students

In order to see if the results obtained were significant, I ran a matched t-test comparing the results both from the pre-test and the post-test. I used the software RStudio to determine the normality of the data and also to carry out the matched t-test. Table 7 shows both the  $p$  and  $t$  values, as well as the level of significance.

Test	Mean (%)	S.D. <sup>4</sup>	t
Pre-test	81%	0.12	- 4.9612
Post-test	96%	0.05	

\*\* Significance =  $p < 0.025$  ( $p = 0.00034$ )

Table 7. Significance of findings from pre-test and post-test

Table 7 confirms the positive results I commented on above. The students in this study go from 81% competence to 96% on average (almost 100%). Moreover, the Standard Deviation decreases at the end, meaning that there are not such extreme cases as those at the moment when I conducted the pre-test. In other words, it can be concluded that the improvement of these students in terms of preposition competence when using the Alegro system is statistically significant.

<sup>4</sup> S.D. stands for Standard Deviation

Another way of looking into the results is in terms of the students' level of competence (i.e. comparing group CD – B2+ – with AB – C1). Because there was a balanced number of students in both groups (9 vs 10), I could examine the results attending to each group independently to determine which one improved the most and, in this way, benefitted the most from the system's advantages. In order to interpret the results, Table 9 will be useful.

<b>Group (level)</b>	<b>Pre-test</b>	<b>Post-use</b>	<b>Post-test</b>	<b>Improvement</b>	<b>Minutes</b>
<b>1CD (B2+)</b>	72%	98%	92%	<b>21%</b>	19.89
<b>1AB (C1)</b>	89%	99%	98%	<b>9%</b>	16.17

Table 8. Performance of the students by group and level

Table 8 shows that, at the beginning of the experiment, group 1AB had a higher competence in terms of prepositional optionality. Specifically, these students surpassed group 1CD by 17%. This is easily explained by the fact that the higher the proficiency is, the better the performance will be. However, it is noticeable to see that by the end of the study there is not such a huge difference (only 6%), even though group AB still scored better results. The distinction in time spent by both groups is so little (only three minutes difference) that I will not consider it relevant here. What seems remarkable is that group CD achieved 21% improvement when compared to the initial pre-test, while group AB only experienced 9% improvement. One possible reason to account for the lack of improvement in this latter group is that, having already reached a higher level of English, there is little room for increase in proficiency and the learning process is slower. Figures 11 and 12 provide a better picture of these results.

As I mentioned above, Figure 11 shows that there is a steady rising in terms of the students' competence when it comes to preposition optionality as their lever of English rises. This was also true of the university students who undertook the similar experiment I conducted (Nogales, 2018), which also included A2, B1 and C2 levels of English. Moreover, Figure 12 shows that group CD (B2+ level) experienced a higher degree of improvement, meaning that it is students with lower competence those that seemed to benefit the most from the online system. This means that, even though group AB scored higher in the post-test, the system did not appear to be so effective, probably because their proficiency was already high from the onset. This trend seems steady, for in the similar study (Nogales, 2018) the lower-level students improved more than those with a higher level too. In any case, there was improvement to a greater or lesser degree by both groups.

