

Teaching multimodal metadiscourse in academic English as a foreign language

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RECEIVED: 1 JUNE 2021 / ACCEPTED: 16 JANUARY 2022

DOI: 10.30827/PORTALIN.VI.21423

ISSN PAPER EDITION: 1697-7467, ISSN DIGITAL EDITION: 2695-8244

ABSTRACT: Even though both visual and textual elements create multimodal discourse, the former have received less attention (Kumpf, 2000) than the latter (Hyland, 2005) when teaching a foreign language. The hypothesis of this study is that teaching how multimodal metadiscourse is organized in academic writing may be beneficial if implemented in English for specific purposes. The objectives of this analysis are to identify the patterns of multimodal metadiscourse and to study if teaching the categories of multimodal metadiscourse could improve performance at communicating effectively in an increasingly multimodal world. Thus, a corpus of sixty-four academic papers on engineering written by native English speakers was compiled. Then, the visual and textual metadiscourse elements were classified with a tool and manually to identify patterns that could be used for teaching multimodal metadiscourse. Additionally, the frequencies of the textual and visual elements were identified. Tasks based on the results were proposed and carried out with an experimental group at Universitat Politècnica de València. The results show the patterns of multimodal metadiscourse, the classifications and the outcomes of the experiment with the students. Finally, conclusions shown that multimodal literacy is not implicit or associated to language proficiency, it should be instructed.

Key words: multimodality, metadiscourse, learning, teaching, English as a foreign language.

El aprendizaje del metadiscurso multimodal en la enseñanza del inglés como lengua extranjera

RESUMEN: Aunque tanto los elementos visuales como los textuales conforman el discurso multimodal, los primeros han recibido menos atención (Kumpf, 2000) que los segundos (Hyland, 2005) cuando se enseña una lengua extranjera. La hipótesis de este estudio es que enseñar el metadiscurso multimodal en la escritura académica puede ser beneficioso en la adquisición del inglés para fines específicos. Los objetivos son identificar los patrones del metadiscurso multimodal y estudiar si enseñar el metadiscurso multimodal puede mejorar la capacidad para comunicarse de forma efectiva en un entorno multimodal. Se compiló un corpus de sesenta y cuatro artículos académicos del área de ingeniería escritos por hablantes nativos ingleses. A continuación, se clasificaron los elementos visuales y textuales del metadiscurso con una herramienta y de forma manual para identificar patrones que pudieran ser utilizados para la enseñanza del metadiscurso multimodal. Adicionalmente, se identificaron las frecuencias de los elementos textuales y visuales. Se propusieron tareas basadas en los resultados y se llevaron a cabo con un grupo experimental en la Universitat Politècnica de València.

Los resultados muestran los patrones del metadiscurso multimodal, las clasificaciones y los resultados del experimento con los estudiantes. Finalmente, en las conclusiones se evidenció que la dimensión multimodal no está implícita o asociada al conocimiento de una lengua, si no que ha de ser enseñada.

Palabras clave: multimodalidad, metadiscurso, aprendizaje, enseñanza, inglés como lengua extranjera.

1. INTRODUCTION

This paper focuses on the teaching of multimodal discourse and metadiscourse devices, that is, on teaching multimodal metadiscourse. Multimodality is a well-known research topic based mainly on Kress and van Leeuwen (1990, 2001) and Kress (2004, 2005, 2010) seminal work. Taking into account these studies, many researchers have paid attention to the analysis of communicative acts as composed by words, images and gestures, not only by words.

Metadiscourse devices have also been studied from a textual perspective. They are those elements in the text that do not add meaning to the message but help speakers to communicate coherently and to persuade readers, self-promote writers and convince the audience. Metadiscourse has been extensively studied by Hyland (2005, 2017) focusing mainly on the analysis of academic English, but some other authors have also focused on contrastive studies of metadiscourse devices comparing two languages (Alonso-Almeida & Álvarez-Gil, 2021; Carrió-Pastor, 2016, 2019a; Mur-Dueñas, 2011) or metadiscourse in different genres and languages (Albalat-Mascarell & Carrió-Pastor, 2019; Moya & Carrió-Pastor, 2018). It should be noticed that, although there have been many researchers interested in linguistic metadiscourse, the concept of visual metadiscourse, that is, the analysis of visual elements that guide readers, has received less attention (Davis & Mason, 2004; D'Angelo, 2018; Kumpf, 2000; Lihong, 2016).