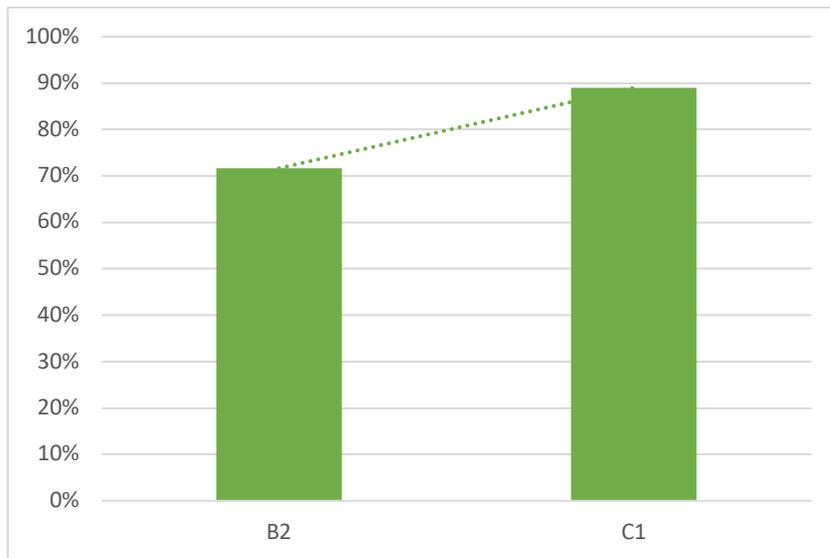


Figure 11. The students' performance in the pre-test by level of competence

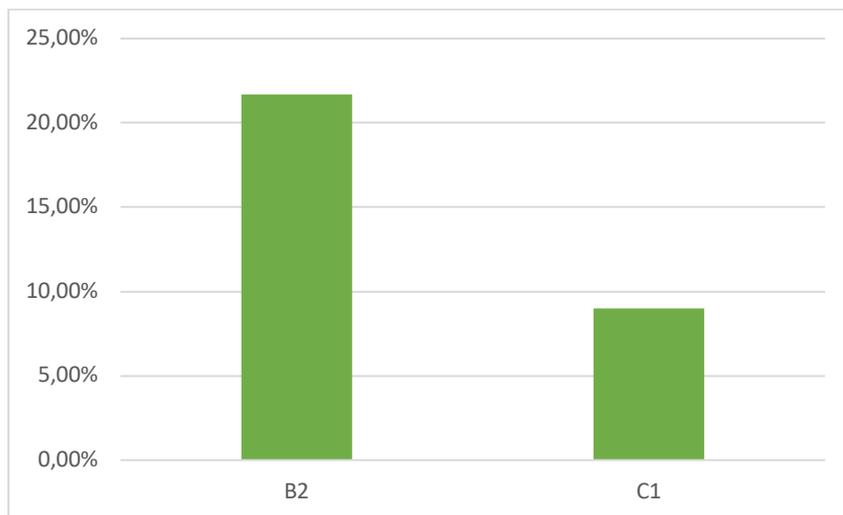


Figure 12. The student's improvement after the post-test by level of competence

Taking all this information into consideration (the overall improvement and the improvement in terms of level of competence), the answer to the first research question postulated in this study (“does the use of the online learning module actually help the high school students in this study develop competence in respect to preposition optionality?”) is positive.

Now, I will answer the second research question (“what grammatical concepts in terms of preposition optionality are critical to the high school students in this study?”). The results I gathered from the experiment will shed light upon this and, also, they will serve to identify what the most logical sequence for the teaching of these critical concepts is in curriculum design. This can be connected to section 4 in Part Two of this thesis,

where I commented on the order of difficulty in the acquisition of the different critical concepts.

<i>Concepts</i>	<i>Pre-test</i>	<i>Post-use</i>	<i>Post-test</i>	<i>Improvem.</i>
<i>Verbs-not-followed-by-of-prep</i>	51.44%	100%	87.42%	35.98%
<i>Verbs-not-followed-by-in-prep</i>	57.60%	100%	97.40%	39.80%
<i>Verbs-not-followed-by-to-prep</i>	71.12%	100%	93.40%	22.28%
<i>Adverbial-destination-doesnt-take-prep</i>	72.24%	100%	100%	27.76%
<i>Dont-use-to-recipient-after-verb</i>	74.35%	98%	93.40%	19.05%
<i>Concerning-is-followed-by-NP</i>	79.11%	100%	97.40%	18.29%
<i>Some-quantifiers-dont-take-prep</i>	83.56%	99,40%	93.40%	9.84%
<i>Because-of-followed-by-np</i>	87.20%	100%	97.40%	10.20%
<i>Compound-prep-where-simple-needed</i>	92.34%	97%	93.40%	1.06%
<i>Verbs-not-followed-by-with-prep</i>	94.80%	100%	97.40%	2.60%

Table 9. The students' performance in relation to the critical concepts

In Table 9 readers can see the students' performance in the pre-test and the post-test in relation to the different critical concepts. As regards the pre-test, it seems obvious that these students find more difficulties when dealing with verb-related concepts, ranging from 51.44% to 74.35% performance. On the other hand, non-verb-related concepts go from 79.11% performance to 92.34%. Surprisingly enough, the concept *verbs-not-followed-by-with-prep* (verb-related) seems to be the less problematic of all, with 94.80% performance in the pre-test.

In broad terms, it can be assumed that, at the beginning, those concepts where verbs are not involved were easier for these students. Regarding the post-test, there has been significant improvement (ranging from 87.42% and 100% - only in one case). Two peculiar cases are *verbs-not-followed-by-of* and *verbs-not-followed-by-in* concepts, both of them showing poor results in the initial test but reaching over 35% improvement after I conducted the post-test. Besides, in the case of the former, this is still lower (87.42%) when compared to the other concepts, but the latter is among those concepts with the highest percentage of performance after I conducted the post-test (97.40%).