Thus, this paper is also concerned with multimodal literacy, which is “[...] the ability to successfully engage with texts that integrate different semiotic resources [...] to construct meanings through reading, viewing, understanding, responding to and producing and interacting with multimedia and digital texts” (Crawford Camiciottoli & Campoy-Cubillo, 2018, p. 1). Second language teaching and multimodal literacy are strongly connected as nowadays communication is composed of verbal and non-verbal elements. The lockdown due to COVID-19 has shown the importance of multimodal literacy to facilitate comprehension and motivate learners. In this vein, I believe the concepts of linguistic (Hyland, 2005) and visual metadiscourse (Kumpf, 2000) should be taught in combination to cover all the aspects of communication. This is why the concept of multimodal metadiscourse emerges, including linguistic and non-linguistic manifestations used to guide, persuade and convince readers.

Few studies have focused on the study of multimodal metadiscourse (Bernad-Mechó, 2018; Carrió-Pastor, 2021) but, to the best of the author's knowledge, no study has focused on teaching multimodal metadiscourse in English as a foreign language. To fill this gap, this paper focuses on teaching multimodal academic English from a perspective of metadiscourse, that is, how image and metadiscourse devices are combined to communicate with the audience. Supporting multimodal metadiscourse learning is also beneficial for teachers to understand how students learn best by implementing strategies in instruction that cater to multiple learning styles.

The hypothesis of this study is that teaching how multimodal metadiscourse is organized in academic writing may be beneficial if implemented in the instruction of academic English as a foreign language. Therefore, the objectives of this analysis are first, to identify the categories of multimodal metadiscourse based on the classifications of Hyland (2005) and Kumpf (2000), and second, to study if teaching the categories of multimodal metadiscourse to learners of academic English could improve their performance at communicating effectively in an increasingly multimodal world. The research questions posed are:

1. Are learners of academic English aware of multimodal literacies?
2. In which way can language instructors teach multimodal metadiscourse?

To meet the objectives and answer the research questions, this article is organised as follows. First, after identifying the objectives and research questions in the introductory section, the following section discusses the different approaches to metadiscourse and multimodality. Second, the section ‘Material and method’ describes the material used and the procedure followed in the study. Third, the results are shown and, finally, conclusions are drawn in the last section.

2. METADISOURSE AND MULTIMODALITY

This paper deals with two issues that are quite recent in the concept of foreign language teaching as conventionally understood, metadiscourse and multimodality. On the one hand, metadiscourse has traditionally been studied by linguists whose aim was to offer a way to understand language in use and to guide a receiver’s perception of a text (Crismore, et al., 1993; Hyland, 2005; Vande Kopple, 1985) and on discourse studies for writing pedagogies or applied linguistics (Carrió-Pastor, 2016; Gillaerts & van de Velde, 2010; Mur-Dueñas, 2011; Thompson, 2001). In this sense, metadiscourse has been considered a term used to engage and persuade readers in specialised discourse, that is, to be proficient in the use of the elements that do not add propositional content to discourse but help the listener to understand, interpret and evaluate information. Some linguists have also been interested in proposing ways to teach metadiscourse effectively. Studies such as those of Bax, Nakatsuhara and Waller (2019), Intaraprawat and Steffensen (1995), Lee and Subtirelu (2015), and Martín-Laguna and Alcón (2015) highlight the importance of metadiscourse in foreign language teaching and learning.

To facilitate the acquisition of metadiscourse, two main categories are distinguished (Thompson, 2001), depending on different functions: textual (also called interactive) and interpersonal (or interactional). Textual devices aim at organising the information depending on the needs and expectations of readers and interpersonal devices intend to stimulate interaction between writers and readers.

Textual metadiscourse is divided into five subcategories (Mur-Dueñas, 2011):

- Logical markers, which are the devices that provide coherence to the text (e.g. moreover, also, similarly, etc.).
- Frame markers, which are the devices that provide cohesion and make it possible to understand speech acts (e.g. finally, previously, regarding, etc.).

- Endophoric markers, which are useful to refer to different parts of the text (e.g. see table x, noted above, etc.).
- Evidential markers, which are the devices that show the evidence about the propositions (e.g. past research, previous, following x, etc.).
- Code glosses, which are used to give examples or explain parts of the text that are very specific for readers (e.g. that is, for example, in other words, etc.) (Carrío-Pastor, 2021).

Interpersonal metadiscourse is also divided into five types (Mur-Dueñas, 2011):

- Hedges, that is, the mitigation strategies and expressions of full commitment, (e.g. may, slightly, possible, probable).
- Boosters, which are used to highlight the conviction of the writer, (e.g. show, confirm).
- Attitude devices that express the affective evaluation of a proposition, (e.g. important, interesting).
- Engagement devices, that is, the elements through which scholars bring the readers into the text, involving them in the negotiation of academic knowledge (e.g., we, us, our).
- Self-mentions, the explicit signals of the authorial persona of scholars (e.g. I, we, us).