Answering research question number two, the most critical concepts (in the post-test) in this experiment and with these students are shown in increasing order of difficulty in Table 9. As I said before, the most challenging ones are the verb-related ones, followed by those where verbs are not involved. Because of that, teachers should place emphasis

upon these concepts in curriculum design. However, there has been improvement in all concepts after the post-test. In the similar study I conducted (Nogales, 2018), the analysis yielded similar results: verb-related concepts were still more difficult to be acquired by the university students.

Lastly, I will give an answer to the third research question: “is the online learning module more effective at a high school level (with students not specialised in English) or at a university level (with students doing a degree in English Studies)?”.

Test	Mean (%)	S.D.	t
Pre-test	72%	0.13	- 6.0807
Post-test	93%	0.07	

\*\* Significance =  $p < 0.025$  ( $p = 0.01695$ )

Table 10. Significance of findings from pre-test and post-test in a similar study

Regarding overall results by both groups, Table 10 portrays the same data as Table 7 (the results obtained by the high school students in this study) but in relation to the experiment that I carried out with university students at the UAM doing their degree in English Studies (Nogales, 2018). As can be seen, the university students used the module on preposition optionality within Alegro and did a pre-test and post-test as well. As Table 10 shows, there was a mean 21% improvement in the university students’ competence as opposed to the 15% improvement by the high school students in this study. However, for issues related to the time spent on the system and individual cases pertaining to the pre-test and post-test, the significance of the results was not as high as in this study ( $p = 0.00034$  – in this study – as opposed to  $p = 0.01695$  – Nogales, 2018).

Taking this into account, although both studies yielded highly significant results, the experiment analysed in this study proved more statistically significant. Thus, answering the third research question, it can be said that the Alegro system is somehow more effective with high school students than with those at a university level. At least, this is true of the high school students in this study and the university students from the similar study I conducted (Nogales, 2018).

As I have shown in this section, in terms of the first research question, the effectiveness of the system to teach preposition optionality has proved successful attending to different aspects. To begin with, when considering the two groups (1AB and 1 CD) as a whole there was 15% improvement in terms of prepositional competence after an average of 17.92 minutes using the Alegro system. Also, analysing the results in terms

of their level of English, even though I reached the conclusion that the lower-level students benefitted more from the system than those with a higher level of English, both of them increased their proficiency to a certain extent.

In terms of the second research question, this study has shown that the most critical concepts for the high school students in this study were those related to verbs (but there was improvement in all of them). This has two advantages: firstly, teachers know the order of difficulty of these concepts and, thus, they can teach the easier ones first; secondly, they know what concepts (given their difficulty) they should devote more time to.

As for the third research question, even though in the similar experiment I conducted (Nogales, 2018) the percentage of improvement was larger, the results were not as significant as in this study. This means that the Alegro system has been more effective with the high school students (not specialised in English) than with the university students in the English Studies degree. This might be the result of the high school students having a lower competence and, thus, more room for improvement. In any case, in Nogales (2018) I also achieved highly positive results that showed that using technology in class can enhance the students' motivation and their learning. Moreover, there have also been other studies which have shown similar positive outcomes. For instance, Li (2017) found that students trying to learn collocations in English will encounter less difficulties if they make use of online corpora (both native corpora or LC). Taking all this positive studies into consideration, it is undeniable that technology like the Alegro system offers plenty of advantages and, thus, it should be implemented in class.

In the following section, I will give a conclusion summarising the main points in this thesis as well as providing suggestions for further research. Besides, I will comment on a number of implications for second language teachers wanting to implement this type of teaching methodology in their classes.

## Conclusion

This thesis has been divided in three main parts. Firstly, in Part One I introduced the theoretical background necessary to understand the experiment that I conducted with high school students to test the effectiveness of the learning module. Here, some important concepts were TELL (Technology Enhanced Language Learning) and CL.

Moreover, in Part Two I explained how, as part of a similar study (Nogales, 2018) I developed the preposition optionality module within the Alegro system. To begin with, I used the information coming from the TREACLE project to learn that preposition optionality was an area of English worth exploring. Afterwards, I employed the UAM CT to come up with the critical concepts I would later implement in the Alegro system. Then, I made use of the Alegro Editor to create teachable explanations for the university students in that experiment (although I used the same teachable explanations for the students in this study). Lastly, I put all that information into the learning module within the Alegro system, which is what the students used in order to work on preposition optionality.