The elements included in both categories should be mastered by learners of academic English to be able to explain their experiments and results and persuade readers about the importance of their findings. The importance of metadiscourse when instructing foreign language learners has been noticed by researchers who considered metadiscourse devices important to be proficient in the target language. For example, Intaraprawat and Steffensen (1995) highlighted the importance of teaching learners how to become more sophisticated and express their ideas more clearly as they are faced with the task of learning the conventions of the discourse community of the foreign language. These authors paid attention to the use of metadiscourse devices by learners at different proficiency levels. Hyland (1999) also paid attention to the use of metadiscourse, but he focused on its possible role in textbooks to improve learners' rhetorical skills. More recently, Bruce (2016) Lee and Subtirelu (2015) and Martín-Laguna and Alcón (2015) analysed the use of metadiscourse devices in the classroom by teachers and learners, highlighting the importance of attitude markers and hedging as central to express critical evaluation (Bruce, 2016); considering that “[...] learners mostly relied on the forms present in the input available, rather than looking for more creative alternatives” (Martín-Laguna & Alcón, 2015, p. 91) and showing that foreign language teachers use more metadiscourse devices “[...] to negotiate classroom interaction for students still in the process of learning the language” (Lee & Subtirelu, 2015, p. 61). Thus, it is a matter of concern for researchers the way metadiscourse is acquired in a foreign language. Some point out the importance of the role of teachers, indicating that “metadiscourse is extremely frequent in teacher feedback on student writing. Both writer/reader visibility and text/language visibility are abundant in this type of data” (Ädel, 2017, p. 66), and that

communication is composed of multiple layers as Ädel (2017, p. 65) shows in Figure 1:

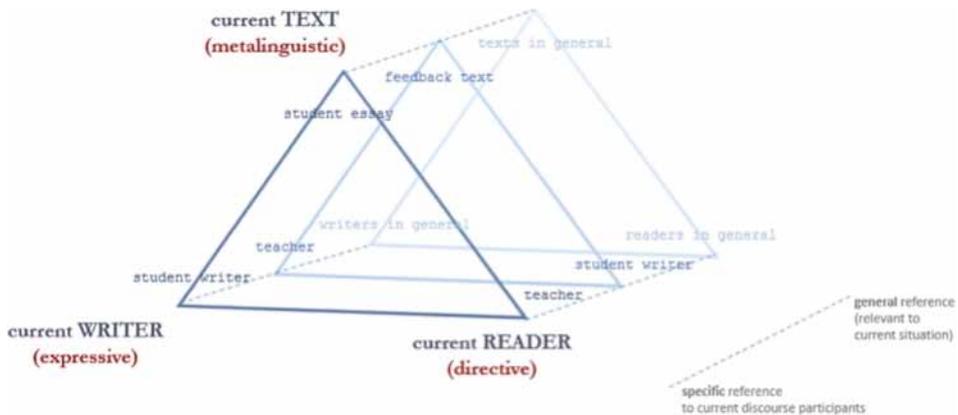


Figure 1. Multidimensional reflexive triangle

Thus, it seems metadiscourse is a complex notion to teach as it is not a matter of memorising vocabulary or grammatical rules, but learners should understand “the notion of English academic writing as arguing one’s own point of view and as demonstrating critical thinking” as MacCambridge (2019, p. 123) explains. And, it seems that the higher the language proficiency is not associated with the higher number of metadiscourse devices used as Bax, Nakatsuhara and Waller (2019) explain:

“[...] it could be interpreted that the overall use of metadiscourse markers increases as learners acquire (mainly basic) metadiscourse markers, but after reaching a certain level, the use of explicit metadiscourse markers decreases as they learn more sophisticated and subtle ways to express the organisation of a text.” (p. 89)

In this study, my purpose is to show different ways to teach metadiscourse interacting with learners of academic English.

The second nuclear topic in this analysis is multimodality, which is based on a functional analysis of language that includes visual communication, oral and written language, and gesture. Kress and van Leeuwen (1990, 1996) are the precursors of multimodality studies, taking the sign, that is a fusion of form and meaning, as its basic unit (Kress, 2004, 2005, 2010). Multimodal literacy refers to the study of language that combines two or more modes of meaning. Thus, multimodality refers to the constitution of multiple modes; that is, speech, written language, music, gesture, mathematical notation, layout of a paper, drawings, images, tables, etc. Language is multimodal and this can be observed in our daily communication (Carrió-Pastor, 2014).

Multimodality has also been the focus of interest of researchers concerned with its pedagogical effects. Most researchers focus on the implications of multimodal learning models (Magnusson & Godhe, 2019; Norris, 2004; Van Leeuwen, 2015; Yeo & Nielsen, 2020) and the design of learning activities (Austin, Hampel & Kukulska-Hulme, 2017; Bao, 2017;

Fariás, Obilinovic & Orrego, 2007; Guichon & MacLornan, 2008; Jiang & Luk, 2016), while others prefer to study multimodal instruction for supporting student learning (Cocchetta, 2018; DePalma & Alexander, 2018; Ho & Tai, 2020; Lee, Hampel & Kukulska-Hulme, 2019; Li, 2020; Peng, 2019; Satar & Wigham, 2017). As stated by Yeo and Nielsen (2020), teaching should be multimodal as “it is hard to imagine teachers using just written or verbal modes to communicate with their students. As well, content, regardless of the subject matter [...] is seldom inscribed in words alone” (p. 1).

As both text and images are useful to communicate in scientific language, I consider multimodality should play an important role in teaching academic English. That means that linguistic metadiscourse and visual metadiscourse (i.e. layout, figures, typography and images) should be taught together. Kumpf (2000) proposes to include visual metadiscourse in linguistic metadiscourse as “[...] the ‘supra-textual’ effect of a document works with the rhetoric of the text to present to the reader a consistent whole” (p. 404), based on Vande Kopple’s (1985) categories of textual metadiscourse. Kumpf (2000, pp. 405-418) proposes the following categories of visual metadiscourse:

- First impression, i.e., the first time readers encounter a document and it influences its reception before reading a paper. Students should take into account this aspect and its rhetorical effect on the reader.
- Heft, that is, the length of a document. Too long academic papers may not be fully read, their excessive heft may prevent readers from consulting it. Spanish learners of academic English should be conscious of this fact as this may be relevant when they send a paper to be evaluated.
- Convention refers to what readers expect from an academic paper on a specific topic. This depends on the specific field of study and it is connected to what is expected taking into account the similarity and dissimilarity with other papers from the same specific context. Learners should know the convention of academic papers from a metadiscoursal perspective to meet the expectations of readers.
- Chunking is the way to arrange discourse. It provides visual relief in a document, preventing dense and difficult to understand academic papers. It includes the insertion of figures, tables, examples, etc. Learners should use tables and figures to help readers understand academic English.
- External skeleton includes page numbers, headings, tables of contents, chapter markers, etc. It shows how the academic paper is assembled; it is also related to chunking. Learners should be aware of the existence of an internal and external skeleton. The internal skeleton includes textual cohesion (textual metadiscourse) and the external skeleton includes visual metadiscourse and textual metadiscourse.
- Consistency refers to organising the text following the same features, for example, using the same font, the same kind of figures and tables, the same format in references, etc. Students should see the document as a unified whole, including parts that support the description of a common theme.
- Expense means that readers perceive a document considering the amount of money spent in the edition of the book. This aspect is not so important in academic English given that most papers are published in electronic format.
- Attraction describes the ability to maintain the interest of readers, engaging them.

This is accomplished through engagement markers but also visual elements can engage readers to read a paper to its end. This category is essential in academic English and learners should be trained to accomplish this.

- Interpretation refers to the description and discussion of the data included in tables and figures. The significance of data should be commented and this shows authorial control and presence in an academic paper.
- Style refers to the correct use of boldface, italics, colour... Academic writers should use a fresh, clean and visual style, complementary to the tone of the text.

Kumpf's proposal (2000) is based on grading student documents in technical writing classes, that is, these categories are suggested considering the use of metadiscourse devices in language teaching.

I believe the inclusion of text and visual conventions in teaching metadiscourse in academic writing is essential to show foreign language learners that language is not only vocabulary and grammar but that there are aspects such as culture, linguistic conventions, etc. that should be also acquired as they are crucial in professional or specific settings.

It has to be noted that the teaching of multimodal metadiscourse in English for academic purposes has received little attention till now. Thus, to fill this gap, this paper focuses on the identification of the categories present in multimodal metadiscourse (a combination of linguistic and visual metadiscourse categories) in academic papers to help learners acquire strategies to organise writing and persuade readers.

3. MATERIAL AND METHOD

This is an exploratory study, which aims to analyse if the identification of multimodal metadiscourse may improve the acquisition of rhetorical skills in academic English. In this section, the material is first described and then, the method followed is shown.

3.1. Material

A corpus of sixty-four academic papers on engineering written by native English speakers was compiled to identify the patterns of multimodal metadiscourse in academic papers. The total number of tokens of the corpus analysed was 620,833. The specific topic of research papers of the corpus was chosen given that the control group and the experimental group was mainly composed of PhD students of science, technology, engineering and mathematics (STEM). This corpus was used to teach textual and interpersonal metadiscourse devices to the control group and the experimental group. The corpus was also used to identify the characteristics of visual metadiscourse based on Kumpf (2000), that is, first impression, heft, convention, chunking, external skeleton, consistency, expense, attraction, interpretation and style. As interpretation and expense were not applicable to the corpus, they were eliminated from the list. The linguistic and visual devices that composed multimodal metadiscourse were taught only to the experimental group.