Finally, in Part Three I described the experiment that I conducted to assess the effectiveness of the system with high school students from first year Bachillerato. As was seen, the system yielded positive results in relation to the three research questions postulated. In relation to the first research question, the online learning module actually helped students enhance their competence on preposition optionality by 15% after an average of 17.92 minutes of software use. As regards the second research question, the experiment revealed that those concepts which are critical to these students were those where a verb is involved (verb-related concepts). Lastly, in connection with research question number three, it was seen that, even though the level of improvement with university students in the similar study (Nogales, 2018) yielded seemingly better results, these were not as significant as this year's experiment. This means that the Alegro system works better with high school students (at least with the population used for this study).

Despite the results were quite good, there are a number of implications I will now comment on that teachers should take into consideration. In relation to TELL, I explained that software can play the role of tutor when “the knowledge resides in the machine, from where it is delivered to the learner in small chunks with frequent reinforcement” (White & Walker, 2013, p. 3). This is undeniably the role of the Alegro system, for this programme has been designed to give students a number of explanations on its own, without the need of a teacher. One of the implications teachers wanting to implement

systems like Alegro in their classes should consider is that, although this software can play the role of teacher (because it is a so-called tutor), they should always use it as complement to the class. This point is reinforced by Szendeffy (2015), who states that tutor systems such as Alegro should be used “on their own time or as assigned homework as a supplement to other activities” but they should not substitute the teacher (p. 10).

I want to highlight the importance of the teacher, because as I mentioned in the experiment described in Part Three, I asked students to use the system for three weeks at home, around ten minutes a day. However, taking a look at the time spent by each student, one soon realises that no one spent that much time. Of course, because they are high school students they need someone who is in charge of the activity. Nevertheless, it is important that, as Szendeffy (2005) contends, students develop their autonomy and resort to the teacher as a last resort (p. 7). To solve this, one solution could be that the teacher allows students to use the system for ten minutes at the beginning or at the end of the class. In this way, the teacher is present to monitor that everyone uses the system and, at the same time, students are working on their own.

I also explained some of the advantages that TELL brings to class. For instance, Kranthi (2017) talks about the possibility of having a student-centred approach and “controlling the pace of progress” (p. 32). Indeed, thanks to the Alegro system, students can decide what contents to learn first and what later. In the experiment described in Part Three, students could choose the amount of time they wanted to give to each critical concept and to the system itself, and that was reflected in the results. Kranthi (2017) also mentions that individualised learning is difficult to achieve. Again, thanks to the Alegro system the students in this experiment could focus on those areas which were more problematic for them, each one advancing at their own pace.

Regarding CL, in Part One I also commented on the fact that corpora are helpful because “teachers can prepare their own exercises and explanations” (Santamaría García, 1995). Without the shadow of a doubt, one of the advantages of the Alegro system is that it offers easy-to-understand descriptions of the critical concepts as well as exercises in the form of the sentence probes I described in section 6 of Part Two. Besides, the same author explains the difference between the inductive and deductive approaches to learning. Whereas the former entails that students are presented with the grammar first to later do exercises, the latter gives exercises first so that students can discover the grammar concepts and rules by themselves (*ibid.*, 1995, p. 193). It has been generally accepted that the deductive approach to learning grammar yields better results. Furthermore, as I have

shown in this thesis, technology offers advantages to implement this type of deductive teaching. With the Alegro system, the students in this study learnt through the different sentence probes and, in those cases where they answered incorrectly, they could resort to a proper explanation.

Something else that is worth addressing is the level of the students in this study. It is undeniable that given the nature of IES San Mateo as part of the “Programa de Excelencia,” all the students had an outstanding level of English, meaning that the results here might not reflect the reality of other high schools in Madrid. For this reason, teachers reading this thesis need to realise that, perhaps, their own students may have different needs, or may need to implement the system in a different way. Possibly, students with a lower level of English competence will need a bigger exposure (i.e. more time using the system) or even supervision of the teacher in order to be able to use the module.

In spite of these implications, the results in this experiment were noteworthy in that the students improved their competence of English in terms of preposition optionality all the same (15% after an average of only 17.92 minutes on the system). Nonetheless, further research could be conducted. For example, different modules other than preposition optionality could be created. Besides, the Alegro system could be implemented in other secondary schools and other L2 teaching contexts such as ESP (English for Specific Purposes) or academies, to see if the results yielded are equally good.