The experimental group was composed of 146 students who were enrolled in a training online doctorate course of twenty teaching hours at Universitat Politècnica de València on academic English during the academic year 2020-21. The control group was composed of 146 students enrolled in the same online training course the previous academic year, 2019-20.

The students were Spanish speakers and were doing their doctoral dissertation in different STEM doctorate programs at the same university. They needed to read and write research academic papers while they were doing their dissertations and, consequently, to be familiar with the style and culture of academic English.

At the beginning of the online course, a questionnaire of five questions was designed to identify if the control group and the experimental group were aware of multimodal literacy and it was compulsory for all the students. The questionnaire included multiple choice questions and it tested students' awareness of textual, interpersonal and visual metadiscourse. Examples were given and students should choose one of three options. The answers collected from this questionnaire were also part of the material analysed in this pilot study. The questions posed to the students aimed at identifying if they were aware of the relationship between the textual and visual elements of discourse, with examples extracted from the corpus analysed.

After that, exercises focused on teaching linguistic metadiscourse to the control group and tasks for teaching multimodal metadiscourse to the experimental group were designed to be included in the syllabus of the course. Multimodal metadiscourse was only focused on in the experimental group. The exercises included some examples from the corpus and the most frequent and less frequent subcategories (see Results section).

Finally, multimodal metadiscourse tasks were designed to evaluate the control group and the experimental group. The activities evaluated multimodal metadiscourse knowledge in both groups, although only the experimental group received specific training on this. The answers were collected and compared to identify if both groups obtained similar or different results after being trained with different material.

3.2. Method

First, the corpus was analysed with the help of a specific tool (METOOL) to identify metadiscourse devices and, then, manually to identify and classify the visual metadiscourse in the corpus of engineering papers. METOOL was designed through a joint project (FFI2016-77941-P, funded by the Ministerio de Economía y Competitividad, Spain) to compile, tag, identify and analyse metadiscourse devices. Manual tagging of the visual elements was carried out to study and identify the figures, images, first impression, heft, convention, chunking, external skeleton, consistency, expense, attraction, interpretation and style. The corpus was analysed to obtain the different frequencies of the multimodal metadiscourse used in academic papers adapting the categories proposed by Hyland (2005) and Kumpf (2000), as shown in Table 1.

Table 1. Categories and subcategories studied in the corpus

TEXTUAL METADISCOURSE	INTERPERSONAL METADISCOURSE	VISUAL METADISCOURSE
Logical markers	Hedges	Tables (and interpretation)
Frame markers	Boosters	Figures (and interpretation)
Endophoric markers	Attitude markers	First impression
Evidential markers	Engagement markers	Convention
Code glosses	Self-mentions	Chunking
		External skeleton
		Consistency
		Attraction
		Style

The subcategories of visual metadiscourse ‘interpretation’ and ‘expense’ were not studied in the corpus. The first one was included in ‘tables’ and ‘figures’, as I think these two sub-categories should be included, given their importance in STEM. ‘Expense’ was not included given that all the papers of the corpus were studied in electronic format and, thus this aspect was not important in our corpus. All the papers were very well edited by international and well-known journals. While the students were analysing the corpus, all the students in both groups answered the questionnaire about their perception of multimodal literacy. It was a compulsory task for all the students.

Once the occurrences of the different multimodal metadiscourse categories and subcategories had been identified, material based on the corpus was designed to teach multimodal literacy to STEM learners of English. The co-occurrences of textual and visual elements in the exercises were taken into account, explaining to learners how multimodal metadiscourse should be used. Tasks based on the results of the multimodal analysis of the corpus were proposed and carried out with the experimental group, while the control group was only instructed in the sub-categories of textual and interpersonal metadiscourse. Activities on linguistic metadiscourse were also done by the control group. The same tasks were done by both groups at the end of the course to identify if knowledge of multimodal metadiscourse is implicit in the linguistic background of STEM students or if training on multimodal metadiscourse is necessary.

Finally, after the collection of all the material, academic English learners were evaluated on their proficiency on multimodal metadiscourse, the same tasks were designed for the control group and the experimental group, given that the evaluation aimed to identify if the group trained in multimodal metadiscourse could use multimodal literacy more proficiently.

4. RESULTS AND DISCUSSION

The results of this experimental study have been divided into the different material obtained taking into consideration the objectives and research questions.

4.1. Identification of multimodal categories and results of the analysis of the corpus

In this sub-section, the data obtained answers the first objective of this study, that is, to identify the teaching categories of multimodal metadiscourse and their frequencies. First, Table 2 shows the occurrences of textual and interpersonal metadiscourse found in the corpus. They are crucial to organise ideas and to guide readers. Logical markers were the most frequent devices, supporting previous findings by other researchers, such as Hyland (2005) and Mur-Dueñas (2011). Logical markers are essential to structure ideas and show the desired path to readers. As the corpus was composed of academic papers, evidential markers and code glosses were also frequent as writers provide evidence of their statements citing other researchers and showing examples of their data. Thus, through the analysis of the occurrences of textual metadiscourse, learners can see the most important devices that should be mastered to write a research paper.

Table 2. Occurrences of textual metadiscourse

TEXTUAL METADISDISCOURSE	OCCURRENCES
Logical markers	9,256
Evidential markers	2,418
Code glosses	2,191
Endophoric markers	1,172
Frame markers	1,055
Total	16,092

Some examples extracted from the corpus that could be used to show the use of textual metadiscourse to academic English learners are shown below in (1) samples of logical markers and evidential markers and in (2) samples of code glosses and logical markers:

- (1) *“Moreover, the authors (Pioner et al. 2016) demonstrated the feasibility of using this system in conjunction with hiPSC.”* [Eng35]
- (2) *“For instance, framing a decision outcome as a loss in value (rather than a gain) can reduce the decision makers’ acceptance of risk and, in turn, lead to more conservative outcomes.”* [Eng01]

STEM academic writers guide readers with the use of logical markers and provide examples of their statements in research papers. They are conscious of the importance of guiding readers and providing evidence about their statements. Thus, STEM learners should be trained in the use of textual metadiscourse markers given their importance in communication.

Table 3 shows the occurrences found in the corpus after the tagging of interpersonal metadiscourse, whose devices show the way writers skilfully use rhetorical choices, striving to cast a credible representation of themselves. Hedges are the most frequently used devices in this category, followed by attitude markers and boosters.

Table 3. Occurrences of interpersonal metadiscourse

INTERPERSONAL METADISDISCOURSE	OCCURRENCES
Hedges	7,815
Attitude markers	5,319
Boosters	3,142
Self-mentions	1,610
Engagement markers	1,576
Total	19,462

Academic writers frequently used hedges to hide their face and mitigate the imposition of the findings of the research. This is a common characteristic of academic culture and this is why these devices have been extensively studied (Carrió-Pastor, 2019b; Hu & Cao, 2011; Hyland, 1998; Uclés-Ramada, 2020) by many researchers. They are not only genre bound but they also are used in a dissimilar way in different cultures. Teachers should pay special attention to the training on hedges as they have several functions in language and their differences should be practised to be acquired properly. I also found in the corpus that

attitude markers were frequently used; this fact has been also noticed in previous research (Carrió-Pastor, 2019a). Additionally, Hyland (2005) explains that “Attitude markers indicate the writer’s affective, rather than epistemic, attitude to propositions, conveying surprise, agreement, importance, frustration, and so on, rather than commitment” (p.180). Boosters played a relevant role in the construction of identity in the corpus. Some authors consider this sub-category to be complementary to hedging (Uclés-Ramada, 2020) but most authors consider that boosting is used to influence readers’ opinion about the findings of research. Attitude markers and boosters are, thus, important in academic writing but learners should know how to accommodate their use to the conventions of their specific field of knowledge, as these devices are used in different ways (Carrió-Pastor, 2019a). Some examples that can be used to illustrate their use to academic language learners are shown in (3) with examples of a booster, an attitude marker and a hedge, (4) with examples of hedges and (5) with examples of self-mentions:

- (3) “Physiological traits evaluated here were *extensively* reported in the literature to be *relevant* for future wheat breeding as they *may* directly contribute to yield increase.” [Eng25]
- (4) “There has also been *relatively little* emphasis on indicators that can be used from the client’s perspective”. [Eng02]
- (5) “*We* have used this configuration in order to examine consistency between the previous model and *our own* solid and deformable slide configurations”. [Eng10]

The occurrences as well as the samples shown here could be used to present models to STEM learners of academic English. It is essential to explain to academic learners the concept of metadiscourse and the importance of being aware of the increase of the illocutionary force of speakers when used appropriately. The frequencies identified in the categories provide learners with objective data and the examples make them aware of the functions of metadiscourse devices in research papers. Below, figure 2 illustrates the subcategories and their frequencies.