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## Appendix A. Pre-test on preposition optionality competence

1. Concerning your injury, your health insurance covers all medical expenses – Correct – *Concerning-is-followed-by-NP*.
2. I am in against the suggestions proposed by the CEO – Incorrect – *Compound-prep-where-simple-needed*.
3. Most these questions are too difficult to be answered by some students – Incorrect – *Some-quantifiers-do-not-take-prep*.
4. I find it hard to trust people I haven't known for quite some time – Correct – *Verbs-not-followed-by-in-prep*.
5. Susan didn't come to the party because of her severe headache – Correct – *Because-of-followed-by-NP*.
6. I'm not sure I believe Loreen regarding to the reason why she didn't come to class – Incorrect – *Concerning-is-followed-by-NP*.
7. I showed to my son a drawing I had recently finished – Incorrect – *Dont-use-to-recipient-after-verb*.
8. The king abused his power for as long as he could – Correct – *Verbs-not-followed-by-of-prep*.
9. Only brave people are able to face dangerous situations – Correct – *Verbs-not-followed-by-to-prep*.
10. I'm glad there are people who regret of those mistakes that they made in the past – Incorrect – *Verbs-not-followed-by-of-prep*.
11. My parents promised me we would go to Hawaii for three weeks next year – Correct – *Adverbial-destination-doesnt-take-preposition*.
12. My brother decided to end his affair and tell his wife the truth – Correct – *Verbs-not-followed-by-with-prep*.
13. She got great marks because her hard work – Incorrect – *Because-of-followed-by-NP*.
14. I found 100 Euros while I was taking a walk – Correct – *Some-quantifiers-do-not-take-prep*.
15. Rachel has been meaning to send Carol a very special package for a long time – Correct – *Dont-use-to-recipient-after-verb*.
16. Have you decided if you're attending to the lecture tomorrow? – Incorrect – *Verbs-not-followed-by-to-prep*.

17. My parents called me last night so I would come to home at once! – Incorrect – *Adverbial-destination-doesnt-take-preposition.*
18. I can't remember if I left my book inside the glove box – Correct – *Compound-prep-where-simple-needed.*
19. As soon as I heard the man shouting, I entered in the building – Incorrect – *Verbs-not-followed-by-in-prep.*
20. My girlfriend wants to marry with me – Incorrect – *Verbs-not-followed-by-with-prep.*

## Appendix B. Post-test on preposition optionality competence

1. Concerning your request, we do not allow pets in the rooms – Correct – *Concerning-is-followed-by-NP*
2. We are not in against your proposal – Incorrect – *Compound-prep-where-simple-needed.*
3. I can't answer most these questions – Incorrect – *Some-quantifiers-do-not-take-prep.*
4. I don't trust his judgement – Correct – *Verbs-not-followed-by-in-prep.*
5. They were arrested because of their race – Correct – *Because-of-followed-by-NP.*
6. We will not make any concessions regarding to the proposed road – Incorrect – *Concerning-is-followed-by-NP.*
7. I showed to Fred my new car – Incorrect – *Dont-use-to-recipient-after-verb.*
8. The king is abusing his powers – Correct – *Verbs-not-followed-by-of-prep.*
9. Soldiers often face dangerous situations – Correct – *Verbs-not-followed-by-to-prep.*
10. I always regret of the mistakes I made as a child – Incorrect – *Verbs-not-followed-by-of-prep.*
11. I will go overseas for three weeks next year – Correct – *Adverbial-destination-doesnt-take-preposition.*
12. I have ended my relationship with Mary – Correct – *Verbs-not-followed-by-with-prep.*
13. Because your efforts, the children were saved – Incorrect – *Because-of-followed-by-NP.*
14. The government saved twenty million Euros this year – Correct – *Some-quantifiers-do-not-take-prep.*
15. I sent my brother a very special package – Correct – *Dont-use-to-recipient-after-verb.*
16. I attended to your classes this semester – Incorrect – *Verbs-not-followed-by-to-prep.*
17. I want to move to here next year – Incorrect – *Adverbial-destination-doesnt-take-preposition.*

18. The book is inside the box – Correct – *Compound-prep-where-simple-needed.*
19. He entered in my room while I was asleep – Incorrect – *Verbs-not-followed-by-in-prep.*
20. Will you marry with me? – Incorrect – *Verbs-not-followed-by-with-prep.*