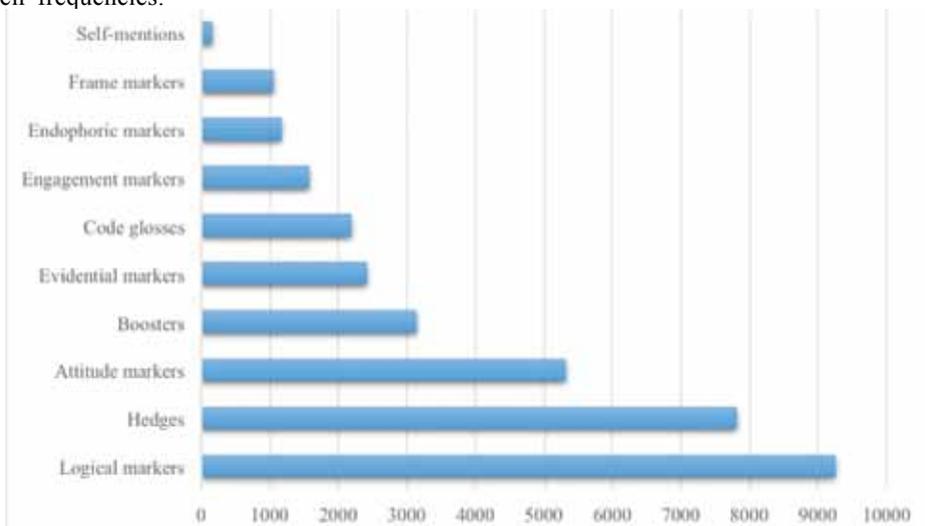


Figure 2. Occurrences of metadiscourse devices in the corpus

These results may be useful to design material for teaching metadiscourse. In this study, the data was used to identify the most important devices that play a relevant role in academic English. As can be seen in Tables 4 and 5 (visual metadiscourse), engineering researchers used more tables than figures to show the data associated with their findings. Tables were used more frequently than figures as shown in Table 4:

Table 4. Occurrences of tables and figures

VISUAL METADISOURSE	OCCURRENCES
Tables	354
Figures	179
Total	533

Once the number of tables and figures was identified, the following step was to check if the categories of visual metadiscourse identified by Kumpf (2000) were fully accomplished or not by academic writers. For this, the research papers were manually annotated and it was shown that all the authors made decisions on visual ways in which they may help readers understand academic papers, engaging them.

Table 5. Occurrences of visual metadiscourse

VISUAL METADISOURSE	OCCURRENCES
Tables (and interpretation)	64 papers
Figures (and interpretation)	64 papers
First impression	64 papers
Convention	64 papers
Chunking	64 papers
External skeleton	64 papers
Consistency	64 papers
Attraction	64 papers
Style	64 papers

It should be taken into account the fact that editorial managers and editorial companies implement strict rules of style to researchers. Thus, academic writers should follow the external skeleton, the conventions and style of the journal or their papers are not published. I think this is the reason for the perfect layout of the papers, the strict rules of international journals and the work of the editing committee.

4.2. Results of the questionnaire of students' awareness about multimodal literacies

In this section, the results of the questionnaire that students of both the control group and the experimental group should do in the first session of the online training are shown. The students were aware of academic English but the questionnaire intended to identify if

they were aware of multimodal metadiscourse to interpret the results correctly. The data were also useful to identify their awareness of the importance of multimodal metadiscourse. The results obtained here also answer the first research question of this paper. Table 6, below, shows the correct answers of the 146 students enrolled in the academic years 2019-20 (control group) and 2020-21 (experimental group).

Table 6. Answers control group and experimental group

QUESTIONS	STUDENTS WITH CORRECT ANSWERS CONTROL GROUP/TOTAL (%)	STUDENTS WITH CORRECT ANSWERS EXPERIMENTAL GROUP/TOTAL (%)
1. Define metadiscourse	74/146 (50.6) students	71/146 (48.6) students
2. Identify the differences between textual and visual metadiscourse	54/146 (36.9) students	52/146 (35.6) students
3. Define multimodal literacies	32/146 (21.9) students	35/146 (23.9) students
4. Link textual and visual metadiscourse	85/146 (58.2) students	89/146 (60.9) students
5. Give an example of visual metadiscourse	15/146 (10.2) students	7/146 (4.7) students

It can be seen that the answers were quite similar in both groups. This fact was expected, as metadiscourse teaching is not included in most syllabuses of academic English. Therefore, few STEM students answered correctly the definition of multimodal literacies and gave an example of visual metadiscourse. It should be noticed that in question 4, 'link textual and visual metadiscourse', learners showed that they knew the difference between textual and visual elements in research papers, but they were not aware of the specific terms of multimodality and metadiscourse before receiving specific instruction in the course.

4.3. Material designed for the acquisition of multimodal metadiscourse

Regarding research question 2, the way language instructors can teach multimodal metadiscourse, the guidelines provided by Farias, Obilinovic and Orrego (2007) and Van Leewen (2015) were considered. The material provided to STEM learners of English was composed of:

- a) Multimodal academic papers, taken from the corpus, in which multimodal metadiscourse was highlighted and learners should answer a specific task identifying visual and textual metadiscourse.
- b) Videos about metadiscourse and multimodality, given that videos about multimodal metadiscourse were not found. Some examples of the videos are:

<https://www.youtube.com/watch?v=cgxYBxKeOa8> (Metadiscourse)

<https://www.youtube.com/watch?v=PrSiC1sHTM4> (Metadiscourse)

<https://www.youtube.com/watch?v=nt5wPIhhDDU> (Multimodality)

<https://www.youtube.com/watch?v=mymp7Ep72Ho> (Multimodality)

- Questions were asked to learners about multimodal metadiscourse and it was compulsory to debate these concepts in the forum of the subject.
- c) Specific training and tasks to comment and discuss tables and figures in academic papers extracted from the corpus. First tables and figures were shown isolated and after learners discussed them, they were given feedback comparing their answers with the ones of the authors.
 - d) Training and tasks about first impression, convention, chunking, external skeleton, consistency, attraction and style of academic papers (visual metadiscourse) and their relationship with textual metadiscourse.

This material was prepared for the experimental group while the control group was trained with traditional exercises about metadiscourse.

4.4. Evaluation of the use of textual and interactional metadiscourse and multimodal metadiscourse

In this section, the results related to the second objective, that is, the performance of learners at communicating effectively in an increasingly multimodal world, are shown (see Table 7). The control group received training in textual and interpersonal metadiscourse, while the experimental group received training in multimodal metadiscourse. The results of the different evaluated tasks are shown in Table 7:

Table 7. Evaluation experimental and control group

GROUPS	TASKS	STUDENTS WITH CORRECT TASKS MULTIMODAL METADISOURSE/TO- TAL (%)
Control	Task 1 (papers)	37/146 (25.3) students
	Task 2 (forum)	42/146 (28.7) students
	Task 3 (comments and discussion)	120/146 (82.1) students
	Task 4 (visual and textual metadis- course)	65/146 (44.5) students
	Writing a paper (improve commu- nication)	108/146 (73.9) students
Experimental	Task 1 (papers)	127/146 (86.9) students
	Task 2 (forum)	146/146 (100.0) students
	Task 3 (comments and discussion)	146/146 (100.0) students
	Task 4 (visual and textual metadis- course)	98/146 (67.1) students
	Writing a paper (improve commu- nication)	135/146 (92.4) students

The evaluation of the different tasks, which are the ones derived from the material presented in section 4.3, shows that the experimental group improved their knowledge of multimodal metadiscourse. It should be noted that, even when the experimental group obtained a higher number of correct tasks, more training seemed to be needed as few tasks were answered correctly by all the students. Specifically, Task 4, which involved knowledge about first impression, convention, chunking, external skeleton, consistency, attraction and style of academic papers and their relationship with textual metadiscourse, was failed by a high number of students. Thus, this experiment and its results may demonstrate that knowledge on multimodal metadiscourse is not innate in the mother tongue of foreign language learners and should be included in their training. I believe proficiency in multimodal metadiscourse is essential to show findings and communicate with readers.

5. CONCLUSIONS

The approach taken in the study has been a bottom-up one, whereby the data has provided input on teaching multimodal metadiscourse, ultimately making the model of metadiscourse multidimensional rather than one-dimensional. As the objectives and research questions have been discussed in the Results section, in the Conclusions, I refer only to the most outstanding aspects.

Nowadays, teachers face different ways of teaching that include most of the times language (words), images, videos, etc. In this vein, this paper proposes different categories, which have been tested in this experimental study, to be taken into account to teach multimodal metadiscourse. This proposal may be useful to improve learners' communicative performance in academic English. Given that STEM students are not in general aware of the importance of metadiscourse to organise discourse, persuade readers and show the importance of their findings (see Table 6), the main aim of this paper was to draw attention to the importance of being proficient in multimodal metadiscourse.

Some materials were also proposed for language instructors to work on multimodal metadiscourse. The results obtained after the training of the experimental group showed that multimodal literacy is not implicit or associated to language proficiency, it should be instructed, as shown in Table 7. Additionally, the electronic format of research papers allows writers to include more visual elements than in printed format and this should be considered in academic language teaching. Teachers should instruct learners to emphasise the importance of visual information when describing academic findings.

Finally, a few limitations of this exploratory study should be pointed out. First, the proposal should be tested with different groups to validate the conclusions of this study. Second, the material was not sufficiently large to claim learners improved their multimodal literacy awareness. Thus, more specific tests and material of this type need to be prepared to train learners of academic English on multimodal metadiscourse.

6. ACKNOWLEDGEMENTS

This paper shows some of the findings of the research project “Identification and Analysis of Metadiscourse Strategies in Research Articles in English and Spanish” with reference FFI2016-77941-P, funded by the Ministerio de Economía y Competitividad, Spain (2017-2020).

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